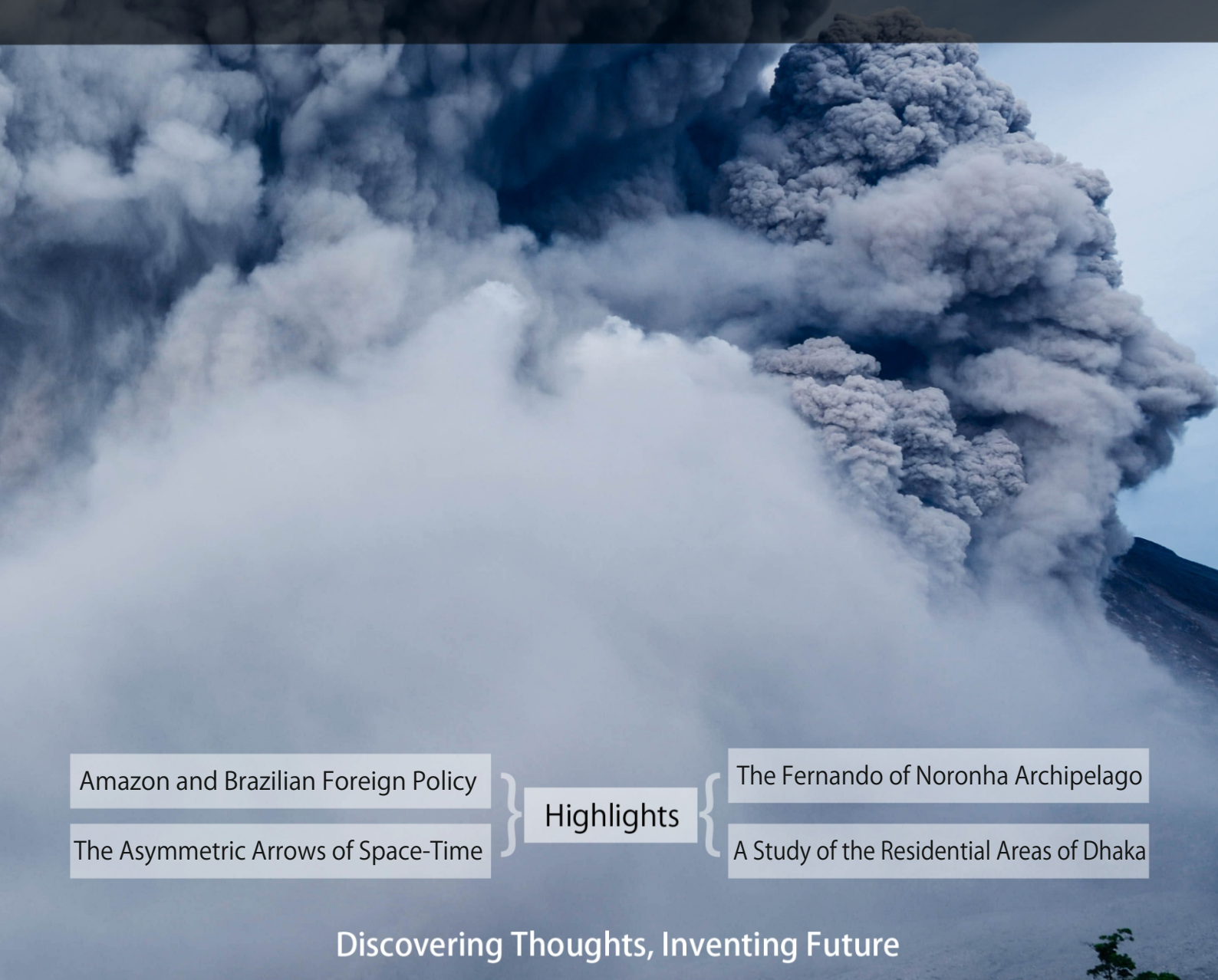
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Amazon and Brazilian Foreign Policy

The Asymmetric Arrows of Space-Time

Highlights

The Fernando of Noronha Archipelago

A Study of the Residential Areas of Dhaka

Discovering Thoughts, Inventing Future

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Transitioning from Natural Conservationism to Sustainable Development: A Shift in Environmental Policy

By Julio Lopes

Abstract- Contrasting the conservationist bias of environmental balance with that of sustainable development, the author distinguishes the influence of both in the current formulation of environmental policies, including trends, respectively, more regulatory or redistributive as public policies. In this sense, it highlights the global need to overcome natural conservationism, a remnant of the 19th century and whose obsession with the untouchability of nature does not admit the synergies between nature and humanity, fundamental to promoting sustainability. Which, if assumed as a progressive ideology, it transcends the left-right differentiation, implying broad coalitions, both political and socioeconomic, so that we become socially ecological.

