



## **“Coming back better, post Covid-19”: the role of science, technology and good practices in conservation and sustainable development in Latin America**

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## **ABBREVIATIONS**

CCAD	Central American Commission for Environment and Development
CBD	Convention on Biological Diversity
CONICYT	National Commission for Scientific and Technological Research
CONCYTEC	National Council of Science Technology and Technological Innovation
COP	Conference of the Parties
COOPEGUANACASTE	Cooperativa Eléctrica de Guanacaste
COVID	SARS-CoV-2 virus
CSIRO	Commonwealth Scientific and Industrial Research Organization
ECLAC	Economic Commission for Latin America
EPA	Environmental Protection Agency
GDP	Gross Domestic Product
IIAP	Instituto de Investigaciones de la Amazonía
IBC	The Common Good Institute
IIED	International Institute for Environment and Development
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
NDCs	Nationally Determined Contributions
SDGs	Sustainable Development Goals
SPDA	Peruvian Society for Environmental Law
UFAM	Universidad Federal de Amazonas
UNEP	United Nations Environment Programme
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund

## Introduction

The Covid-19 pandemic has shown rather starkly the impacts of a systemic crisis that affects everything –environment, collective psychology, political processes, economy, trade, etc., etc. without exceptions.<sup>1</sup> The fragility of societies has become more evident, unveiling concerns and structural weaknesses, challenging industrialized and developed countries alike. However, over the past few months, opportunities have risen to rethink development and reflect on how to “recover better” from a crisis. What does this mean? Basically, it is a matter of consolidating a conservation agenda and the sustainable development model as pillars of a brighter and more equitable and resilient future, inclusive of all, that allows mitigation of systemic environmental risks. Clearly, what happens with regards to climate change and biodiversity in the years to come shall be an indicator of whether recovering better was feasible and realistic.

In addition to Covid-19, recent reports from the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES), the Intergovernmental Panel on Climate Change (IPCC), Living Planet 2020 – World Wildlife Fund (WWF), and the MapBiomass Amazon Initiative, among others, are new wake-up calls. They reconfirm a worrisome trend towards biodiversity loss at all levels, the deterioration of environmental conditions and little progress in the fight against climate change.

This grim picture on the situation of biodiversity and climate change requires policy decisions and renewed commitments at the international level, as well as decisive actions from countries. It also demands ingenuity, creativity and appealing to the intelligence of human beings.

In this context, different international forums are preparing a number of meetings and policy messages to guide and support the conservation and development agenda, including through adequate funding for technology and innovation.<sup>2</sup> Some regions are also beginning to develop policies and laws to promote conservation and address climate change. Several countries are implementing measures and strategies to try and mitigate and reverse these negative trends.<sup>3</sup> However, nothing comes easy, especially in a context where many countries are governed by populist regimes, less inclined to rely on science and accurate data.

Fortunately, even in this complex scenario, there is a persistent and sustained effort by activists, civil society organizations, the private sector, scientists and different actors to rebel and show it is possible to mitigate biodiversity loss and climate change. Many times, in alliance and with the collaboration of government agencies, i.e. ministries of environment, forest services, extension agencies, etc., very positive

and visible impacts are generated that encourage actions and involvement of the population, and set an example on the feasibility of sustainable conservation and development agendas. These alliances and collaborations implement and highlight responses based on science and technology, and good practices as well. Responses provide with lessons and often open opportunities to scale-up solutions.

This essay provides some examples on how science, technology, creativity and good practices contribute to conservation and also how in certain cases and with appropriate messaging, it is possible to streamline solutions into the policy making process.

