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The Amazon Third Way Initiative/Amazonia4.0: Radically changing the sustainable development paradigm for the Amazon

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Ciencia, Tecnología e Innovación: ejes transversales de la agenda regional de desarrollo sostenible e inclusivo hacia 2030

Bajo el lema “Transformando nuestra región: Ciencias, Tecnología e Innovación para el Desarrollo Sostenible” el Foro Abierto CILAC 2018 está concebido como una contribución a la implementación de la Agenda 2030 suscrita por la Asamblea General de las Naciones Unidas. Desde el consorcio de instituciones organizadoras del Foro Regional de Ciencias de América Latina y el Caribe, existe el compromiso de trabajar en pos de contribuir al logro de las metas y objetivos señalados en esta estratégica hoja de ruta para el desarrollo sostenible de nuestra región.

La UNESCO, como agencia especializada del Sistema de Naciones Unidas, dedica sus esfuerzos al avance del conocimiento en cinco grandes campos vitales para el desarrollo humano y sostenible: la educación, las ciencias naturales, las ciencias sociales y humanas, la cultura y la comunicación e información.

Para cumplir con esta misión, la UNESCO opera en cinco ejes estratégicos: a) la definición de estándares internacionales; b) el desarrollo de capacidades; c) la organización y difusión de conocimientos; d) la cooperación internacional; y e) como laboratorio de ideas. Así, el Foro CILAC constituye una plataforma para potenciar estas estrategias, fortaleciendo las políticas de ciencia, tecnología e innovación de los países de América Latina y el Caribe.

La serie de Policy Papers que aquí se presenta ha sido concebida como un estímulo para la elaboración, regional y colectiva, de conocimiento relevante para responder a los objetivos de desarrollo sostenible planteados en la Agenda 2030.

Estos documentos, elaborados por expertos de reconocida trayectoria en sus respectivos campos de conocimiento, identifican desafíos y proponen ideas claves para avanzar. En sus aportes, los autores describen áreas innovadoras de conocimiento y de acción, valoran su potencial para el futuro de la región –ya sea como oportunidad o como amenaza-, ofreciendo a consideración posibles escenarios para la toma de decisiones.

Estos aportes no pretenden ser conclusivos sino que, principalmente, se ofrecen como una invitación de la UNESCO a todas las partes interesadas para que, en conjunto y sin obviar diversidades o divergencias, podamos avanzar en el debate público sobre el rol a jugar por parte de las ciencias, tecnologías e innovación en el presente y el futuro de América Latina y el Caribe. La construcción de sociedades del conocimiento que sean más sostenibles, democráticas, inclusivas y con amplia protección a los derechos humanos, constituye una tarea urgente y necesaria.

El espíritu de los textos que hoy publicamos es el de enriquecer estos debates, promoviendo su continuidad en el tiempo que viene. Lo hacemos con el convencimiento de que estos esfuerzos son imprescindibles para avanzar en la agenda regional, de cara a la implementación de los objetivos de desarrollo sostenible. Porque para conectarse al futuro deseable, debemos conectarnos a la ciencia.

¡Buena lectura, buenos debates!

Lidia Brito,

Directora, Oficina Regional de Ciencias
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The Amazon Third Way Initiative/Amazonia4.0: Radically changing the sustainable development paradigm for the Amazon*

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* Nobre and Nobre, 2018.

For the last two decades, the Amazon development debate has been torn between attempts to reconcile two rather opposing views: on one hand, a vision of setting aside large tracts of the Amazon forests for conservation purposes (referred hereafter to as The First Way) and, on the other hand, seeking a 'sustainable' resource-intensive development, mostly through agriculture/livestock, energy and mining (referred hereafter to as The Second Way). However, reality is showing that a 'convergent reconciliation' is not happening at all for the obvious reason that high input agriculture/livestock drives a rapid expansion of the commodity frontier, especially for beef production, and industrial-scale mining requires infrastructure such as energy and that, in turn, drives people and further deforestation for agriculture / livestock purposes. The decrease of Brazilian Amazon deforestation from 2005 to 2014 (about 75% decline) opens a window of opportunity to think of a novel sustainable development paradigm: The Amazon Third Way/Amazonia4.0.

