AGRICULTURAL POLICIES IN DEBATE

The struggle for "green" in the era of the carbon market

Tropical production versus temperate standards

DANIEL VARGAS

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FGV EESP ESCOLA DE ECONOMIA DE SÃO PAULO

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Introduction

What is "green"? In popular parlance, it is a color. In physics, a particular wavelength spectrum. In chemistry, the product of a particular light-absorbing structure. In leisure, the mixture of blue and yellow. In the international climate transition in which the world finds itself, "green" has another meaning: it is an economic condition based on scientific, economic and legal *standards*, based on which planet-friendly activities are selected and distinguished.[1]

These "*green standards,*" for example, structure and organize the carbon markets, guide the allocation of resources between companies and sectors, guide many innovations in the economy, regions or countries. They are also the ones that have been increasingly pointing out, in private planning, where efforts should be placed. Or, in diplomatic negotiations, they determine the direction of priority commitments to the planet.

Since the 2000s, the concept of *green* has made substantial progress in the temperate world. Rich countries – especially in Europe – were the first to become aware of this and, under pressure from international agreements, embraced the environmental commitment faithfully and powerfully. They were also the ones who, in order to organize and direct their efforts, have built the science and the foundations for decarbonization, starting with the carbon market.

Since 2015, the global scenario has changed. With the Paris Agreement, the rest of the world fiercely joined the same global climate agenda. The tropical world, of which Brazil is a part, then took on the commitment to decarbonize its production matrix, for the sake of the environment and the planet. Once divided, rich countries and developing countries are now part of the same set of obligations.[2]

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1 The analysis is inspired by a tradition of thought that assigns the meaning of concepts to the context in which they are found – *pragmatism*. For example, see John Dewey, The Quest for Certainty: A Study of the Relation of Knowledge and Action (1929); The Reflex Arc Concept in Psychology (1896) and Reconstruction in Philosophy (1920). For a contemporary perspective, see also, for example, Hilary Putnam, Representation and Reality,

2 For an overview of changes in climate governance brought about by the Paris Agreement, see The Paris Agreement on Climate Change, organized by Daniel Klein, Maria Pia Carazo, Meinhard Doelle, Jane Bulmer and Andrew Higham, Oxford University Press (2017).

In 2021, in Glasgow, the planet's global pact with the climate was completed. All countries around the world agreed to create the *general foundations* of a global carbon trading regime – the carbon market. The purpose is to ensure, step by step, the integration and harmonization of various emissions trading regimes on the planet, enhancing the global capacity to fight the monster of climate change.

The whole world, in short, has now assimilated the same shared global decarbonization script originally set up to guide and support the decarbonization of temperate countries. The "*green standards*" have gone global. At the same time, a version of "temperate green" has also become global, not often able to see the particularities of tropical food-producing countries.

This essay examines, in the first place, the tensions that the globalization of green standards, constructed primarily from the experience and urgencies of the temperate world, impose on the tropical world. In the analysis, special attention will be given to the dynamics of carbon exchanges and the economic consequences that tend to fall on developing countries producing food.

The central purpose of the presentation is twofold. The first is to discuss how the *green compass of climate transition* is currently out of balance. The second is to draw attention to the economic and social effects of this distortion. On the one hand, the tendency to "hide" the merits and environmental contributions of tropical countries – the green assets. On the other hand, the tendency to overestimate contributions and raise demands on the developing world.

The final balance of this process is hampering competitiveness or closing the market for tropical production. And, indirectly, creating benefits or preferences for other parts of the world. And the most serious damage to the world: compromising the engagement of producers and leaders, especially in developing countries, affected by a kind of protectionism disguised as green.

This essay is organized into five parts. Part I describes the general theme and challenge. The next three parts address (II) *scientific tensions* (scientific parameters that distort *green*), (III) *economic tensions* (economic parameters that distort the conversion of green into income), and (IV) *legal-institutional tensions* (institutional parameters that distort the fair allocation of responsibility for emissions between countries).

The last part (V) suggests guidelines for Brazil to start solving the problem. The key: the tropicalization of green as a state task, unfolded into two movements. Inwards: a movement for scientific-production progress that matures tropical metrics and methodologies to measure the emission of each Brazilian product. Outwards, as a reflection of internal politics, a movement of *aggiornamento* – improvement – of economic and legal standards based on which we allocate prices and responsibilities for the green transition on the planet.

1. Green

1.1. Consensus and dissent

Over the past 30 years, the fight against climate change has advanced along several parallel paths. At an international level, the UNFCCC is the global forum for mediating dialogues between countries. The private sector, led by the financial sector, is increasingly embracing commitments to decarbonize its portfolios and investments. Subnational entities, increasingly active in the climate agenda, also play a leading role in production conversion policies and experiments. All of this is embedded in a voluminous network of civil society organizations.[3]

As a whole, these organizations and entities have established a movement for climate transformation – and, above all, a global movement of economic transformation – supported by three consensuses and a major challenge.

The first consensus: the *hidden cost*. The development of countries and companies over the past two centuries has been supported by a hidden cost – the free provision of nature services. No company or country has paid for these services. But, over time, society and the planet have picked up the bill in the form of climate inflation – arctic melting ice, rising sea levels, growing number and impact of wildfires, storm surges, and changes in the rainfall cycle.

The second consensus: *pricing*. Solving the problem will require us to reveal and internalize this hidden cost in the companies' business models and in the countries' strategies and development plans.[4] Environmental services, so to speak, need to be "priced," starting with the most pressing demand on the climate agenda today: the pricing of carbon filtering service in the atmosphere – in one word, the pricing of carbon.

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3 On the network of actors in the climate agenda, see Kate O'Neill, The Environment and International Relations, Cambridge U. Press (2009).

4 In economics, externalities that are not properly recognized or internalized generate social consequences. The solution would require mechanisms that would improve or overcome traditional institutes of regulation, taxation and compensation. For an overview of the climate agenda and economics, see, for example, William Nordhaus, Economics and Policy Issues in Climate Change, Routledge (2018); and Nicholas Stern, The Economics of Climate Change: The Stern Review, Cambridge U. Press (2006).

The third consensus: *varied institutional forms*. There is no single way to price environmental services. There are different ways and arrangements, such as taxation of polluting activities, taxation at the border of imported products, modifications in institutes of responsibility or contracts, changes in the organization of property. The most promising mechanism – and the most recognized in the world today – to address the two previous consensuses is the carbon market, which also takes different shapes.

The three consensuses reveal, together, the prevailing intention on the planet to combine the economy and the "green," making nature a partner of production. Amidst the consensuses, however, a basic and increasingly sensitive question takes the lead of international discussions: what exactly is "green"?

In the immensity of production practices that are so diverse on the planet, in such varied climates, geographies, social realities, "green" is the attribute that distinguishes production and commercial activities that deserve protection, support and encouragement, against "non-green" activities that, as soon as possible, should cease to exist.

It is green that makes it possible, for example, to measure, evaluate, and price activities, people, companies or countries in one part of the planet – and compare them with green in other parts. It is also green that will dictate who or what will legitimately deserve preferential or subsidized credit, as, in practice, provided by the carbon market.

1.2. Green standards

The definition of green in the climate agenda is a dynamic and complex process that involves agreements and practices that move forward side by side, not always in an orchestrated way, but establishing, over time, references of action.

Two basic characteristics define the standards. The first one: once created, they inhabit the subsoil of our perceptions. They are no longer an immediate object of strangeness or questioning, to become an unrevealed assumption, a subtext of reflection and action. The second is a consequence of the previous one: the standards become a kind of invisible piece of knowledge, fed and reinforced by practice.

It is this invisibility, paradoxically, that gives standards rigidity and effectiveness in the performance of their tasks. After all, they saw the shared foundation upon which social collaboration should occur in the daily routine of problem-solving.

In overall climate governance – and in the changing economy – *green* is the result of a pattern of references of three layers, not always dissociated or easily dissociated.

a. Science: the measurement of nature

The first layer of green is formed by a set of scientific *standards*, metrics and methodologies for measuring emissions and the environmental contribution of products, companies, sectors and countries. These standards serve as a reference to specify, in a natural environment, the environmental footprint of a product, activity or company.

For example: what is the carbon balance of a rice paddy? How much do soy crops in southern Mato Grosso impact the planet's climate? How to measure the environmental footprint of livestock farming in the French towns?

The answer to these questions is provided by science, based on a range of measurement standards, made up of factors and metrics, based on which we estimate the impact on the climate and define prices – as we will see below.

b. Economy: the economic conversion

The second layer is the conversion of green into an asset – and environmental services into economic resources. In the climate transition, green is also a set of economic standards, which allow us to convert "environmental assets" into "economic assets," and "environmental damage" into "economic debts." Organized on a shared platform, these assets and liabilities become a market that rewards more sustainable activities, that is, greener activities.