## The environmental crisis: biodiversity loss and climate change

Something in which scientists and serious scholars coincide is that the world is living a prolonged and increasingly exacerbated environmental crisis due to the actions of human beings.<sup>4</sup> The pandemic induced by Covid-19 has allowed the planets' precarious situation to be visualized much more clearly. At the same time, the practical implications of a “systemic crisis” where environmental, social, economic and even political dimensions converge, can be directly felt.<sup>5</sup>

The idea in this section is not to repeat already known data and information on the state of biodiversity and the environment in general. In Box 1 recent data of the WWF, IPBES and IPCC as some of the most respected bodies in the world of environmental sciences, are synthesized to illustrate the severity and urgency of the work to conserve biodiversity and mitigate the effects of climate change.

### Box 1

#### Numbers and alarm data

- An extension equivalent to the surface of Ecuador is what the Amazon has lost (9 countries) in the last 17 years, between 2000 and 2017. This adds up to 29,5 million hectares (MapBiomias Amazonia, 2019).
- Between 1970 and 2016 Latin America lost 94% of its biodiversity (WWF, 2020).
- The main factors for this are the loss of ecosystems (51.2%), the over-exploitation of land and marine species (21.8%), the effects of climate change (12.5%), the introduction of invasive species (12.2%) and contamination (2.3%) (WWF, 2020).
- With 1.5 degrees of global temperature elevation, 18 million people will suffer the lack of water in Latin America; with 2.0 degrees of elevation, 25 million people (IPCC, 2019).
- In any scenario, tropical diseases (dengue, malaria, etc.) will expand and affect at least 10 million people in the region towards 2050 (IPCC, 2019).
- During the following years, 1 million species will be irretrievably lost, many of them in the Amazon and other tropical forests that are still maintained, mainly due to land use changes, the impacts on ecosystems due to climate change and human intervention (IPBES, 2019).

This Box allows one to rapidly understand the future challenges humanity and specifically Latin American countries shall face.

The situation for Latin America is particularly stressful and perhaps the challenges even greater. It is the most important mega region in terms of biodiversity; the most diverse with regards to indigenous peoples; and possibly one of the most vulnerable

to the effects of climate change, including forest fires and other events.<sup>6</sup> The combination of richness, vulnerability, political instability and extended corruption makes Latin America a region with diverse fluctuations and different tones in social, economic and political discourses. In terms of development, the region always seems to be struggling to reach its development potential but not wholly overcoming structural and systemic problems.



## **The international movement and its impacts: national programs, plans and measures**

The initial confusion generated by the Covid-19 crisis still persisting in many countries, has led to a very interesting dynamic. Mostly internationally driven, many initiatives have emerged - from intergovernmental forums, international cooperation agencies and various countries - seeking to revitalize the enthusiasm for conservation and the ideal for sustainable development, somewhat staggered by the pandemic and its effects. All these initiatives highlight the need to strengthen efforts for biodiversity conservation and protection of the environment as a sine qua non condition for sustainable development. There is no other option or Plan B.

For example, under the framework of the United Nations and the Convention on Biological Diversity (CBD), the Post-2020 Biodiversity Agenda, which seeks to implement the 2050 Vision on Biodiversity, emphasizes the need to reach 2030 with a reduction in the net loss of ecosystems (i.e. forests), a decrease in the loss of threatened species, the maintenance of genetic diversity, the generation of nature benefits for people and improving participation in benefits derived from the use of genetic resources and traditional knowledge. There are preliminarily agreed indicators to measure these goals.<sup>7</sup>

On the other hand, the next conferences of the parties both to the CBD (COP 15) such and the Paris Climate Agreement (COP 26), pledge to adopt decisions to ensure convergence between the biodiversity conservation agenda and climate action, and to pressure countries that assume their responsibilities more intensively in order to reverse the negative trends previously described.

As a general framework to these processes - and others - the 2030 Sustainable Development Agenda and the Sustainable Development Goals (SDGs) serves as a reference directed towards all conservation actions and environmental protection, as well as programs, plans and projects on sustainable development at different levels.