Keywords: *sustainability - environmental policies - sustainable development.*

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Transitioning from Natural Conservationism to Sustainable Development: A Shift in Environmental Policy

Julio Lopes

Abstract- **Contrasting the conservationist bias of environmental balance with that of sustainable development, the author distinguishes the influence of both in the current formulation of environmental policies, including trends, respectively, more regulatory or redistributive as public policies. In this sense, it highlights the global need to overcome natural conservationism, a remnant of the 19th century and whose obsession with the untouchability of nature does not admit the synergies between nature and humanity, fundamental to promoting sustainability. Which, if assumed as a progressive ideology, it transcends the left-right differentiation, implying broad coalitions, both political and socioeconomic, so that we become socially ecological.**

Keywords: sustainability - environmental policies - sustainable development.

> "Dear earth, give me a good harvest", says the religious man. "Whether the earth wants it or not, it must give me a good harvest", says the irreligious man. "The earth will give me when I give what is proper to its essence", says the true man: "the earth does not want to give, neither should it give, but it will only provide good fruit if all the conditions are fulfilled by me".
>
> *Ludwig Feuerbach, 1849*[1]

I. Introduction

The implementation of environmental policies is strictly conditioned by how the ecosystemic balance of the environment is conceived, especially regarding *human involvement* in it. Thus, there are two possible approaches to formulating environmental policies corresponding to the following normative ideals of environmental balance[2]:

- *Conservationist Approach:* Where the environmental balance is conceived as *static*, and it is deemed necessary to limit (or even prohibit) human intervention in environments that require *protection or restoration*.
- *Sustainability Approach:* In which environmental balance is conceived as *dynamic*, harmonizing environmental ingredients (especially other forms of life) with new forms of human presence (pre-existing or not), in order to become positively interdependent.

While the protection or restoration of pre-existing environments governs conservationist environmental policies, the articulation of *news* synergistic interdependencies concomitant with the formulated environmental policy governs *sustainable environmental development* policies.

Only humans extract non-renewable resources from nature for their use, rather than using them directly as they are found. Humans have designed a way of life based on finite elements which can lead to *pollution* and *resource exhaustion*. Such symptoms stem from the same problem — *environmental degradation* —, and both require the same solution — *recycling*. Resources are extracted from the environment, and pollution is the excess that is not recycled through natural processes. In order to *restore* resources as they are consumed and *eliminate* pollution, the recycling process must be accelerated, sometimes in ways that do not occur naturally. However, that is not always the case (Macneil et al., 1991: 27-35). So, why is the extraction of non-renewable resources not observed in their conversion into renewable resources through artificial processes?

The production process is guided by *market* logic, as *a market economy can only function in a market society* (Polanyi, 2001: 81). Thus, *labor and land are essential components of the industry, which ultimately consists of human beings and the natural environment* (Polanyi, 2001: 84). However, including these elements in the market mechanism results in the subordination of society's natural human essence to the laws of the market. This historical industrialization process, driven by the immediate and individualistic logic of capital, decomposed the natural essence of humans and society into tradable elements. As a result, the industrialization process had a low capacity — or no capability — of recycling resources, leading to the

Author: Senior Researcher in Science and Technology at Fundação Casa de Rui Barbosa, Rio de Janeiro, Brazil.
e-mail: julio64aurelio@gmail.com

[1] Vorlesungen über das Wesen der Religion (Gesammelte Werke), pp. 351, Berlin, Akademie Verlag, 1967.

[2] For other distinctions, different from the one adopted on environmentalism in this text, see Enzensberger, 1976 and Bryant & Bailey, 1997. Such authors question the very notion of sustainable development, while I consider, as will be seen below, that its ecological, social and economic characteristics are the same in any planetary quadrant and therefore, sustainability provides only 3 options: denial or containment of development, its exercise predatory or for the sustenance of the lives that make up an ecosystem (not only natural)

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pollution that followed the geographic trajectory and energetic evolution through time.

Despite the monopolizing vocation of the market, its dynamics often stimulate movements in opposite directions, including social movements against environmental pollution, — as everyone relies on natural resources, including industrial activity. As the exploitation of natural resources exhausts natural resources, it threatens both the productive organization itself and society as a whole. In response, the principle of *sustainable* development aims to maintain the consistency of the industrialization process while addressing the depletion of resources (Brundtland, 1987).