For example: how to convert carbon into an asset? Starting with the definition of property, with the recognition of an authority over goods. And also, with the determination of environmental liabilities as a cost. From then on, the exchange scheme allows for price variations. How much is methane worth? How much is a country's environmental footprint worth?

c. Law: the legal definition

Finally, green is also a layer of legal standards: a set of definitions that resolve uncertainties by establishing rules of conduct and collective organization. On the environmental agenda, these rules can be national – as they define standards of ownership, contracting, and accountability. Or they can be international, determining how countries, committed to the climate, should respond and make their environmental contributions.

For example, what responsibility does a country have for cutting its greenhouse gas emissions? What is a company's responsibility for the quality and safety of the products it sells? What are the conditions for marketing this product? How should the market be regulated?

The sum of these patterns creates a global compass of the world's economic decarbonization actions. As much of the progress in this structure took place in a particular space – of rich and temperate countries, particularly in Europe, taking the first steps to fight climate problems – they created the "compass" that is currently guiding the debate and climate governance actions.[5]

Adjusting the direction of the green compass also means learning to recognize and reveal the standards of climate governance. Doing so requires looking closely at its details – its context, its workings, and its internal dynamics. And thus, shedding light on aspects of reality that create and reinforce that, at a first glance, it may be noticeable to those who carry out routine tasks.

Next, I examine, in the form of an essay, a set of exemplary tensions in this system, created over the last 30 years, for some parts of the planet.

5 For more information on the argument, see also Daniel Vargas, Mercado de Carbono: A Favor dos Países Ricos e Contra os Países Pobres. Revista Agroanalysis, v. 42, n. 4 (April 2022). Available at https://bibliotecadigital.fgv.br/ojs/index.php/agroanalysis/article/view/87779 (Retrieved on December 16, 2022).

2. Scientific tensions

I begin with a set of tensions caused by uncalibrated scientific standards.

The first tension lies in the principle of *temperate averages* to estimate reality in the tropical world. The second tension lies in the *biases embedded* in measurement processes that distort reality in the tropical world. The third tension lies in the extrapolation of "blame" – the attributes of a reality are unduly connected to another, very different one.

The three tensions reveal challenges to rigorous scientific progress.

2.1. Temperate averages in a tropical context

I call the first tension distortion of temperate averages.

The global measurement regime organized by the UNFCCC is an intelligent machine capable of learning and evolving over time. The system works like a steeplechase: as one moves forward, new research and data tend to correct inaccuracies and detail generalities.

To make it work, the global regime operates in three directions.

The first one: we start from a *global standard*. The IPCC produces (1996, 2006, 2019) and disseminates a list of emission factors and gas conversion metrics based on global averages, for a variety of activities and products. These factors work as a "proxy," a reference to guide the measurement effort of all countries in the world.

The second one: global averages – the so-called tier 1 – can be moved away and replaced by more precise factors and reference parameters adjusted to the regional (tier 2) or local (tier 3) reality, while backed by advanced science and in publications recognized by the international community.

The third one: as science progresses, new emission data and references are updated and improved. On the one hand, local breakdowns adjust the measurement of emissions.

On the other hand, local data feed back into the general base – the general benchmarks of Level 1.

The combined effect of this process is continuous progress in scientific quality, data production, specification of the environmental footprint of each activity and location.

The dynamics of scientific development, however, tend to produce "advantages" for temperate countries.

The first one: starter distortion. Temperate countries are "the gold standard" of how the global measurement system works – they are the very embodiment of tier 1; after all, science in the developing world, to a large extent until today, is relatively less developed – Brazil, of course, is an important exception in the field.

The second one: translation distortion. Application of the "gold standard" in the temperate world to assess the tropical world's footprint causes distortions that are detrimental to the balance of emissions in food production. What the data tend to leave out, in measuring reality, are the *tropical particularities*, marked by the intensity of photosynthesis and the efficiency of agriculture in capturing carbon dioxide from the atmosphere.

The third one: temporal distortion. Over time, advances in measuring emissions in the temperate world are slower – variations in the behavior of production activities, especially in rural areas, are smaller than in the complex, rich and dynamic world of tropical nature. The northern neighbors, so to speak, have done a relevant part of the scientific work to understand "soils." Those who have a much costlier scientific burden – including pricing their distinguishing features – are the developing countries. Here's the question: those who will most need advances in science over time, to adjust the averages to their reality, are precisely those who tend to have less installed scientific capacity.

Consider, for practical purposes, the following problem.

Europe has announced its intention to "tax" agricultural products at the border. It makes progress in regulating food production and land use. To ensure competitive equality, it must demand that imported products comply with the same decarbonization requirements. When parking at the terminal in the French port of Nantes-Saint Nazaire (western France), the inspector will assess carbon taxation according to the emissions footprint.

How will Brazilian soybean be measured? According to the European rule, unless the country of origin has different internationally recognized references.

Today, the national reference for "metrics" – factors and measurement parameters – is the National Inventory. Over the years, Brazil has made progress in emission factors at the regional level for agricultural products, starting with soybean – these are the tropical emission factors, tier 2. Nonetheless, the country is still on the way to tropicalize – and flesh out, for production activities underway – the emission removal factors, despite recent advances,[6] still lacking international recognition. The outcome: Brazilian soybeans can indeed be taxed according to temperate standards; or, even if part of the tropical factors is admitted, the calculation of removals, so decisive for the balance between us, must be left out of the "price."

In short, the first tension is the following: in climate governance, reference metrics created from *averages* adjusted to the reality of data from the temperate world, have become a "universal calculator" to measure emissions from production activities in other parts of the world. The effect of this process is to distort, over time, the production reality in the tropical world. What looks like a scientific problem will soon become an economic wall capable of imposing obstacles to competition and economic development in the tropical world.

2.2. Caricature of vices

I call the second tension the caricature of vices, with reference to biases embedded in scientific measurement processes that "exaggerate" *vices* in some production activities or regions around the globe.

An example that clearly expresses the problem is the current standard for measuring deforestation in the Amazon. Deforestation metrics in the region tend to exaggerate our shortcomings as they treat forest cutting as a synonym for fire.

Deforestation is terrible for a number of reasons, but it is not right to treat it as a synonym for forest burning. The measurement of emissions resulting from the conversion of forest into other land uses, in the Amazon, treats forest cutting and fire in a basically indistinct way. In forest cutting – deforestation, properly speaking – wood can and should

6 Danilo F. Trovo Garofalo et. al. Land-use change CO_2 emissions associated with agricultural products at municipal level in Brazil. Journal of Cleaner Production, vol. 364, Sep. 2022. Available at: https://doi.org/10.1016/j.jclepro.2022.132549 (Retrieved on December 16, 2022).

be used for different purposes. The 4th Brazilian Inventory began to solve the problem, recognizing part of the use of wood.

There is still a long way to go, though. On the one hand, data on the use of wood from deforestation – largely illegal – are scarce and incomplete. Without data, it is not possible to measure. Without measurement, it is not possible to enter information into the inventory. Although the Inventory recognizes that part of the wood can be used, in practice, it still considers that a large portion of the carbon stored in the forest will turn into carbon dioxide in the atmosphere.

On the other hand, the Inventory[7] itself recognizes (p. 156) the challenge, by announcing that the organic matter of secondary vegetation is calculated as burning. It works like this: after the removal of trees, the area will be burned.

"Industry estimates of non-CO_2 gases (CH4, N2O, CO and NOX) were based on the area of conversion of natural vegetation for human use. That is, it is considered that, after removing part of the original biomass in the form of firewood for the manufacture of furniture or to be used as fuel, it is burned (Box 2.9)"

It does not seem to be the best or only assumption. Firstly, secondary vegetation can also be (and often is) used, which the data does not capture. Secondly, the land can be used for another production use, without the occurrence of fire and without generating emissions. Saying this, however, might give the impression that Brazil is lenient with deforestation and biodiversity loss.

Forest emissions calculation could be assumed as follows: forest conversion can shift carbon stored in the field to other productive and sustainable uses – what used to be done with fossils will now be done with timber. Carbon stock in the forests has now become carbon stock in the cities, homes, industries, streets. It shifted but did not rise into the atmosphere.

We do not want to exchange our stock of natural forests for timber in the cities. But learning to take advantage of the potential of photosynthesis, in forest management and industry, is a valuable route for the future. At the same time, soil can also sequester

7 See chapter 2 of the 4th National Communication of Brazil to the UNFCCC, available at: https://www.embrapa.br/busca-de-publicacoes/-/publicacao/1129471/inventario-nacional-de-emissoes-e-remocoes- anthropic-of-greenhouse-effect gases (retrieved on December 16, 2022)

carbon. Soil preparation increases its organic matter content, hence raw material to convert CO_2 from the atmosphere into food, clothing and energy.

Something must be made clear: the destruction of forests, especially in public areas, is a despicable offense and must be repressed for a number of reasons, starting with the loss of biodiversity and the theft of public lands, as it is usually the case. Nevertheless, these reasons should not include the caricatured, imprecise and distorted idea of deforestation with fire. Incidentally, to do so is to overlook the important challenge of understanding how exactly hot spots in forest fires generate emissions.