Within this context, the last United Nations High-level Political Forum on Sustainable Development - in which compliance of this Agenda and SDGs are verified - debated the Covid-19 impacts on the international development agenda and how countries can resume and strengthen their actions and sustainability measures post Covid-19. A summary of the presidency of this meeting recognizes, among others, different advances to achieve the SDGs, the significant concern of the Covid-19 crisis and its impacts on national and local development, and the need to place the 2030 Agenda at the heart of efforts of countries to “return even better”.<sup>8</sup>



These intergovernmental processes and instruments strongly interact and influence regional and national policies and actions. For example, in the case of Latin America, Declarations of the Forum of Ministers of Environment of Latin America and the Caribbean (Cartagena, 2016, and Buenos Aires, 2018) emphasized sustainability as an unequivocal reference with which to align development and progress. At the next meeting of the Forum of Ministers to take place at the end of 2020 or 2021, depending on the circumstances of the Covid-19 crisis, regional biodiversity conservation and ecosystem restoration are expected to be approved.<sup>9</sup> These are also central issues on the Post-2020 Biodiversity Agenda and instrumental to reach specific SDGs.

Additionally, besides these formal initiatives, led by governments, there are also different declarations and demonstrations from civil society in the region which call for leadership and firmness by governments and different actors to strengthen the conservation, climate change and sustainable development agenda in a collaborative manner.<sup>10</sup> In this regard, influential personalities in Latin America recently launched the “Principles for a Sustainable Future for Latin America in Times of a Pandemic and Global Crisis”, a recipe to direct sustainable development post Covid-19.<sup>11</sup> They specifically propose to renovate climate and biodiversity commitments in the context of SDGs and prioritize national goals for zero emissions, accelerating energy transitions, the solutions based on nature and the development of a resilient society within limits of the planet.<sup>12</sup>

National and international synergies are evident. This complex network of international, regional and national instruments that converge on problems and issues of common interest, demand three essential things: political decision, strong institutions and science/technology and resources that allow for better implementation of commitments and agreed measures.<sup>13</sup>

The urgency to challenge climate change due to its effects in the region and the necessary solidarity with the planet (expressed in the adoption of multiple international commitments), requires in addition, consistency in institutional adjustment processes for the implementation of instruments and their acceptance among society at different levels, from citizens to rural area people. This consistency is particularly volatile in some countries due to structural weaknesses in institutions and also ideological reasons. It is not enough for the environmental authority to centralize climate change as an agenda item. Its integration and streamlining into sectors, often demands important institutional reforms.

## **Examples of technological uses and applications for conservation and sustainable development**

For decades, there has been the need for policy decisions to be well founded in evidence and science.<sup>14</sup> It seems sensible and of common logic but has had significant ups and downs with regard to their materialization. In fact, leading scholars highlight how little this evidence often has an impact on policy decisions, during these times.<sup>15</sup> Ideologies, populism, “fake news”, political calculation, unsubstantiated institutions, etc. seem to have a growing importance in policy decision processes, mainly at the national level, but also with international effects.<sup>16</sup>

However, in the midst of what could also be called a “crisis of common sense and wisdom”, there are also inspiring histories and examples of scientific and technological development and good and innovative practices that at a smaller scale, contribute to conservation and sustainable development efforts.

Many times, they lack the sufficient scale of influence to reach and much less affect policy decision processes at the national level but serve as a reminder and illustration in the sense that there are solutions to a number of urgent problems that affect populations.

Although this policy brief does not address in depth the issue of how to better impact and inform local, subnational and national policies, it does offer some suggestions on how to better position and make these technologies and good practices visible for future analysis, assessment, scaling and transformation processes, to positively impact on policy processes.

There is also the intention to show the tremendous diversity of technological tools and practices that may contribute to conservation and sustainable development in a concrete, measurable and efficient manner. In short, the aim is to take these examples from their confined spaces and show them as options of concrete, real and effective contributions to conservation and development.