Acknowledging the predatory nature of the market does not imply attributing to it an intrinsic inability to deal with environmental degradation, as some have misunderstood. Capitalism has recently demonstrated an undeniable adaptive capacity in integrating ecological constraints. This integration is evident in the proliferation of anti-pollution equipment that enables the control of environmental degradation effects. Even the refusal of such effects is possible through the adoption of impact-mitigating or environment-restoring techniques in the production process (Dupuy, 1980: 16).

However, the flexibility to incorporate ecological concerns does not imply the abandonment of the noted predatory nature. There will be tension between *continuing commodication*, with its immediate and individualistic logic averse to social and/or strategic considerations, and *pursuing sustainability* in the production process, threatened by resource depletion. In this sense, the mistake of traditional interpretations of the relationship between the market and environmental issues is evident, as they create a *preservationist versus development* polarization. Either the *catastrophic* pessimism, which only or fundamentally glimpses the *destructive* aspect of commodification, industrialization, and urbanization, not taking into account the permeability of capitalism to the demand for resource sustainability, or the *technicist* optimism, which almost solely visualizes the *creative* aspect of commodification, industrialization, and urbanization, ignoring the partiality of the incorporation of the environmental issue by the system that is limited, by itself (without interference from agents alien to the market logic), to the aspect of resource depletion of environmental degradation (Dupuy, 1980: 39- 48).

Thus, although the movement of the market is necessary to ensure the supply of natural resources, it will be insufficient to address environmental degradation, as it is limited to the aspect of depletion, neglecting the aspect of pollution.

In the second half of the 19th century, the emergence of associations for the protection of flora and fauna is observed in the US and Western Europe. These associations' demands for environmental protection, restricted to the non-human natural environment threatened by urban-industrial expansion, will be fundamentally oriented towards creating nature conservation units such as parks, reserves, and preservation areas. This is the phase of environmentalism commonly known as *conservationism*, as it focuses on maintaining the balance of *natural* ecosystems, protecting them from predatory activities such as hunting and deforestation. *Conservationist* environmentalism was the primary and dominant stance of environmental protection movements in developed countries until after World War II (reaching its peak of organization with the creation of the International Union for Conservation of Nature — IUCN in Switzerland in 1947), when the context of the Cold War and the subsequent nuclear arms race, raised the possibility of human extinction as a species, will lead to a growing concern for the *human environment* in those countries. While for conservationist environmentalism, the environment will be perceived as a private and localized issue, for environmentalism, which emerged after the post-war period, during the 1960s, will correspond to the perception of the environment as *a social and public issue* (McCormick, 1992).

The *plurality of individuals* involved in predicaments generated by environmental degradation will be an element requiring State intervention to deal with it. There are polluters and those affected, those who depend on environmental degradation and those who depend on its preservation, in addition to the interests involved in the various modalities of environmental damage compensation. In the end, there are winners and losers because often the interests that bear the costs will not be the same as the interests of those that benefit from environmental degradation and/or recovery. In the context of environmental degradation, the decision-making processes aimed at resolving conflicts will be dissociated from the involvement of the State and politics. (Conti, 1986: 979-80).

So, as *depletion of resources*, environmental degradation affects interests whose agents mobilize themselves from the market in favor of increasing the number of renewable items in the production process. According to them, it consists of conferring sustainability to the economic system. As *environmental pollution*, degradation of the environment affects interests of those who are constituted and mobilized outside the market, demanding policies to regulate it as they identify its logic — averse to considerations of ensuring global recycling of the urban-industrial process — as responsible for the harmfulness of the environment.

Therefore, the full incorporation of the environmental issue into the production process and social life does not constitute a reasonable expectation based on market movement. This industry, which is limited to considerations of production sustainability, will neglect the other constitutive aspect of environmental

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degradation: pollution. Confronting it, and therefore environmental degradation as a *specific situation*, will depend on interests, agents, and strategies of distinct collective action, often hostile to commodification. It concerns local, professional, and civil environmentalist social movements. It is from the institutional impact of these movements that the demand for the presence of the State in the environmental issue will stem from, and through the implementation of anti-pollution public policies as a method of addressing environmental degradation.