2.3. Extrapolation of blame

The third tension results from the undue attribution of blame based on a limited view of the reality of a territory or country.

Take the case of biofuel production in Brazil. According to international reference "metrics" in the European and North American biofuel market today, when growing sugarcane in São Paulo, one must consider the environmental footprint of deforestation in the Amazon.

The biofuel market is highly regulated in the world. Among the concerns that motivate the control is the risk of biofuel trade causing the replacement of areas originally intended for food crops with areas now intended for planting raw material for ethanol or biodiesel. What should serve to help the environment, in practice, could end up causing new, even more serious, problems.

To avoid this "replacement of areas" – or the expansion of the agricultural frontier over forest areas, countries that purchase biofuels – such as the United States and the European Union – adopt parameters for calculating environmental impact. At the same time, they also define a formula for calculating emissions, recognized as a green standard by the country, for carrying out commercial operations.

In the United States, this formula is defined by the GTAP (Global Trade Analysis Project), prepared and managed by Purdue University.[8] According to this metric, land use is a

8 The tool is coordinated by the Center for Global Trade Analysis, led by Professor Thomas W. Hertel, Department of Agricultural Economics at Purdue University. Available at: https://www.gtap.agecon.purdue.edu/ (retrieved on December 16, 2022).

zero-sum game: when you decide to plant sugarcane in the area, you are modifying its original use, which could be (a) maintaining the forest, now deforested, or (b) conversion from food area into "biofuel" cultivation area. In both cases, the expansion of the biofuel frontier would have a considerable environmental impact.

It may make sense in countries where land availability is about to run out. In California, planting an extra hectare of corn to produce ethanol is, at the same time, not using that area to plant fruit or vegetables. In Europe, the same thing – which makes sense in a highly populated continent with little available fertile land for food.

In Brazil, the reality is quite different. Firstly, the country has a huge number of areas with very low productive use – degraded areas (or in some degree of degradation) represent around three times the area used for farming.[9] Secondly, tropical agriculture grows two or three crops over the same area in an annual cycle – unlike the temperate world, where the soil is frozen for much of the year. In Brazil, land use is a multiple-sum game – and a field for continued productive use.

By ignoring the Brazilian production reality, the temperate system for controlling the unwanted expansion of biofuel over areas of food production or forest preservation eventually unfairly places the *blame* on us.

Imagine the following situation: a producer who decides to plant sugarcane in the city of Morro Agudo, in São Paulo, is "held accountable" for promoting deforestation in the Amazon 1800 km away from there. It would be like saying that a citizen plants wheat in Sicily, in southern Italy, and someone cuts down a tree on the outskirts of London, in northern Europe.

The direct São Paulo-Amazon connection has been questioned with emphasis by Brazilian research. Embrapa recently released a study pointing out the failures of the "presumption of blame" in the international standard for measuring the carbon footprint of soy, corn and sugarcane. With analyses of satellite data, combined with Brazilian information and data, Embrapa reveals flaws in the emission factors embedded in the North American calculator. In the case of sugarcane, the Brazilian research reduces the weight of emissions by 97%. In the

9 According to data from LAPIG and MapBiomas, Brazil has 160 million hectares of pastures, of which 89 million hectares have some level of degradation. This represents 52% of the pasture areas in Brazil. According to MapBiomas, in 2020, Brazil had 55 million hectares of crops (4.3% of the Brazilian territory) (See https://mapbiomas.org/area-plantada-com-soja-no-brasil-e-maior-que-a-italia#:~:text=A%20%C3%A1rea%20total%20de%20agricultura,milh%C3%B5es%20de%20hectares%20em%202020.; Retrieved on December 16, 2022).

case of soy, by 85%.[10] The results, published internationally and submitted for registration abroad, are under appraisal for a potential updating of the "green" benchmarks abroad.

The importance of tropicalizing indirect impact metrics cannot be overlooked. An aviation company has recently started business talks with Brazil, with the support of FGV-Agro, for the adoption of ethanol from Brazilian sugarcane as a substitute for kerosene in new engines being fabricated. Talks with Brazil were abruptly interrupted. Asked why, they replied: "Brazilian sugarcane has a high emissions footprint, as it generates changes in land use and forest cutting in the Amazon, as revealed by international measurement standards."

This is an emblematic case, but it is not the only one. What happened in this negotiation happens every day with increasing frequency in commercial relations around the world, silently and discreetly. The price of green, based on metrics that transfer blame between regions thousands of kilometers away from each other, define which activities are green – therefore competitive and prosperous; and which ones are not.

2.4. Livestock in oil-stained lens

Another relevant scientific tension on measurement standards concerns the definition of methane gas emission metrics, particularly their application to agricultural activities.

The "gas conversion or parameterization metric" is a formula designed to convert the climate impact of different gases into a common unit to better understand and compare their dynamics. The default currency in the climate market is "CO_2e (CO_2 equivalent)". Each metric, therefore, suggests a path for translating the impact of a gas – in temperature change or in warming – in proportion to CO_2.

Over the past few years, fighting methane emissions has become a global priority (alongside general efforts to fight emissions of other gases, such as CO_2). At the COP26 in Glasgow, over 100 countries committed to cutting down on methane emissions.[11] Since

10 See the BRLUC (Brazilian Land Use Change) method available at https://brluc.cnpma.embrapa.br/ (Retrieved on December 16, 2022). And Danilo F. Trovo Garofalo et. al. Land-use change CO_2 emissions associated with agricultural products at municipal level in Brazil. Journal of Cleaner Production, vol. 364, Sep. 2022. Available at: https://doi.org/10.1016/j.jclepro.2022.132549 (Retrieved on December 16, 2022)

11 For further information, see https://www.globalmethanepledge.org/ (retrieved on December 16, 2022).

then, dozens of countries have developed their policies focusing on methane control, according to the emission sources in their economy.

The global convention has been to look at methane emissions as an equivalent challenge from three sources: (a) livestock (from ruminant digestion), (b) oil (through leakage from extraction) and (c) landfills (from "fermentation" of organic matter). Each of these activities, in the world, accounts for about 30% of global methane emissions. Livestock, in this view, is as harmful as oil or landfills.

The global view of the problem, however, is gradually being dilapidated – or partially challenged – by scientific studies that reveal particular attributes of the methane cycle in livestock. The IPCC, in a report released this year (AR6, p. 137), recognizes the value of these studies, conducted at Oxford University,[12] and warns against the risk of current metrics significantly overestimating methane emissions.

Where exactly is the problem?

Methane gas has particular characteristics compared to other gases. It is a fast gas: unlike CO_2, which survives from 100 to 1,000 years in the atmosphere, methane has a short life span, from 10 to 12 years. On the other hand, it is a powerful gas: while living in the atmosphere, its warming potential is more than 20 times greater than CO_2 – molecule by molecule, it can be 80 times greater, depending on the temporal distribution of heating, considered in the metric of calculation.

In short, methane is "fast and furious." But what exactly should be the "measure" used to quantify the impact of methane emissions in different sectors? How do you deal with different metrics – with varying impacts? How does each of these metrics impact different economic activities? In particular, how should the methane cycle in livestock be measured?[13]

Flow gas. Methane is a flow gas, unlike CO_2, a stock gas that survives for a long time in the atmosphere. In 12 years, methane is "subtracted" from the environment through

12 See Myles R. Allen et al, A solution to the misrepresentations of CO_2-equivalent emissions of short-lived climate pollutants under ambitious mitigation. Climate and Atmospheric Science volume 1, Article number: 16 (2018). Available at https://www.nature.com/articles/s41612-018-0026-8 (Retrieved on December 16, 2022).

13 For an overview of methane emission metrics and their differentiated impact on Brazilian livestock, see Talita Pinto et. al.Panorama de Emissões de Metano e Implicações do Uso de Diferentes Métricas. Observatório de Bioeconomia da FGV, FGV EESP. Available at https://eesp.fgv.br/sites/eesp.fgv.br/files/ocbio_panorama_das_emissoes_de_metano_e_implicacoes_do_uso_de_diferentes_metricas_pt.pdf (Retrieved on December 16, 2022).

a degradation process called hydrolysis, in which the methane molecule breaks down into CO_2 and waste. Stock gas, once released, adds to the "environmental liability" of the planet, while we are here. Flow gas, on the contrary, enters this liability, but quickly withdraws from it. Calculation of the warming caused by methane, therefore, must be able to consider, after 12 years, the gas that entered the atmosphere today.

Cattle are a filter. As opposed to what conventional metrics consider, cattle are less an oil tanker than a filter. An oil tanker removes carbon stored deep in the earth for thousands of years and spurts it into the atmosphere, firstly as methane, then as CO_2. Cattle, on the contrary, recycles the carbon present in the atmosphere, captured by pastures via photosynthesis, fed and digested by cattle, which it temporarily eliminates as methane, before going back to being the same CO_2 that lived in the atmosphere before – it then forms a cycle. Cattle do not invent carbon; it recycles carbon from the atmosphere.