Examples in Box 2 are presented in a summarized way. In some cases they refer to science and hard technology and, in others, a to a combination of these with strategies, local organization and mainly conservation practices. As already mentioned, countries in Latin America have started to implement discretely and at a small scale, some technologies and innovations applied to conservation and sustainable development. There are many, a variety and extended examples of these high-end and low investment technologies in all the countries in some context.

## Box 2

### Science, technology and good practices applied to conservation and sustainable development

Denomination	Area	Summary
“Citizen Science Project” for the Amazon led by a consortium of organizations including, the Wildlife Conservation Society (WCS), Research Institute of the Peruvian Amazon (IIAP, in Spanish), Frankfurt Zoological Society, The Common Good Institute (IBC, in Spanish), among others. <sup>17</sup>	Locations in the upper and lower Amazon of Brazil, Ecuador, Colombia and Peru.	Low-cost technology packages are implemented such as “FieldKit” for water and climate monitoring (i.e. sensors, cellular and information nodes of open access); and “Ictio” for the communal monitoring of fish in lakes and rivers through a cellular application, that is transmitted to a open access database that would predict migration due to environmental impacts and others, and assess the status of conservation, among others.
“Proyecto Providence” that integrates the Laboratory of Applied Bioacoustics of the Technical University of Catalonia (UPC, in Spanish), Instituto de Desenvolvimento Sustentável Mamirauá and the Universidad Federal de Amazonas (UFAM) of Brazil, and the Commonwealth Scientific and Industrial Research Organization (CSIRO) of Australia. <sup>18</sup>	Extreme South of the Mamirauá Reserve, between the Amazon River and Japurá in Brazil.	Deforestation is monitored and the presence or absence of species in particularly vulnerable ecosystems through audio sensors, cameras, thermal imaging and movement, to understand the actual process of biodiversity change and adaptation at a regional scale.
“Environmental Alert” and “Legal Clinic” of Sociedad Peruana de Derecho Ambiental. <sup>19</sup>	Madre de Dios Amazon	Technological tool oriented to facilitate citizen access to environmental justice, mainly for legitimate users of the Amazon Forest in Madre de Dios (communities, local committees of protected zones, indigenous groups and small concessionaries) facing illegal activities including logging and illegal mining. Basically, mobile devices are used to upload complaints to a platform that provides answers from competent authorities. A free legal clinic also provides legal orientation for those affected.

Denominación	Lugar	Resumen
“Satellite Monitoring (GPS) of Fishing vessels.”. <sup>20</sup>	Mexico, Peru and other countries.	In the case of Mexico, the Comisión Nacional de Acuacultura y Pesca (CONAPESCA) through the Sistema de Monitoreo Satelital de Embarcaciones Pesqueras (SISMEP), monitors in real time the whole Mexican deep-sea fishing fleet on both coasts of Mexico, providing information on their location and in time the volume of legally permitted catches to disembark. In Peru, the Centro de Control de Seguimiento de Flotas Pesqueras through the Ministry of Production (PRODUCE, in Spanish) has been implemented to monitor in real time illegal fisheries activities being conducted within the 200 miles, mainly industrial fishing vessels.
“Earth BioGenome Project” organized by the Smithsonian Institute, University California Davis and with the participation of a global network of scientific institutions including Universidad Autónoma de México, Universidad los Andes de Colombia and Universidad de Chile. <sup>21</sup>	Global and the Amazon region.	Through regional nodes and the application of genomic tools and advanced moveable kits to identify the taxonomy of species, over the next 10 years it seeks to decipher DNA sequences of all species on the planet, mainly for conservation purposes and understanding biodiversity distribution and evolution, starting in the Amazon Biome.
“FabLab Initiative”, designed at the Massachusetts Institute for Technology and expanded all over Latin America.	Global, with nodes by countries, for example, FabLab Peru.	FabLab is a global network of laboratories/ local innovation centers, that allows promoting innovation by providing access to digital fabrication tools. Specifically in Peru, FabLab uses digital fabrication (i.e. synthetic biology) that contributes to improving social living conditions at the local level, industrial transformation and environmental conservation.
“La Ruta Natural Viajes y Destinos, Conservamos por Naturaleza” promoted by SPDA in collaboration with local communities. <sup>22</sup>	Peru, coastal, mountainous and jungle regions.	A guide of “natural routes” that emphasizes enjoying the routes and final destination. It focuses on routes to places where you can interact with local people and elevate the trips experience as well as the destination and landscape.
“Save the Monkeys” initiative promoted by people who are activists.	Guanacaste Province, Costa Rica.	Dozens of elevated boardwalks have been installed that connect damaged ecosystems by roads and highways to provide a safe passage for monkeys and other animals among fragmented habitats. A very low-cost high impact technology that involves civil society and COOPEGUANACASTE (public lighting company).