A new opportunity is emerging to protect the Amazon and the indigenous people who are its custodians by harnessing the physical, digital and biological technologies of the Fourth Industrial Revolution (4IR). How would this work?

Forests in the Amazon are the result of millions of years of evolution. Nature has developed a wide variety of biological assets which include metabolic pathways and genes of life on land and aquatic ecosystems and the natural products they produce – both chemical and material. These were developed in conjunction with biomimetic assets - the functions and processes used by nature. 4IR technologies are increasingly harnessing these assets across many industries from pharmaceutical to energy, food, cosmetics, materials and mobility, and making profits. However, to date, these profits have not been channeled back to conserve the Amazon and to support indigenous and traditional communities that are the custodians of Nature.

The Amazon Third Way/Amazonia4.0 aims at unleashing a novel opportunity emerging to protect the Amazon ecosystems and the indigenous and traditional peoples who are their custodians and at the same time develop a vibrant, socially-inclusive 'green economy' in the Amazon by harnessing Nature's value through the physical, digital and biological technologies of the 4th Industrial Revolution, resulting in a socially-inclusive, 'standing forest, flowing river' new development paradigm.

As the region is still very disconnected from the main centers of technological innovation dealing with technologies of the Fourth Industrial Revolution and the advanced bio-economy, we see the Amazon Third Way/Amazonia4.0 initiative as a multi-level path toward a new inclusive bio-economy. It is possible to integrate the fostering of a highly innovative, entrepreneurial and technological economy with the revaluation of non-timber forest and industries with low end technologies. The evolution of both paths will eventually lead to a vibrant and inclusive bio-economy, respecting the forest standing/flowing river mantra.

Introduction to the Problem

It is more urgent than ever to find alternative ways to develop the Amazon. This realization comes with the science-based analysis that the Amazon may have come much closer to a tipping point than previously thought. Recent analysis (Lovejoy and Nobre, 2018) lend support to the idea that the whole Amazon system might flip to a second stable climate vegetation equilibrium, with degraded savannas covering most of the central, southern and eastern portions of the basin.

6

The drivers of such change are deforestation, climate change, and increased forest fires. Given the simultaneous and synergistic impact of these drivers of change, total deforestation must not exceed 20% to 25% to avoid transgressing a potentially irreversible tipping point. Currently, deforestation is 16%. If that happens, that would result in emissions of over 30 billion tons of CO₂ and reduce significantly the strength of the Amazon carbon sink.

Global climate considerations also matter: CO₂ emissions from forest burning may well be the biggest unresolved global climate challenge. Without reductions in rainforest burning, including in the Amazon, international goals called for in ratified international Conventions for climate, biodiversity, and water protection cannot be reached.

Deforestation in the Amazon is the largest source of GHG emissions of many Amazonian countries, including Brazil. Over 1 million km² of the tropical forest of the basin have been cleared corresponding to about 16% of the biome. And deforestation rates are increasing again throughout the basin after a decade of significant reductions (2004-2014). Additionally, the Amazon forests are an important natural sink of carbon removing 1 to 2 billion tons of CO₂ every year. Therefore, a standing forest bio-economy can support keeping these natural climate change solutions forever reducing the drivers of commodity frontier expansion. Also, there are over 200 million hectares of degraded or abandoned land in the Amazon. In the proposed new bio-economy, a large fraction of these areas can be restored through agroforestry systems providing for the value chains

and removing over 1 billion ton of CO₂ per year for over 30 years, contributing to the needed negative emissions to reduce the risk of climate change.