The *policy* is, therefore, a condition for the *full* incorporation of the environmental issue into the social dynamics. And the main reason for this will reside in its agents, constituted and mobilized in the function of the fight against various forms of pollution and representatives of ecological rationality extrinsic to the market. By prioritizing aspects of environmental degradation, distinct from the depletion of resources and absent in the business agenda, they postulate market regulations that protect society from its environmentally negative externalities. Their connection to the issue of pollution reveals the *negativism* of these agents towards environmental degradation to a greater degree than agents motivated by market logic, mobilized solely in the face of resource depletion. However, additional factors suggest the significance of policy in promoting *ecologization*, which refers to the integration of environmental concerns into societal practices.

Another essential reason for the implementation of public policies lies in *interdependence* as a characteristic of environmental degradation issues. This logic stems from the historically verified relationship between the urbanization process and environmental degradation (Macneil et al., 1991). By altering natural environments and replacing them with artificial ones, the process of urbanization progressively and uninterruptedly transforms environmental protection into a collective good. The urban space, inherently concentrated with various activities and populations, brings about conjunctures in which actions taken by some individuals affect others, even if they were not directed toward them. The process of urbanization brings together different human activities and groups, creating interdependence among them. This *interdependence* can result in *environmental issues* that affect everyone indiscriminately. The *policy* will respond to the specific conditions of urban life related to public order and the use of urban space, as any diffuse situation (De Swann, 1965: 127).

On the other hand, although the interdependence scenario means a high vulnerability of various segments of the population to activities developed by certain groups, the reciprocal dependence between them does not imply that the costs of negative externalities fall indiscriminately on everyone. Their dependencies, although reciprocal, are not symmetrical. The negative impact will somewhat affect different groups due to the resources they have for personal protection. Environmental policies are often developed in response to the concerns of different social groups who are affected by environmental issues. However, the specific content of the *policy* is often determined by conflicts between those who are less affected (and in better social positions) and those who are more affected (and in worse social positions). The *policy* will therefore stem simultaneously from the need of various groups to take over the costs of environmental degradation and from the specific distribution of these costs that will affect different sectors of the population. The fact that groups with greater resources for their environmental protection take on such responsibilities is usually linked to their participation in policy *control* (De Swann, 1965: 128).

The high concentration of people in urban areas means that the actions of certain groups can have a significant impact on the public as a whole, affecting not only their own group but also other unrelated groups (De Swann, 1965: 128). This *interdependence* leads to a situation where the costs of certain activities are tendentiously spread across multiple groups in the population, rather than being borne solely by the group responsible for the activity.

The premise of this work is that *environmental degradation* becomes a public concern in situations of intense urban-industrial development, where industrialization relies on non-human energy sources, leading to high energy consumption and consequent waste generation. This is compounded by urbanization, which leads to the concentration of populations in large cities that are incapable of recycling waste through natural or artificial processes, leading to resource depletion and environmental pollution. Consequently, the effects of such depletion and/or pollutant emissions will act upon other segments of the population in the form of *negative externalities*, not limited to those involved in predatory activities.

Therefore, as those affected by environmental degradation increase, distributing the costs of environmental protection becomes essential, since different segments are impacted due to their own unequal resources. Urban movements have emerged to advocate for environmental protection as a collective good, and to push for the inclusion of environmental concerns on the public policy agenda. *Although* the environmental conscience inherited from conservationism, as a pioneering environmentalism, *remains dominant* to the point of preventing (apart from traditional predatory tendencies) the paradigm of sustainable development *from being fully adopted* in environmental policies.

The urban-industrial context, based on the energy and population concentration present in the

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industrialized countries of the North after World War II, whose peak occurred in the 1950s-60s when the environmental issue entered government agendas, — and in the industrialized countries of the South, with the migration of energy-intensive and polluting economic activities from the North, in the 1970s-80s (McCormick, 1992: 102-110), did not acquire this format due to technical factors. The insufficient or non-existent recycling of the urban-industrial process derives from its orientation by market logic, which is alien or even hostile to strategic considerations — such as ecological constraints — of the medium and long term. So, enabling the urban-industrial process for recycling is the fundamental objective of various environmental policy modalities.

The concentration of activities and human populations within the *urban* environment results in situations of *interdependence*, whereby the actions and attitudes of certain segments may produce negative externalities that impact other segments of the population. Environmental movements emerged (in the 1960s-70s in developed countries in the North and the late 1980s in industrialized countries in the South) aimed at *democratizing* the costs of environmental damage, since their impact, in addition to being *public* (since it affects everyone), is also *unequal* and *regressive*, affecting more strongly the majority and unprotected segments of the population. These demands will be the fundamental factors in the conception and implementation of *policies* to address pollution and, therefore, environmental degradation[3].