Denominación	Lugar	Resumen
“World Bank Innovation Laboratory”, drones and space monitoring.	Protected areas in Guatemala and Argentine.	Through a drone system, images were captured on the presence of “gayomba”, a type of invasive plant that generates problems in the protected zones of Guatemala; this system has been introduced to the Parque Nacional El Impenetrable in Argentina, where it was used to detect the presence of invasive species, mapping areas and detecting poachers.
“Audiomoth”, low cost Acoustic Monitoring designed by the University of Southampton (United Kingdom) and Universidad Autónoma de México. <sup>23</sup>	Selva Negra, Yucatan Peninsula.	Acoustic Monitoring system that captures animal sounds (i.e. large felines of the Selva Negra) and identifies chainsaws, shots and other illegal practices affecting indigenous communities in the Northern part of the Peninsula.
“Local Biocultural Heritage Register,” originally promoted by Asociación ANDES, International Institute for Environment and Development (IIED) of the United Kingdom and Sociedad Peruana de Derecho Ambiental (SPDA), among others. <sup>24</sup>	Potato Park, Pisac, Cusco, Peru.	Rural women have been trained on how to use video cameras and document knowledge, innovations and practices in Potato Park communities, that have been lost, with regard to seed selection and conservation, medicinal plant conservation, use of biodiversity resources and land management, etc., such as mechanisms to empower and transmit knowledge to future generations of land-owners, in particular younger people.

Latin America and its ecosystems are a real biodiversity global “hotspot” but at the same time the region is highly vulnerable to environmental problems and anthropogenic interventions. It is therefore essential to contribute to the dissemination of knowledge on technological options, innovation and good practices that may contribute to conservation and sustainable development; understand the institutional architecture and existing<sup>25</sup> enabling or sometimes discouraging policy and normative framework, and propose recommendations and suggestions to promote a regional and national agenda on these matters.

It is evident that human ingenuity, science and technology (high-end tech or simple good practices and local knowledge) offer a growing arsenal of tools to face conservation challenges on multiple fronts, and this way, contribute to sustainable development. So called “highly complex” technologies can be added to other low-cost and “simple” ones, where the participation of society -citizens, bird watchers, researchers, landowners, among others - plays a central role in the identification, compilation and interpretation of data, early alert, etc.