If it is true that pasture sequesters – it should also be true that grazing livestock – the status quo of beef production in most parts of the world – sequesters carbon if pasture is improved. This recognition, on the one hand, seems to go beyond the purpose of conversion metrics; after all, the point here is not to convert and compare the warming of gas against CO_2. But it is important to know how to accurately calculate how a production activity impacts the environment. Such task seems to demand the inclusion of pasture sequestration in the original measurement of the impact of livestock. Otherwise, the metric would be treating different production systems with the same measure – when, in fact, they have varied impacts and relevance levels.

The development of methane metrics – like other emissions metrics on the climate agenda – has occurred, primarily, with an eye focused on the reality of oil production systems, which only emits. When invited to look at other "biogenic" production activities, which combine activities to remove carbon from the atmosphere, tensions and distortions arise that science must, step by step, improve. Until then, however, the economic transition game is being played – and the product of influence metrics is to discredit livestock.

3. Economic tensions

In this topic, I examine the tensions with economic standards that distort the conversion of green into *value* – in the economic conversion of the environmental attribute.

Economic standards allow for the conversion of nature into economics – the natural phenomenon into a social phenomenon. This conversion is far from simple or automatic. And the more complex the "object" that one wants to understand, the harder the conversion process.

The first tension lies in the silence – or disregard – of green stocks in the tropical world. The second tension lies in the silence of green virtues, present in the continuous incorporation of sustainable production techniques and technologies. The third tension addresses the particular form of economic selectivity, which does not only despise the past, but predefines, based on a particular vision, the economic green of the future for all.

In common: the past does not count in the climate debate. The economic pricing that takes place is a pricing in half: the future that is being built now is calculated; the past – which the temperate world has lost – does not count.

The outcome is a balance of costs and opportunities that is unfavorable to the tropical world.

3.1. Silence of natural virtues

The first tension concerns the economic patterns that hide the *natural and artificial virtues of the tropical world*.

By *natural virtues*, I mean the stock of environmental assets available in a country or property. In the Brazilian case, our forests cover more than 60% of the national territory, mostly located within rural properties, and protected as Legal Reserves (LR) and Permanent Preservation Areas (PPAs).

This massive forest area, however, has no "value" and is not recognized as an economic asset in the carbon markets around the world. Why is that so?

The answer is straightforward: carbon markets do not price "stocks," only flows. What carbon markets are designed to protect and encourage is effort "at the margin" to improve the atmospheric carbon balance. The foundation of carbon markets, in other words, is *marginalist*, aimed at rewarding borderline environmental efforts for what is achieved or produced "tomorrow", not for what was achieved "yesterday."

The existing environmental assets, starting with the forests and underground carbon, are not credit generators.

This economic pattern of the carbon market, however, generates immense distortions.

The first one is: the cost of *doing something new* is rewarded; the cost of *maintaining something done* is not.

Maintaining an established asset, in fact, can be as expensive or more expensive than creating it. Stabilizing carbon in nature is not just a natural attribute – it is also a human commitment and action, which ultimately involves a choice to do or not to do.

This choice, made by a farmer, is not for free. A country's effort to maintain a carbon stock permanently on either above or under the ground as biomass is not for free either. Doing so comes at a price, which the country and its farmers must continually pay for. In the Brazilian case, this cost begins with the price of inspection and compliance with demanding and rigorous environmental legislation.

Without pricing existing assets, the risk of the market structure and exchanges that we organize on the planet is to create an environment in which the transition figures do not add up. The option not to price *assets from the past* also means a decision to transfer the costs of preserving the forest stock to the "old" economy, to the country or to the landowner. After all, the new carbon economy only takes care of what is done on the margins, on the border.

Consider a successful landowner in Alta Floresta, state of Mato Grosso, in the Amazon biome, whose property is profitable. They must maintain at least 80% of the native forest area preserved – without any degrading economic activity – as required by the

Legal Reserve law, in addition to guaranteeing the PPAs.[14] The region, however, is often the scene of illegal activities, such as mining or selective logging. This farmer, like others in the region, is threatened with property invasion and theft. In theory, guaranteeing the integrity and safety of private property is a task to be done by the State. In practice, the control system weakness transfers the onus to the owners, who may be liable for "environmental damage" to their land. How should they finance the preservation and potential restoration of 80% of their land? Using the income produced in 20% of the property.

The system may not stand still – and it often does not – if the gains from the *new carbon economy* (the premium you pay, the subsidy you get) are insufficient to make up, on average, for what was lost from carbon in the old economy, due to the high costs of preserving green assets, especially in an environment of poverty and underdevelopment.

Also – an aftermath from the previous issue – the opportunity cost of maintaining the green asset can be not only higher, but much higher than the cost of producing it in other parts of the world. The cost of "amortization" of the preserved stock (an obligation of Brazilian farmers) creates a competitive edge against farmers from other parts of the world, where LR and PPA laws do not exist. At the end of the line, the goods produced in tropical lands or in temperate lands compete for the same space on the market shelf. The victory of one or another, in this case, lies in the "green weight" imposed on producers in Brazil.

It is important to understand the strategy that climate governance has adopted to protect the environment. On the one hand, we *moralize* the past ("it is important to preserve forests and natural resources!") and we *price* the future, converting only what is done on the border into an asset. Therewith, we burden the farmers and the developing country for the preservation of their stocks; it is, after all, a moral duty to the planet, formalized in law.

The most vigorous path, and the fairest for the planet, might be the opposite: "moralizing the future" and "pricing the past" – or, at least, equalizing the two circumstances. In this case, we would attribute an economic value to the contribution that preserved countries have made to the planet, starting with the compensation of tropical farmers guarding the

14 See the Brazilian Forest Code, Article 12 et seq. Available at https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2012/lei/l12651.htm (Retrieved on December 16, 2022).

forest. And we would recognize the effort, especially by rich countries, to reduce their emissions at the margin as a "moral quality."

There are different routes to follow to promote the new regime – such as the creation of new international funds, financed by those who deforested original forests in the past or by the planet's dirty trade (for example, 10% of the world's oil income) – in addition to global regimes of scientific and technological development on biodiversity, shared with megadiverse and preserved countries.

A deep concern that lies at the heart of the carbon market structure that prevails today, and in the negotiations on advances in international regulatory regimes, is that it forces us to live with a paradox: *those who preserved the most in the past must also bear the highest costs for maintenance of the planet's green future.*

For those who deforested and polluted, a prize.

For those who preserved it, an obligation.

3.2. Silence of technical virtues

The previous pattern highlighted how the current carbon market regime tends to hide *natural virtues* of tropical countries like Brazil. Here I highlight how this regime also tends to hide our *artificial or technical virtues.*

By *technical virtues*, I mean the flow of environmental services continuously provided by the country through the incorporation of techniques and technologies that improve the sustainability of production. Starting with what happens in the Brazilian countryside, with the continuous incorporation of the latest production techniques and technologies over half a century that make it possible to convert "smoke" into relatively clean and cheap food, clothing and energy.

Today, all this progress lacks "economic" recognition in carbon market structures.

Take two examples.

The first one: the Brazilian Midwest was built, over the last 50 years, on a scientific-technological revolution conducted by generations of new techniques and productive innovations that allowed to make the acidic infertile soil of the *Cerrado* a fertile environment for food production. A core aspect of this transformation is the expansion of the organic matter from the soil, also increasing its carbon footprint. Farmers intuitively know that the soil is the home of food. Taking good care of the soil, by preparing and protecting it, is also preparing the food manger to produce more food of better quality and, therefore, increase productivity and income.

However, today's environmental task has given soil cultivation and soil protection a new name: *carbon storage*. Soil, after all, is one of the biggest carbon sinks on the planet and can be a warehouse supporting the planet in the war against climate change. None of this is recognized in the carbon market. The knowledge assets held by the country have no price in the market in which they are born (only indirectly, in the product sold).

The second example: in Monte Carmelo, the farm Fazenda Três Meninas implemented, over a decade, a wealth of techniques and technologies that allowed local coffee crops to become carbon "negative." The effort is expensive – an investment of at least 20% of annual income for 5 years, not to mention other costs incurred and risks taken by small-scale production. All the effort, made possible by science and tropical techniques, however, does not generate a single carbon credit.

The reasons are many. The generation of credit, in this case, requires adjusted methodologies, which do not exist. The price and market access conditions are prohibitive. The bureaucratic complexity is almost insurmountable for a self-employed farmer, and intermediary services are limited and not affordable – with extremely high costs (down payment plus 50% of credit at the end, as a rule).[15]

But there is a more plausible reason: the carbon market today excludes actions in agribusiness as sources of credit.

Before understanding the details of why, consider a third case.