The challenges to achieving sustainable development in the Amazon can be broadly categorized in three categories, similarly to a conceptual framework laid out for planetary health (Whitmere et al., 2015):

- i. conceptual failures (imagination challenges), such as the vision of the Amazon as only a source of commodities and energy and the lack of imagination to create alternative, less socially and environmentally damaging development pathways based on the rich biodiversity;
- ii. knowledge failures (research and information challenges), such as negligible amount of research funding to Amazonian institutions and focus of research and monitoring systems on land use transformations and almost nothing to unveil the hidden economic and societal value of biological and biomimetic assets;
- iii. implementation failures (governance and policy challenges & entrepreneurial capacity failures), such as the failure of Amazonian countries' governments to recognize the risks of current and past development policies and the inefficient implementation of a diversified economy by public and private actors and even the failure to share more equitably the benefits of the current resource-intensive economy.

We must analyze a challenge that comes before the search for practical solutions. The major flaw when discussing the development of tropical regions is the conceptual challenge of lack of imagination and creativity. Why can't we imagine an alternative future for the Amazon? Brazil is proud to be considered an environmental power for its vast renewable resources of water, climate and especially for its incomparable biodiversity. However, at no time in our history has an innovative development model been conceived, planned, invented or

implemented in which biological diversity was economically relevant, except as an aesthetic value of utility for few activities such as tourism or, in another sense, for the country image of lush tropical nature.

The intense resource based agribusiness, mining and hydropower in the Amazon generate wealth and little of that is reinvested to propel health and education improvements within the Amazon beyond what is called for in the licensing process. That is in part due to the regressive taxation system and in part due to historical inefficiencies in investments in public services. For instance, the highest average per capita income region in Pará—annual per capita income of close to R\$ 50,000-- is the iron ore-rich Carajás area, with overall income higher than national average. However, social indicators such as health and education services are no different than other regions of the State of Pará and much lower than national averages. In summary, very little of the wealth remains in the region and improves the wellbeing of the population.

The Amazon Third Way Initiative/ Amazonia4.0

The heightened, critical risk to the Amazon forests calls for intensifying the search for disruptive socioeconomic alternatives and transformations. For many decades contradicting strategies to develop the Amazon have been at work: conservation (we call it the ‘First Way’) versus resource-intensive development (which we call the ‘Second Way’). Considerable efforts were made by successive governments and by NGOs to reconcile those two ways through agricultural ‘sustainable intensification’, -- albeit with meager results. The question therefore remains how to unveil the potential of a forest-biodiversity economy in the Amazon.

We argue that a radically different ‘Third Way’ for sustainable development of the Amazon is within reach. We propose to utilize modern technologies of the 4th Industrial Revolution (4IR) to harness the biological and biomimetic assets of the Amazon’s biodiversity. And we postulate that this *Amazon Third Way or Amazonia4.0* can support a standing-forest-flow-

ing-river bio-economy while being socially inclusive. Ultimately, developing a green economy in the Amazon as a key pathway to sustainable development, prosperity, social inclusiveness and keeping forests standing.

4IR technologies increasingly harness natural assets across many industries from pharmaceuticals to energy, food, cosmetics, materials, and mobility. Indeed, they are making profits, but to date these profits have not been channeled back to conserve the Amazon and to support the custodians of nature--indigenous and traditional communities—and also urban population in the region.

The approach of the Amazon Third Way/Amazonia4.0 would embrace and enhance the emerging Fourth Industrial Revolution, an accelerating confluence of technological breakthroughs covering wide-ranging fields such as artificial intelligence, robotics, the internet of things, blockchain, genomics, synthetic biology, DNA editing, nanotechnology, energy storage and quantum computing, as well as bio-mimicry. This new economy has the potential to become much larger than the present one based on the unsustainable use of natural resources. This would catalyze disruptive innovations and provide needed mechanisms to improve the wellbeing of local populations. It excites me because it is a new and disruptive vision of empowering forest people through knowledge and the use of modern technologies, something rarely attempted anywhere.