## Recommendations

1. As long as environmental problems continue to be exacerbated - particularly biodiversity loss and extended climate change – human beings must resort to ingenuity and highly focalized responses, and in some cases, more comprehensive solutions. Science, technology and evidence-based good practices play and will play a crucial growing role in terms of conservation and sustainable development. To contribute to national and regional efforts in making these tools visible, promoting their escalation and assessing how they can be inserted and incorporated - through adequate translation – into policy decision processes, it is suggested that an informal regional multidisciplinary working group is formed to discuss and showcase examples of science, technologies and good practices for conservation having concrete practical effects.
2. As insistently repeated for many years, science and technology must be the basis and on the pillars of public policies in general – environmental, social and economic. The emphasis of cooperation and both public and private funding, in the light of what has been learnt due to Covid-19 and the environmental deterioration of the planet, must focus on sponsoring the generation of responses based on knowledge (including forms and traditional knowledge systems), formal science and reliable efficient and environmentally adequate technologies. In parallel, initiatives must be supported to translate and integrate these responses coherently in the dynamics of policy decision processes at different levels, in order to permeate the construction of sustained and robust public policies.
3. The examples summarized in this policy brief, even if small and localized, offer potentially scalable responses that require state action with a vision of the future, enabling associations and public-private collaborations as mechanisms for a more extended implementation, and on other scales, the responses to the problems identified. These types of responses cannot remain in the realm of an isolated project or initiative, but due to their success and proven efficiency, they must extend as a contribution to inspire extensive measures from the state sector and public finances. Scaling goes through an evaluation, deliberation and trial process at other levels.
4. It is essential to emphasize that for conservation and sustainable development, a combination of advanced sciences and technologies is required, with responses that sometimes provide less in technological terms and more in terms of organization, collaboration, management, good practices and momentum, through examples and peoples involvement. In that regard, appreciating wisdom and traditional knowledge in localized contexts, can many times lead to efficient and effective solutions to problems.

5. In general, institutions in charge of promoting technology – i.e. National Council of Science Technology and Technological Innovation (CONCYTEC) in Peru or National Commission for Scientific and Technological Research (CONICYT) in Chile, or similar in other countries – have a tendency towards the promotion, attention and financing of complex science and technology such as biotechnology, genomics, bioinformatics, satellite positioning, information technologies and platforms, etc. However, there is a wide and robust range of what can fall under the scope of “general techniques and good practices” with a high impact in terms of contributing to conservation and sustainable development. To that effect, funding programs with public funds should be implemented to also meet tools with proven effects for conservation and local development – potentially scalable, in addition.
  
6. Apart from South-South collaborations, there needs to be further collaboration between Latin America and the Caribbean and Europe and industrialized nations. A space is being created and opened in the post Covid-19 world to strengthen collaboration and exchanges of knowledge, practical know-how, scalability methodologies, etc. In some cases, it will be targeted technologies which are required; in others, responses may not be as efficient, but ensure high social and conservation returns, such as nature-based solutions and the like.