15 For an analysis of the bottlenecks in the development of the carbon market in Brazil, see Daniel Vargas et al. O Avanço do Mercado Voluntário de Carbono no Brasil: Desafios Estruturais, Técnicos e Científicos. Observatório de Bioeconomia da FGV, FGV EESP. Available at chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://eesp.fgv.br/sites/eesp.fgv.br/files/eesp_relatorio_lab_bioeconomia_04_ap5.pdf (Retrieved on December 16, 2022).

Brazil launched, a few years ago, a national Low-Carbon Agriculture (ABC) program. The ABC program, from the beginning, became a benchmark in the promotion of sustainability in the country. The federal government has recently allocated BRL 5 billion to the adoption of good practices. It is little money, compared to the total funds annually assigned to finance the production of food in the country (BRL 270 billion), but, in absolute terms, the amount represents a substantial progress for a developing country.

All of these investments – funded by the country and by farmers – generate a relevant environmental effect. Today, the country has more than 15 million hectares that embrace the integrated crop-livestock-forestry technique, in varying degrees of sophistication.[16] None of this is nonetheless recognized as credit generators in the carbon market today.

The paradoxes that result from this are evident. A Norwegian oil company installs a filter to stop oil leakage, and sells carbon credits; a Brazilian sustainable farmer recovers pasture areas, qualifies food production in the field, and does not receive any benefit for it.

An American electric car saves combustion engine emissions and, in recognition of environmental support, receives carbon credit (e.g., Tesla). A Brazilian rancher who recovers and improves pasture, which significantly reduces methane emissions and increases carbon capture through photosynthesis, gets nothing.

At the base of the problem is a mismatch and prejudice.

The mismatch is the lack of methodologies, in the certifying institutions that "recognize" the environmental asset and convert it into an economic asset. It does not seem to be lack of science – science, in this case, is imprinted on the daily routine in the field. It is prejudice: unwillingness to recognize intelligent and professional soil management as a tool for transforming "dirt" in the atmosphere into economic utilities and carbon reserves.

The vilification of agriculture and livestock farming – especially in the high culture of rich countries – deters companies and institutions from supporting the trade of carbon credits in rural areas. Prejudice spreads throughout the chain, and the initial process of creating new methodologies does not move forward, or moves like a snail.

16 Check data from the ILPF Network, available here: https://redeilpf.org.br/ (Retrieved on December 16, 2022).

The combination of problems is a bad scenario for the climate. It is morally reprehensible to finance agricultural activities via carbon credits, many of which are already profitable, but it is not to finance the credit of those exploring dirty energy sources, as long as they prove their marginal contribution to the planet.

The effects of distortion are the most negative ones: (a) we deter the field's ability to support climate and the planet; (b) we threaten the competitiveness of tropical production and, what is more serious, (c) we "lose" the farmers in the hard effort to promote the climate agenda.

3.3. Economic selectivity

In recent years, decarbonization of transport has come to be interpreted as synonymous with *"electrification."* Electric cars do not have a combustion engine, do not have exhaust pipes and, therefore, do not release residues from burning fossil fuels. Electric car emissions are "zero."

In Europe, efforts to decarbonize transport are rigorous, partly because of the difficulty of the Old Continent in promoting changes in household energy consumption. To promote a regional policy, the European Parliament approved, in 2022, a law that prohibits the sale of combustion engine cars from 2035. The motto is: "zero transport emission from 2035." In 2030, the reduction target is 55% for cars and 50% for vans.

In the United States, the year of "ban" on combustion engine cars is also 2035. The United Kingdom is more ambitious: from 2030, no combustion engine cars can be sold. Norway, 2025 is its target date. In Japan, the limit date is 2035. Other developed countries have also taken on commitments.

The shift entails a range of significant transformations in the auto industry – and in society. Electric cars will require refueling infrastructure across the country. It will be necessary to think of ways to ensure safe disposal of batteries – produced in large numbers. And the automakers themselves will now have to race against time to improve the autonomy of net zero cars.

Decisions rushed by the developed world should impact the rest of the planet. In a global market made up by large hierarchical automobile complexes significant investment and

innovation decisions, such as the end of a production structure and the birth of a radically new infrastructure, tend to become universal. What will be done for Europe and the United States may arrive in Brazil or South Africa sooner than expected.

This is what signals the decision of General Motors (GM), which recently announced that it is withdrawing investments in hybrid cars in Brazil to focus on efforts to build a global electric car model. In the same direction, other automobile companies consider this path as inevitable – as the green path for transport on the planet.

GM's announcement turned on the alarm bells in Brazil.

The country has developed, since the 1970s, with the National Ethanol Program, a valuable scientific-technological infrastructure for the production of engines powered by ethanol. It organized a clean fuel distribution framework. It supported sugarcane crops to supply the market. Promoted mandatory mixes to create demand. Changed the consumer culture. Under the leadership of the government, the country promoted an adjustment in the economy and society to promote the production of biofuel, currently disseminated in the Brazilian flex-fuel car, introduced in 2003.

Studies show that the flex-fuel technology creates an important competition between transport energies, ensuring less vulnerability to the country. It is also an important source of innovation in many ways. And generates great savings in greenhouse gas emissions. In contrast, European electric car releases 92gCO_2eq/km, where the Brazilian ones, releases half of it (46gCO_2eq/km), depending on where the battery is produced and the power that fuels the vehicle abroad.

Despite the advantages of Brazilian ethanol today, decisions by major automakers, pressured by governments, to accelerate the construction of alternative cheap technology, capable of replacing the combustion model, point in another direction, threatening the future of flex-fuel cars and the national ethanol. If the decarbonization of transport is equivalent to adopting the European electric car models, the value and potential of the green route crossed by Brazil decades tends to disappear.

By announcing its withdrawal from flex-fuel technology, what ignores is that electrification can and, in fact, should take on different formats and combinations that are still being experimented with. Between the combustion engine and the electric one, there is a rainbow of arrangements and possibilities, whose best arrangement is still unknown.

From an environmental point of view, the price of batteries, the cost of energy needed to produce them, the challenge of disposal and reuse are mounting concerns. From an economic point of view, ethanol production plays a relevant economic and social role in the creation of jobs and highly relevant social progress in developing countries such as Brazil.

Electrification of transport is a promising path. But we are not sure whether it will prosper. Nor is it certain that it will come alone, irrespective of other arrangements of other technologies and knowledge. Toyota, for example, has explored alternatives, such as the hydrogen cell engine (which feeds the battery of electric motor engines with energy generated by a chemical reaction between oxygen and hydrogen, releasing water as waste), the hybrid-flex vehicle (which complements electric engines with a traditional flex-fuel engine), the plug-in hybrid vehicle (which includes connection for external electric supply).

The succession of technologies often hides variations in course and pattern – disputes over paths and opportunities that can shape up futures and impact the economy of countries in different ways. In the world of innovation, as in developing countries, choices – not always technical or objective – direct the selection of routes that, once inhabited by advanced economically established technologies will be retrospectively recognized as winners.

The midfield of borderline choices is a delicate strategic arena for countries and companies. Technology creates the new – what it does not do is determine, among the possible paths, which one will prevail – and who will be left with the old path's account. A variety of coordination routes – with standards other than green for transport decarbonization – could be better adjusted to the reality of tropical countries such as Brazil, combining, in the short and long term, economic efficiency, productive inclusion and more sustainability.

The answer, however, does not always depend on what the country wants or expects – or what would be most promising for development in the tropical world. It depends, in this case, much more on who has the final word on the production of technologies in the rich countries of the temperate world.

There is the green standard for decarbonization in transport.

3.4. Superficial cost

The voluntary carbon market has made great strides around the world over the past five years. Today, this market imposes an international division of decarbonization work. Developed countries in the temperate North "sell credit" by *innovating* in technology and production techniques. Developing countries in the tropical South, in turn, "sell credit" to the extent that they *plant* forests or *regenerate* deforested areas to clean up other people's mess.

The root of the problem dates back to the origins of the "official" carbon market created by the UN with the Kyoto Protocol. For the first time, the Protocol defines a range of emission targets for a group of rich countries, listed in Annex I. At the same time, to facilitate the fulfillment of targets by rich countries, the Protocol allows developing countries to sell carbon credits, provided that they support emission reduction projects. This is the Clean Development Market (CDM).

The CDM did not prosper. Projects were expensive, approved in a centralized environment, and were time-consuming. However, the "seed" left by the CDM was to create a network of social and private organizations that cultivated and developed the international practice of credit trading. On the side of rich countries, it served as the matrix and embryo of parallel carbon credit markets, led by the private sector and its sectoral commitments to reduce emissions. On the side of developing countries, it served as a reference for a network of development and trade of credits with the developed world.

Since the Paris Agreement, two important innovations have knocked on the door of the carbon market.