Finally, an ecologically balanced society is inconceivable without assigning the State the responsibility for the conception and implementation of environmental public policies. The *policy* is a basic condition for resource renewal and non-polluting methods to replace those based on non-renewable and polluting resources in the urban-industrial process. This is because the incorporation of environmental costs by market logic is undoubtedly biased, either by transferring them to society (through damage to the physical integrity of the population and/or the price system) or by inertia resulting from private ownership of the means of production (which hinders, or even prevents, the diffusion and substitution of *energy-intensive* and polluting techniques with *cleaner* and less energy-intensive ones), especially when the same economic group holds the technological patents. The *insufficiency* and even inefficiency of the market as an allocator of costs resulting from environmental degradation and as a rational coordinator of the use of natural resources will require effective state intervention to overcome the limits of capital in assimilating environmental logic (Conti, 1986: 979-80).

II. The Policy-Making of Environmental Balance

From the end of the 19th century to the 1960s, in the developed countries of the North, and from the late 1970s to at least the mid-1980s, in the industrialized countries of the South, the initial and dominant form of environmentalism as a social movement was *conservationism*. The term, coined by environmentalists, refers to environmental protection movements aimed at maintaining the balance of natural environments threatened by urban-industrial expansion. Its scope is to *conserve* nature, which is susceptible to destructive activities. Although its manifestations through flora and fauna protection societies have been observed since the end of the last century in the USA and Great Britain, and in Southern countries undergoing a rapid process of industrialization, it is with the intensification of urban-industrial expansion in the post-war North and in the 1970s, in the industrialized South, that there is an effective proliferation of significant conservationist groups (McCormick, 1992: 151-171).

These movements share a characteristic of harsh criticism towards civilization as a historical process, evaluating industrial progress as essentially negative. Such activists often idealize the pre-industrial context in their countries, typically referred to as romanticism. Conservationists[4], who have been labeled as "prophets of doom" and "new Jeremiahs," warn about disasters — mainly related to resource depletion — that have not yet occurred. They conceive humanity as inherently predatory and therefore stand in opposition to its growth in technical, economic, and population plans (Chisholm, 1974).

This *conservationist tradition* of the environmental movement will correspond to the configuration of a *predominantly regulatory tradition* in environmental public policies. This is because conservationist environmentalism, by limiting environmental protection to preserving the balance of natural ecosystems, will demand measures that prevent or discipline the action of factors that are potentially predatory in natural regions.

[3] Even the slogan of *sustainable development* itself, which emerged in the United Nations Conference on Environment and Development (commonly referred to as Rio-92), also is the product of Latin American economists associated with the issue of development in the capitalist periphery. The vulnerability of these countries to environmental degradation is heightened by their lack of access to the new materials technology and energy conservation that is available in the northern hemisphere countries (McCormick, 1992: 152).

[4] According to its designation, for this environmental bias formulated in the 19th century, environmental balance is synonymous with the conservation of Nature, and its most radical formulators called themselves preservationists. Conservationist influence was flagrant in President Roosevelt (Callicott & Frodeman, 2009; Thoreau, 1854; Muir, 1894; Redekop, 2016).

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The destruction of natural ecosystems does not occur without affecting interests. Individuals living in sparsely or non-urbanized areas, who are dependent on them for their livelihoods (usually through primary economic activities), and people whose leisure is linked to access to these districts, are often disturbed by urban expansion. From their association, movements arise to defend the natural environment, threatened by the construction of industrial facilities or the conversion of rural land into urban areas.

The preservationist demands of these movements advocating for the *integrity* (and even the inviolability) of natural ecosystems, will argue in favor of *policies* that safeguard nature threatened by urban-industrial expansion. Environmental *policy-making*, in its initial formulations and implementations, presented a predominant *regulatory* content (Löwy, 1967: 690). Simultaneously, the preservation of the natural environment could only result from regulating its constituent components, especially those external and intervening in it.

In this situation, negative externalities resulting from the degradation of the *natural* environment affect socially defined interests (populations that use natural resources for their sustenance or leisure) and geographically delimited areas (by the territory relative to threatened native heritage). Although these movements did not initially focus on environmental issues as a part of the social agenda, as they were primarily focused on localized environmental degradation in areas that were not yet urbanized, they nonetheless spurred the government to take action to prevent the spread of environmentally destructive practices driven by market logic as a result of urban-industrial expansion.