The Amazonia Third Way/Amazonia4.0 can be seen as one of the much-needed disruptive social and technological transformations towards a sustainable development pathway. It calls for

“an Amazon-specific Fourth Industrial Revolution innovation (4IR) “ecosystem” that is able to rapidly prototype and scale innovations that apply a combination of advanced digital, biological, and material technologies to the Amazon’s renewable natural resources, biomimetic assets, environmental services, and biodiverse molecules and materials” (Nobre et al., 2016).

Such innovations also apply to enhancing biodiversity-based value chains that would carry

a unique 'Amazon-brand' and able to reach global markets with such differential.

Underpinning the development of a standing forest-flowing rivers, biodiversity-driven bio-economy in the Amazon is the underlying assumption that such an innovative economy must be deeply rooted and developed in the Amazon. The region must not be seen only as a producer of primary inputs to bio-industries elsewhere. Rather, it must generate local and diversified bio-industries and value-added products across all links of the value chain. It should also be a valuable source of new knowledge on the biological and biomimetic assets hidden in the biodiversity and on the way countless species interact. Preconditions to achieve this would be, on the one hand, much enhanced entrepreneurship, and on the other hand, and capacity to effectively utilize modern technologies of the 4IR. Another important precondition is the existence of advanced biology laboratories, public and private, across the Amazon to generate new applied knowledge and train human resources necessary for such enterprise.

A novel capacity development program needs to be created to cover these two interlinked dimensions. It must focus on the development of innovation "ecosystems" in the Amazon. There is a suite of 4IR technologies that are becoming not only available, but affordable. They are easy to use anywhere, and they do not require sophisticated laboratories or advanced skills for their operation.

Within a proper legal and ethical framework, the Amazon Third Way/Amazonia4.0 offers unprecedented opportunities to local populations to develop a vibrant, socially-inclusive 'standing-forest, flowing-river' green economy. By harnessing nature's value through physical, digital, and biological technologies of the 4th Industrial Revolution, we can simultaneously protect the Amazon ecosystems and their traditional custodians.

The region is still largely disconnected from the main centers of technological innovation deal-



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ing with 4IR technologies and the advanced bio-economy. The Third Way initiative is conceived as a multi-level path toward a new inclusive bio-economy, combining a highly innovative, entrepreneurial and technological economy with the re-valuation of non-timber forest products and industries with low-end technologies.

One important element in the strategy is the development of 'Amazon Creative Labs'. We propose the launching of a number of such labs - laboratories for innovative experimentation set up throughout Amazonia. They will provide intensive training linked to local potentials to generate a virtuous insertion on bio-economy related new opportunities. Typically, Creative Labs will be located in smaller communities—including indigenous communities--, villages, and towns, and university campuses, assembled on tents or on floating platforms packed with state-of-the-art equipment and technology for both, wide audience learning processes and core value chain local development.

That will be developed concomitant to establishing public policies to encourage both knowledge development in public and private advanced biology laboratories and innovative entrepreneurship and bio-industries.

In sum, within the Amazonia Third Way/Amazonia4.0 Initiative, an approach has been developed to operationalize the principles and practices that will allow a proposed paradigm shift for Amazon sustainable development. It defines seven interconnected dimensions:

- (1) the recognition of existing natural knowledge;
- (2) the ability for learning from Nature;
- (3) the capacity to applying biodiversity-based knowledge to human needs;
- (4) the capacity to produce biodiversity-based goods, processes and solutions;
- (5) the insertion of biodiversity-originated products on a local-to-global bio-economy;
- (6) the fair sharing of socioeconomic benefits and life quality improvement for all;
- (7) the raising of the Amazon biome's intrinsic value by local and global societies.

Conclusions

Are there examples of the potential of such biodiversity-driven bio-economy at scale? The Açai berry illustrates the enormous economic possibilities of keeping forests standing. It is the fruit of the Amazonian palm tree, an abundant species with more than 100 trees per hectare. Like thousands of other natural products originating from tropical biodiversity, açai was used as food by indigenous and traditional populations, who over centuries developed effective techniques for selecting and increasing its productivity in agroforestry systems.