The first one: the end of the CDM, as it has existed since Kyoto. The division of labor between rich buyers and poor sellers disappeared, with the recognition that all countries in the world have a duty to set their individual targets for cutting down on emissions. An additional reason: the CDM did not have the necessary scale and flexibility to generate, in fact, a global market. Furthermore, "regulated" markets and other pricing structures were moving forward concomitantly in reality.

The second one: the emergence of a new emissions trading market, supported by the so-called Article 6. In fact, this article opens the door to two new markets.[17] The market between nations, provided in article 6.2, whose exchange criteria are still under negotiation. The informally called sustainable development market, provided in article 6.4, on project-actions, whose global operating conditions also continue to mature, under the leadership of the so-called "Supervisory Body," a kind of governance structure of the new market in the UNFCCC.

Changes in the form and direction of the carbon market, however, do not modify a central feature of the regime. What was established, in the shadows of the old CDM, was a regime of "free competition" for credit – a competitive carbon market – in which the basic logic of decarbonization is to pursue the lowest social cost of carbon. Companies and countries, in an increasingly integrated regime, will compete for the highest environmental return on a green investment.

What is formed in the world is a particular division of labor between rich and poor countries. The rich, who cannot cut down on emissions while developing technological solutions for energy and transport, pay the poor to plant trees or protect forests to clean up their mess. As soon as the technologies are ready, then they will stop planting trees among us, and will start selling us their technology that we will have to use to avoid contaminating the planet.

The advantage of the model, again, is that it lowers the cost of the environmental challenge. The whole world can now do more with less, thus ensuring less effort with the best environmental return. A French company that invests in cutting-edge engineering innovations to improve the storage capacity of lithium batteries pays large amounts to reduce, in a relatively short period, its environmental footprint. It is cheaper, for now, to offset carbon footprints by planting forest in poor countries than by trying to cut fat from its production process in France.

The calculation is simple: the price of planting a tree in the Amazon is cheaper (and viable) than the price of revolutionizing, overnight, the French production process.

But what exactly goes into calculating the costs on each side?

17 On the subject, see Daniel Vargas, O Artigo 6 do Acordo de Paris e o Mercado de Carbono: Preparativos para a COP26 em Glasgow. Observatório de Bioeconomia da FGV, FGV EESP. Available at https://eesp.fgv.br/sites/eesp.fgv.br/files/eesp_relatorio_lab_bioeconomia_01_v2.pdf (Retrieved on December 16, 2022).

Today, the price of effort "at the margin" is the marginal cost of reducing one unit of carbon per production activity. If it is cheaper to remove carbon from the environmental balance via trees than via high-tech innovation, then it is also environmentally and socially better to do so. After all, we are helping the whole planet.

However, it turns out that the context in which the "activity" takes place cannot be ignored in the comparison. The context of poverty and socioeconomic abandonment creates vulnerabilities and risks to the success of the environmental measure. Today, a forest is planted. Tomorrow, a vulnerable and fragile population can degrade it to earn income. Was it more "efficient" to plant trees in the Amazon?

Neither is the investment in building human and social capital in rich countries considered in the comparative cost balance. This capital is the outcome of several million tons of emissions over decades, to generate the educational infrastructure in which engineers studied, the structure of services they use, the structure of society in which they live, which serve as the foundation so that, now, centuries later, they can achieve technological innovation that sequesters carbon.

If the price comparison is the marginal cost of planting trees *versus* the marginal cost of disruptive battery innovation, the answer is one. If the price comparison considers the cost of developing the socioeconomic structure as a whole – not just the single act of sticking a carbon molecule in the ground and turning away – the ultimate price of green investment for the consequent environmental transition can be much higher.

The climate marginalism of the carbon market tends to "deprice" the socioeconomic value of green. And it justifies a questionable division of labor between countries. The seemingly efficient exchange effectively allocates carbon to cheaper activities. But at the expense of ignoring inequalities and inconsistencies in capabilities that, in a second moment, could themselves turn against the climate.

It is an escape from the fundamental problem, and, deep down, an escape from the pact concluded in the 1990s, especially in the Earth Summit (Eco-92). Climate must be seen and treated as an integral element of the development project of nations.

4. IV. Legal-institutional tensions

Finally, I analyze the legal-institutional tensions.

They concern the structures that guide the allocation of obligations and responsibilities for greenhouse gas emissions.

The first tension lies in *additionality*: under the pretext of "adding" an environmental good, it creates a global race for the lowest common denominator that can harm the green project. The second tension is the responsibility for emissions: the current regime places a higher environmental cost on the shoulders of food producers than on oil producers. The third one is "diffuse" liability for damages: to combat environmental challenges, flexibility in the standard of care means that many are now to pay for the mistakes of few.

In common: the responsibility, hence the green burden and cost, is disproportionately placed on the community in the tropical world.

4.1. Additionality that "subtracts"

The first legal tension concerns the basic criterion for generating carbon credits: *additionality*.

Green, in carbon markets, is the *additional* effort to a baseline, that is, that there is an environmental gain as a result of the deliberate effort of human action (e.g., clean development mechanism projects).[18] Additionality, in other words, sets a "frontier" for the recognition of the environmental good.

However, there are doubts whether this additional element should be the result of an action that goes beyond the obligation imposed by the current legal rule. From this

18 See Article 12.5, C of the Kyoto Protocol and Article 43 of Decision D.3/CMP.1: "A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity."

prevailing perspective, in theory, everything that the legislation defines as an *obligation* could not be recognized as additional, therefore, as a legitimate activity to get credits.[19]

The legal component of additionality fulfills two functions in the global horizon of the carbon market.

The first one: respect for the *sovereignty* of national law.

What the law of a country determines is a duty. A duty is an obligation imposed on the citizens. If the law determines an environmental obligation, such as the protection of a legal reserve, landowners failing to comply with the law cannot now be compensated for their fault, collecting credits, for example, for the effort of regeneration in the international carbon market.

The second one: *legality.*

Allowing a landowner who once deforested to be financially supported today to repair his fault would create the risk of encouraging illegality as a business opportunity. In other words: it is better to deforest – and benefit from it – and then get paid again to replant or correct the fault. A market of illegality that pulls the moral ruler down.

This view is at the base of the global structure of generation of carbon credits, the purpose of which was also to create a particular trade regime that did not override the structure of national obligations. At the top, construction of the new. At the bottom, national obligations.

However, there are deep limits to this *pattern* of organization of the market for environmental services.

In the current standard of additionality, countries that adopt more demanding environmental standards are also those most threatened with punishment. In other words, those who most raise the bar, expose themselves the most, as every degree of high ambition translates into less space to operate.

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19 For more information on the legal aspect of additionality, see Leonardo Munhoz and Daniel Vargas. Adicionalidade de Serviços Ambientais na Perspectiva Jurídica: O Pagamento por Serviços Ambientais em Áreas Legalmente Protegidas. Observatório de Bioeconomia da FGV, FGV EESP. Available at https://eesp.fgv.br/sites/eesp.fgv.br/files/adicionalidade.pdf (Retrieved on December 16, 2022).

Here is the first serious problem with the legal standard of additionality. If there are greater environmental expectations in a tropical country like Brazil, it is precisely because here there are more environmental resources, hence more "value" to protect. Environmental problems are a function of the existing value – if there is no value, there is no environmental problem or any other problem.

The problem is magnified against historical data. Environmental law, as an autonomous self-contained discipline, is a relatively new area of law that has flourished over the past half century, particularly in the developing world, under continued international pressure and influence. Until then, environmental law was a qualifier of property rights, or a specific administrative regulation.

The expansion of environmental law in the world, in other words, was accompanied by pressures that raised the "environmental bar" in poor countries to much higher and more rigorous levels than in advanced countries. The recipe was the following: since the problem is big, put some more pressure. More pressure, more police power, more enforcement, more punishment, more rigor – this was the "green" path expected from the developing world, to ease pressures on the forest.

In the past, rich countries demanded and, in some cases, enforced the adoption of environmental standards in developing countries. In Brazil, for example, the increase in the legal reserve from 50% to 80% in the Amazon takes place in the midst of international pressure.[20] Today, tropical countries are required to meet a degree of demand and interference in property that, in much of the rich world, would likely be questioned.

In fact, there is no hydraulic relationship between obligation and market (more obligation, less market; more market, less obligation). Deep down, it depends on the particular arrangements and the circumstances in which they operate. In a local circumstance, in which accumulated environmental liabilities, often with failures that escape private responsibility, or that involve "reciprocal blame" of an imperfect regulatory apparatus,

20 The increase of Legal Reserve from 50% to 80% in the Amazon was approved by Provisional Measure no. 1.522, of 1996. The measure was systematically reissued, until Constitutional Amendment no. 32 amended the Brazilian legislative process to restrict the issue and reissue of provisional measures (MPs) in the country. Regarding PMs in force, article 2 of Constitutional Amendment 32 provides that "provisional measures issued before the publication of this amendment remain in force until a further provisional measure explicitly revokes them, or until a final decision by the National Congress." The statute that increases the Brazilian legal reserve, valid and accepted throughout the country, never went, in fact and directly, through the deliberative process of the National Congress.

generate an environment of insecurity and confusion, the solution to the chronic problem can and must rely on the most diverse resources.