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1. The notion of a “systemic crisis” is very much associated to the economy, finances and banking (e.g. the 2008 financial crisis). In fact, parallels are made between the systemic risks of the financial and ecological systems. In short, they are risks associated to complex systems which are non-linear, have different levels of stability and are marked by hysteresis, contagiousness and synchronization. When system variables are affected, they potentially impact on every other variable. See, Khambu, J. et al. Part 3. Systemic Risk in Ecology and Engineering. *FRBNY Economic Policy Review*: November 2007 pp. 25-38.
2. This includes the Conference of the Parties (COP) of the Convention on Biological Diversity (CBD) (COP 15), COP 26 of the Paris Climate Change Agreement, among others.
3. All the countries in Latin America have some form of strategy, action plan, or in some cases laws that address biodiversity conservation and climate change. In the case of climate change related instruments, see a recent list compiled in: FAO and Fundación Futuro Latinoamericano. 2019. *Rural climate resilience in Latin America, a review of experiences, lessons learnt and scaling-up*. Quito. License: CC BY-NC-SA 3.0, Available at, <http://www.fao.org/3/ca4632es/ca4632es.pdf>
4. For a well documented and very didactic synthetic approach on the environmental state of the planet and how to solve its problems, I recommend: Maslin, M. (2021) *How to Save our Planet. The Facts*. Penguin Publishers.
5. It is estimated that as a result of Covid-19 and the holding back of national and international economies, the regional Gross Domestic Product (GDP) will drop by 1.8% and at least 30 million people will be pushed into poverty in Latin America and the Caribbean. CEPAL. Press Release. *Pandemia del COVID-19 nos llama a Construir un Nuevo Modelo de Desarrollo y Reforzar la Integración Regional para enfrentar la Crisis*. 7 de abril, 2020. Available at <https://www.cepal.org/es/comunicados/pandemia-covid-19-llama-construir-un-nuevo-modelo-desarrollo-reforzar-la-integracion>
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7. Although the Zero Draft of the Post 2020 Framework for Biodiversity includes references to the need to establish synergies between the global biodiversity agenda and climate action, it maintains worrying silence with regards to the complex connection between these and public health. This is particularly relevant taking into account the possible origin of Covid-19 in live animal species. See, <https://www.cbd.int/doc/c/efb0/1f84/a892b98d2982a829962b6371/wg2020-02-03-en.pdf>
8. This Forum is under the aegis of the United Nations Economic and Social Council (ECOSAC) which coordinates most international actions on sustainable development. The last session (virtual, due to impacts of the pandemic) of the High Level Forum was in July 2020. See, [https://sustainabledevelopment.un.org/content/documents/269252020\\_HLPF\\_Presidents\\_summary.pdf](https://sustainabledevelopment.un.org/content/documents/269252020_HLPF_Presidents_summary.pdf)
9. The United Nations will soon be launching the Decade on Ecosystem Restoration as a symbol and reference to the urgency of recovering; with concrete actions in the restoration process of different ecosystems affected by human action, and in this way contribute to mitigate the effects of climate change.
10. Ruiz, M. *Preparando el Camino a la Sostenibilidad: una Nueva Economía Post Covid para América Latina*. Serie de Comercio y Medio Ambiente. KAS, SPDA, No. 11, August 2020. See, <https://spda.org.pe/wpfb-file/preparando-el-camino-a-la-sostenibilidad-pdf/>
11. This recent and important guiding instrument (non-binding in legal terms) has been signed by personalities such as the former Presidents Ricardo Lagos (Chile), Felipe Calderón (Mexico), ex Ministers such as Manuel Pulgar Vidal (Peru), Yolanda Kakabadse (Ecuador), Marina Silva (Brazil), Manuel Rodríguez (Colombia), among others. The document of May 2020 is available at, <https://wwf.panda.org/es/?363990/principiosfuturosostenible>
12. With regards to climate change in particular, some preliminary positive results are beginning to show. The process to comply with the Paris Climate Agreement and its commitments of Nationally Determined Contributions (NDCs) requires achieving articulation and mainstreaming decisions and actions. Examples of articulation and trans-sectoralization include the National Climate Change Cabinet in Argentina, the National Commission on Climate Change in Peru, the Climate Change and Risk Management Division in Colombia or Presidential Advisory Committee of Climate Change in Chile. These institutional frameworks constitute advances that, among other aspects, ponder on the way science and technology contribute to climate change adaptation and mitigation at different levels.
13. Hunter, D. et al. (1998) *International Environmental Law & Policy*. University Casebook Serie. Foundation Press. New York.
14. Pain. E. How Scientists can Influence Policy. *Science*. February 14, 2014. Available at, <https://www.sciencemag.org/careers/2014/02/how-scientists-can-influence-policy>

15. Paul Krugman, the 2008 Nobel Memorial Prize in Economic Sciences actually says that politicians always find a reason for not doing the right thing. See, Krugman, P. (2014) *Why Economics Failed*. New York Times, May, 1. Available at, [nyti.ms/1kz4iZ7](https://nyti.ms/1kz4iZ7)
16. The most notable cases from these events are verified in the debate on climate change. In the United States of North America and mainly Brazil, the highest levels of power continue to deny a problem with the climate despite overwhelming evidence and international consensus. See, Washington, H., and Cook, J. (2011) *Climate Change Denial: Heads in the Sand*. Earthscan from Routledge. United Kingdom, United States of America.
17. See, <https://www.amazoniencienciudadana.org/>
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