Today, açai has firmly connected farmers in Amazonia's agroforestry systems with global markets. Production, collection and processing techniques have been improved. More than 200,000 tons of açai fruit are produced per year, as well as hearts of palm and other derived products. And growers' income is much higher than earnings by workers in livestock or logging, supporting more than 350,000 people in the state of Pará alone. The value of açai lags behind only beef and tropical timber -the main vectors of Amazon deforestation- among products of animal and vegetal origin in the Amazon. At the current rate of growth, it will reach second place in a few years.

Many hundreds of biodiverse products in the Amazon are already known and used, albeit on a small scale. If they could follow the example of açai, a more dynamic, equitable and powerful economy would emerge -one far different than the current regional economy based on meat, timber, grains, energy and minerals, which by their nature are concentrators of wealth.

The greatest potential lies in what has not yet been discovered. The great capital of this century is not material, but knowledge. Science and technology can unveil the incomparable biological and biomimetic assets hidden in Amazonian biodiversity, leveraging innumerable new bio-industries and services in an innovative pathway to the bio-economy of the future, a more equitable and all-inclusive green economy. That is what the Amazon Third Way/ Amazonia4.0 initiative aims to unleash.

Implications and Recommendations

First, we need to understand the nature of the socioeconomic and political drivers accounting for the rapid transformation of the Amazon in the last 50 years and the consequences of the resource intensive development policies in action in contrast with the view of forest preservation and setting aside large tracts for conservation.

As mentioned before, the Amazon Third Way/ Amazonia4.0 is not one more attempt to reconcile resource-intensive development with conservation. Instead, it will seek to implement the 21st Century paradigm of knowledge societies to Amazon realities through research and development, entrepreneurship, 21st Century skills and education, and fit-for-purpose sustainable development policies towards a standing forests-flowing rivers inclusive bio-economy

Second, we have to deal with solution spaces, recognizing that an important effort has been done to identify and diagnose the risks to the Amazon of the current development actions and policies, including their fragilities. We are in urgent need to find feasible solutions of a different nature: driven by communities and by an entrepreneurial revolution powered by the Fourth Industrial Revolution and not only by powerful legacies, assisted by altogether more sustainable policies based on knowledge, be it scientific/technological or traditional.

Third, we must discuss in more details the role of some key enablers and catalysts to jump-start sustainable pathways for the Amazon in two categories, those to enable a biodiversity based development, namely research, development and innovation; harnessing the Fourth Industrial Revolution technologies to unlock the economic value of nature; and conducive regulatory framework; and those necessary to implement such novel paradigm, agroforestry systems; innovative entrepreneurship; bio-industries; product-based and knowledge-based value chains.

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OBJETIVO DE DESARROLLO SOSTENIBLE 15:

Vida en la tierra

La vida humana depende de la tierra tanto como del océano para su sustento y subsistencia. La flora provee el 80 por ciento de la alimentación humana y la agricultura representa un recurso económico y un medio de desarrollo importante. A su vez, los bosques cubren el 30 por ciento de la superficie terrestre, proveen hábitats cruciales a millones de especies y son fuente importante de aire limpio y agua. Además, son fundamentales para combatir el cambio climático.

La actual degradación del suelo no tiene precedentes y la pérdida de tierras cultivables es de 30 a 35 veces superior al ritmo histórico. Las sequías y la desertificación también aumentan todos los años; sus pérdidas equivalen a 12 millones de hectáreas y afectan a las comunidades pobres de todo el mundo. De las 8.300 especies conocidas de animales, el 8 por ciento ya está extinto y otro 22 por ciento corre el riesgo de desaparecer.

Los Objetivos de Desarrollo Sostenible apuntan a conservar y recuperar el uso de ecosistemas terrestres como bosques, humedales, tierras áridas y montañas para 2020. Detener la deforestación también es de vital importancia para mitigar los impactos del cambio climático. Es urgente tomar medidas para reducir la pérdida de hábitats naturales y la biodiversidad, que son parte del patrimonio común de la humanidad.

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