The fundamental criterion for the proper functioning of the arrangement is not an abstract assumption, it is not about finding and repressing the ones to be blamed in an environment fraught with overlapping confusions, but situated pragmatism – the measure capable of effectively resolving the liabilities and generating simultaneous economic and environmental benefit. The freedom to create a variety of environmental-economic complexes in each region must be recognized, without the expectation or presumption of imposing a single or universal model.

Deep down, at its limit, the institute of *additionality* hardly stands up. On the one hand, it creates an environmental race in reverse – a quest for the "legal lowest denominator." After all, those taking more demanding obligations will also be punished for this. On the other hand, it tends to applaud and reward less green countries.

This second problem is more serious, and can be better understood by a hypothetical stylized example.

Consider that the world approves the creation of a biodiversity market, working analogously to the carbon credits market on the climate agenda. Those who *additionally* increase biodiversity get credits. Whoever reduces, pays for the loss incurred.

Now consider the situation of two countries in the world. The first is a temperate highly populated country with poor vegetation called *Temperadistan.* The second is a country with 61% of its territory covered by native vegetation, heavily forested, with unique biodiversity, named after a tree – Brazil.

Consider, finally, that *Temperadistan*, with some additional effort, grows three eucalyptus trees, a flower and a bee at the entrance to a city. There has been a gain of biodiversity. Consider, on the other hand, that Brazil lost biodiversity, because there was degradation and deforestation of some of its native biodiversity.

The additionality gains of *Temperadistan*, in the biodiversity market, would entitle it to a credit, while the loss of biodiversity in the country named after a tree would create the obligation to pay a credit. Would it make sense for the most biodiverse country in

the world, poor and with sparse resources, to spend resources to reward the eucalyptus from the rarefied biodiversity of the temperate, rich world?

The exaggeration of the example only magnifies the original problem. No matter how much *Temperadistan* increases its biodiversity, no matter the level of effort put in; yet it will be thousands of years away from the complexity of life that the self-cultivation of biodiversity over millennia has produced in the preserved tropical world.

Instead of adding, *additionality*, in its current legal shape, is actually an invitation to "subtraction," and a valve for transferring resources from poor to rich countries through the distortion of starting-line conditions in favor of temperate countries.

4.2. Biased emissions accounting

The second legal tension concerns accountability standards for greenhouse gas emissions between countries.[21]

Consider the two cases below.

Norway extracts oil from the sea and exports it. Brazil produces food in the Midwest and also exports it. Who should bear the greater burden of emissions from oil and food: the country that produces or the country that consumes?

In the case of oil, the answer is the country that "consumes." Accounting for fossil emissions takes place in the country of destination. It does not matter how much oil Norway pulls out of the ground – if it "sends" oil out, it is the destination country that will "pay" the green price for the product.

In the case of food, the criterion is the opposite. Accounting for food emissions takes place at the source, in the country where it is produced. It does not matter if Brazil eats all the food it produces, or sells a large part of it to feed 1 billion people on the planet. Once you produce the food, you must pay the "green cost."

21 The original approach to the theme is discussed in Daniel Vargas and Luis Gustavo Barioni, Contabilidade Climática Vesada, Revista Agroanalysis, v. 42, n. 8 (August 2022). Available at https://bibliotecadigital.fgv.br/ojs/index.php/agroanalysis/article/view/88139 (Retrieved on December 16, 2022)

Splitting responsibility between the two types of production – oil and food – is far from simple or consensual. It is actually an accounting standard adopted a long time ago, and never properly questioned, which survives by a silent consensus.

According to the IPCC, the basic criterion for assigning responsibility is the "place of issue." As in oil, burning occurs at the destination, which is where accountability takes place. In the case of food, in turn, it is considered that the "burning" occurs at the source, in land management, rather than on food consumption.

One may wonder whether this standard is really consistent. These are the basic steps of the process. Agriculture takes carbon out of the air and the soil, and puts it into food. The food will be transported, processed, sold. At the end of the line, the food eaten by citizens from different parts of the planet will result in the breakdown of proteins and sugars, producing CO_2 as a residue of human work.

The CO_2 that the food sequestered at the source with the human effort of planting is now eliminated by digestion and breathing, at the *destination*, where people consume it. There is a cycle of circulation of human carbon which was previously in the atmosphere, entered the soil through photosynthesis, before being eliminated through breathing. Who is responsible for the weight of this carbon?

As a presumption of calculation, the regime considers that the responsibility for the emission must be at the source, in the land management, and not at the end, in human breathing.

But it should not be necessarily like this.

A look at the effects of this standard helps to understand how intricate the problem is.

For oil producers, climate accounting is a *free pass* – an endless license to continue extracting oil from the ground, on condition that the dirt is exported. Saudi Arabia is the global model for green.

In turn, in food-producing countries, the taxable event is materialized as soon as the land is touched. Everything else that is done from then on, to feed human beings, will be a cost to be paid by those who dared to combine intelligence with nature to feed human bodies.

The current system creates a curious competition between the oil and food industries. Given the choice, in which of the industries should a country invest its efforts and guide its economy? The orientation of climate accounting is very clear: *"oil is green!"*

In the coming years, global carbon accounting tends to become increasingly standardized, with stricter inventories, on a global basis, and audited by the UNFCCC. As this process progresses, recording emissions will also be perceived not only as an instrument for environmental management, but for controlling national accounts, defining prices and allocating costs and opportunities for production and development.

Three other emission accounting standards could be considered.

(1) Oil and food producers emit at the source.

(2) Oil and food producers emit at the destination.

(3) Or food emits at the destination; and oil, at the source. On the one hand, as the first drop of oil is extracted from the bottom of the earth, environmental problems are already confirmed. The entire discussion that follows is a shift of blame as to who and when will pay the bill. On the other hand, at a time when the planet lives with hundreds of millions of people in extreme poverty, most of them in the tropics, are we going to bet on climate change by taxing those who produce food?

4.3. For the sake of climate, one shot in the crowd

The concern for forests has entered the center of the planet's environmental agenda. In particular, there is growing concern in the world with the expansion of the agricultural frontier into natural areas. What is worse, a part of this process takes place due to the "demand" of consumption by the middle class in developed countries. Consumers, especially on the European continent, do not want food contaminated with environmental damage.

One of the major targets of global concern is Brazil, where, in recent years, deforestation rates in the Amazon have increased substantially. Compared to 2013, when the country reached the historical minimum rate of deforestation of 4,000 km² in the year, deforestation in the last year exceeded 15,000 km².

To fight the import of deforestation, the European Union is working on a law that requires companies to demonstrate that their products are "green." To do this, the statute innovates in the standard of responsibility.

Firstly, it expands the companies' civil liability for actions that go beyond their direct action, as opposed to what typically occurs in civil relations. Secondly, it reverses the burden of proof to oblige companies, preventively and in cases of risk, to take action to avoid buying products from deforested areas.

The practical effect of the new "green standard" is potentially radical. The European standard creates a general pact of distrust in the market. In practice, everyone is "unsustainable" until proven otherwise. Only those who, in advance, can prove that the distrust placed on the table is unreasonable will be able to access the European market.

The pact of distrust applies to everything and everyone. It applies to the market: traders, slaughterhouses, other agents in the chain, producers in general. But it also applies to the national state itself where production takes place. It is neither enough to have a national law, such as the Brazilian Forest Code, to attest to the country's commitment to the environment, nor is it the vision of the highest level of the Judiciary, which attests to the constitutionality of the Forest Code, which, in turn, recognizes the farmers' right to freely use the legal reserve surplus on their property.

Europe requires that the law be complied with, and today it is not.

By crossing information on deforestation and rural properties, it turns out that 99% of farmers do not practice deforestation. The number may be a little different – perhaps 2% of farmers are "black sheep" and may commit offenses. Or there may be more agents committing illegal acts – 5%, or even 10%, who knows. The vast majority, however, are law-abiding, meaning they do not deforest to produce and sell food.

It is true that European consumers are not obliged to buy or eat what they do not want. Much less is the European continent obliged to watch the problem peacefully, and do nothing. Europeans cannot "enter" Brazil and force us to act in a different way, but they can decide what to buy or not to buy from Brazil. Along these lines, the European decision is a sovereign decision, on the rules it wants to enforce on its territory.

In this case, however, it is important to consider two specific aspects of the European decision.

The first is *procedural.*

The European standard has extraterritorial effects, but not indirectly. Its objective is extraterritorial *since day 1.* What it wants is to ensure that food production taking place in other parts of the tropical world, starting with Brazil, meet criteria that Europeans consider appropriate. These criteria, of course, includes complying with Brazil's own legislation, but it goes further – and restricts products from any deforested area (even if authorized by national law).

The European decision is original by challenging the foundations of the environmental and commercial dynamics that organize the world. There are international forums for climate mediation and negotiation, such as the UNFCCC, for two reasons. Firstly, because countries, each one of them, have problems that can impact everyone else. Secondly, because it is believed that the best way to deal with these problems is to seek consensual solutions.

Similarly with trade, there are shared parameters (GATT) and trade law institutions (WTO) to prevent moral disagreements about what is fair, about what should be done first, about how to protect interests of one against the other, about how to ultimately act in an economic environment with respect and reciprocity.[22]

The world's environmental and trade rules, in other words, are rules that aspire to global communion and coexistence; they affirm a kind of *planetary proto-constitution*,[23] on the basis of which countries, with their variations and difficulties, agree to *disagree*, and, even so, to walk together to build *consensus*, even if, on the grounds of merits, they profoundly disagree about the reality and prospects of the other.

22 The standards of international trade today severely limit the arena for experimentation and national divergence. Under the pretext of sparing subsidies, they threw away the "ladder" with rich countries, in the past, scaled up productivity and social development. But it is the rule of the game, which guides trade relations on the planet. To understand the international trade regime constraints, see Roberto M. Unger, Free Trade Reimagined, Princeton U. Press (2007).

23 On the dynamics of global constitutionalization, see Anthony Lang and Antje Wiener, Handbook on Global Constitutionalism, Elgar ed. (2017). On the constitutionalization of international trade, see chapter 30: Global Commercial Constitutionalization: the World Trade Organization, by Joel P. Trachtman. On the global constitutionalization of the environmental regime, see James R. May and Erin Daly, Global Environmental Constitutionalism. Cambridge University Press (2014).

The second problem with the legislation is about the *outcome.*

If deforestation ends in Brazil, as a result of European imposition, the ends may justify the means, and the new order may be imposed as the truth and global consensus. This victory, however, must first be *practical* and *moral*, before we celebrate it.

In practice, the poor will pay the bill. The standard for fighting deforestation imposed by Europe impacts the cost of production for all farmers. Ultimately, of course, the consumer will be able to afford the price of the most expensive food and, at this moment, we will test the strength of belief. In turn, in the struggle within the chain, to secure margins, the most likely to happen is a redistribution of costs, with smaller and fragmented producers at the very bottom, paying more.

After all, each producer will now have to seek brokerage services, including consultants, auditors and certifications capable of providing a list of individualized data on the property to confirm the legality of their product. Leading producers have scale and structure, and should pass the new notary toll relatively unscathed. The little ones can suffer and pay the fat part of the bill.

Distrust breeds distrust. The second effect of the witch hunt in tropical countryside, for the sake of protecting forests, is a reaction in the field of sensitivities. In the midst of 4 million family businesses, the imposition of a general and indistinct cost contributes to a feeling of injustice in the minds of each member. Whether we like it or not, whether we are right or wrong, the harsh reality is this: 99% of farmers will now have to pay to prove they didn't commit the crime.

In the imagination of ordinary citizens, in small towns, the message that arrives is a horror-comedy movie. "To fight the criminal in the crowd, someone points a gun from a distance and shoots until the thief turn himself in." Could it be that the projectile hits the target? Or that the crowd temporarily withdraws? For sure. But it could also be, which is much more likely, that the thief is not so unprepared and finds escape routes for his meat to reach the consumer. As the old adage says: "cattle do not die of old age."

Meanwhile, a good rancher – the vast majority, now vilified and weakened – will have to digest the "necessary evil." The feeling of incomprehension and injustice tends to distance them, instead of bringing them closer to the educational process of improving sustainability practices that are so important for the planet. In the big cities, fear and

punishment are quintessentially the weapons for sending criminals away and fighting crime. For those who have lived marginally abandoned for decades, the effect of constant threat can be the opposite: bringing good and bad farmers together on the same side of the resistance.

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Conclusion. The joint effect of tensions resulting from the "green standard" on global climate governance is substantial.

Examined individually, each one of them seems to coexist with specific ambivalences or vices – some perhaps justifiable or understandable in a given space of time. As a whole, however, the sum of tensions reveals a trend, a *global direction.* The *north* of the "climate compass" is out of calibration.

Science shows the tropical world sometimes distorted by temperate averages, *biases* and blame extrapolations. The economy, in converting green into *value*, conveniently prices environmental goods, ignoring valuable assets for the climate and the economy of most tropical countries. The law sets unbalanced weights and measures for assigning obligations and responsibilities for emissions, and if something gets out of hand, the innocent must pay for the guilty.

The combined effect of the standards that define *green* and guide the economic transition is a balance of costs and opportunities that is unfavorable for the tropical world, especially for preserved countries committed to food production.

How to solve the problem?

5. Tropicalization

The basic task now is to pursue the "tropicalization of green standards."

To do so, we must remember the context of the key problem.

Climate governance, for nearly half a century, has been marked by a division of labor. Rich countries are left with the primary burden of decarbonizing their economies and, in doing so, freeing up space in the atmosphere for the rest of the world. Poor countries, in turn, would participate in the global regime as beneficiaries, of creditors of rich countries, as long as they also help reducing emissions on the planet.

To support and guide the decarbonization efforts of the rich, over the last two decades, an infrastructure has been gradually created to decarbonize the economy of the most polluting countries. The result of this process, over time, has been a relatively successful decarbonization regime in Europe – the continent has cut down on most of its emissions.

The dualism of "green" regimes has collapsed. The Paris Agreement changed the climate "division of labor". And an actual mutation in the organization of the global climate agenda took over the world. Every country in the world has committed to decarbonizing the global economy. From potential beneficiaries of international support, developing countries have become internationally obliged to decarbonize.

The green standards, established over the first two decades of the twentieth century, and unfolded-updated by "green" commitments from new market sectors, fed by experience and pressure from temperate countries, are globalized along with the new post-Paris climate governance. They have seen a growing number of basic units of general reference to mark out and redirect the progress of economic activities, and cause tensions.

At the foundation of these tensions are *biased* scientific, economic and legal standards. The way to the solution is neither accepting the "sovereignty" of temperate standards and adjusting the tropical body to fit the bed – as in Procrustes – nor it is entering a pure route of resistance, and just complaining about its inaccuracy or injustice. The path is to build variations-details of green, adjusted to different parts of the world, based on the most rigorous and advanced science, starting with the tropical world.

How can we do this?

The country must assume, as a project and a national priority, the tropicalization of green.

Ultimately, Brazil must be able to generate and provide metrics and methodologies that fit the national reality like a glove, in order to mark out each hectare and each product in the country. This information, in turn, needs to be hosted on an easily accessible continuously updated national public database under the observation and attentive guidance of an international scientific council.

Within Brazil. The decision to create this database is simple; building and nurturing it, quickly and systematically, however, is the big challenge. It is not just the duty of a ministry or a government, much less of half a dozen knowledgeable researchers. It must be a commitment and a national movement, responding to a state priority, and dialoguing with urgencies in the private sector.

This collaboration and dialogue will allow the rapid productive development of tropical metrics and methodologies, as well as the feeding and ratification of our national reference databases. Science must respond to reality, while reality must learn from the frontier of innovation.

Outside Brazil. The tropicalization of standards will also require qualified orchestrated diplomatic action from the country. The diplomacy of standards, by the way, is an increasingly vigorous strategy between great powers – and, for this very reason, it cannot fail to be one of our attentions. As a reflection of internal politics, diplomacy must prioritize action in forums where standards of action on the environment are negotiated or reformed.

An example is the carbon market supervisory committee, linked to the UNFCCC, responsible for updating methodologies of Article 6 of the Paris Agreement. Other spaces for defining green are spread across multiple multilateral organizations, as well as social organizations, often as powerful or more powerful than a public institution.

6. Closing remarks

This essay addressed the tensions lying at the foundation of global climate governance on the standards of *green*, defined by science, economics and law, which serve as a map and compass to guide the economic transition of the planet in the coming decades.

In science, it highlighted how current measurement criteria distort the reality of the country, overpricing our sins and belittling our merits.

In economics, it examined how the conversion of green into an asset is a biased process that tends to ignore a valuable attribute – forestry wealth and biodiversity, combined, in Brazil, with a history of developing sustainable technologies and production techniques.

In law, it assessed how criteria for assigning global duties and responsibilities impose a special questionable burden on tropical food-producing countries.

The last section of the essay champions the tropicalization of green as a national strategic priority and suggests a route to achieve it.

None of this will ultimately be easy – and it certainly will not happen overnight. In our favor, however, we have history. Tropical advanced agriculture in Brazil results from a virtuous marriage, initiated in the 1970s, between avant-garde tropical science and the profound Brazil of enterprising farmers eager for growth.

Half a century later, the time has come for us to renew our vows in this union. And to place the best of tropical intelligence at the service of the best of entrepreneurial capacity spread across our green territory.

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