The regulatory policy adequately served the preservationist demands of the environmental conservation movements. This is due to the broad *sectoral impact* of their measures, which reached various branches of productive activities that depleted ecosystems. Primarily, it is because of its *preventive* aspect by conditioning individual behaviors to general norms and delimiting (expanding or reducing) the possible alternatives of individual decisions (Löwy, 1967: 690). Authorization systems, monitoring, quality standards and emission norms are instruments of direct environmental regulation.

Environmental regulatory policy presents two aspects. The first, which could be considered "orthodox," is characterized by a rigid delimitation of the universe of individual choices, marked by the *veto-authorization* binomial, such as prohibitions or restrictions on hunting certain animal species and extracting plant and mineral resources from particular regions. The most representative instruments of this policy are *nature conservation units*, where access to the population is extremely restricted or impossible due to the level of fragility of the ecosystem. This is the case with ecological stations, where the primary purpose is to conduct basic research applied to ecology, and the secondary purpose is to create spaces conducive to the development of educational campaigns for nature conservation. Another example is ecological reserves, whose sole reason is the preservation of flora and fauna (Juniper, 2019: 328-330).

Another modality of regulatory environmental policy, which could be called "unorthodox," is characterized by flexible delimitation of the universe of individual choices, enabling alternative and cumulative decisions. This is the case of ecological parks, nature conservation units that have scientific, educational, and recreational purposes, allowing access by the population, conditioning it, however, to the preservation of the ecosystem. But the main instrument of this type of regulatory environmental policy, whose superiority over the other modality of direct regulation resides in the reduction of administrative costs (of the intense monitoring required) and the possibility of preventing environmental damage (which is, strictly speaking, irreparable through fines), is the Environmental Impact Assessment — EIA. By enabling the evaluation of the potential degradation presented by urban and industrial projects, the EIA elevates the preventive dimension — characteristic of regulatory policies — to the maximum degree (in environmental terms), making it possible for the state to anticipate the effects of environmental modification (Bessa, 1992: 317).

Expanding or reducing the range of individual choices, regulatory policy aimed at environmental degradation will enable the achievement of two essential goals for the management of highly vulnerable natural areas to pollution. These goals are: (1) *the prevention of degradation*, particularly through the prediction of the effects of environmental damage, and (2) *the fulfillment of preservationist demands* of the environment to prevent its alteration.

The degradation of natural ecosystems is characterized by its localized impact, in that it affects only individuals with access to these areas, which, since they have yet to be urbanized, have an effective population flow, and reduced potential. The people affected by the degradation of these areas have similar income and *social status*, and their association will promote conservationist movements to veto the installation of industries and the conversion of rural land into urban areas. Such movements will comprise individuals mobilized based on their subsistence and leisure. In both cases, they are individuals whose interests are *homogeneous* and *linked prior to the impact* of environmental damage. The delimitation of preservation areas has remained the focus of environmental policy since the beginning of environmentalist movements, whose demands, limited to the conservation of nature, have fostered an essentially regulatory policy-making.

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Paradoxically, therefore, pioneer environmentalism or natural conservationism assumes the same separation, between humanity and nature (explicitly or not) assumed by its human predation, in any of its historical forms. Thus, an effectively ecocentric bias of humanity requires its inclusion, even without attributing environmental centrality to it – whose abandonment characterizes any environmentalism or normative ideal of environmental balance tout court[5]

The recent incorporation of redistributive aspects into public policies aimed at environmental degradation will meet the demands and involve agents different from those organized due to pollution of natural environments. The impact of the degradation of *urban* ecosystems will be *diffuse*, as it will affect varied and even unrelated interests. The concentration of individuals with varying income and status levels in urban areas, which reached its peak during the process of *megalopolization* in the developed world during the 1960s and 1970s, and in developing countries during the late 1970s and 1980s, results in interdependence among different segments of the population that can inadvertently inflict harm upon one another.

As a result, all groups can be affected by the actions of any individual or group, resulting in unintended or intentional environmental damage due to their shared presence in common environments. The environment becomes a common good and the impact of environmental destruction will fall upon individuals whose interests, prior to the damage, are *heterogeneous* and *not associated* with each other. What will unite them is the widespread impact, as opposed to the localized effects of natural environmental degradation, of the deterioration of the urban and shared ecosystem. By affecting varied interests (previously separate, and even in conflict with each other), it will encourage the alliance of individuals whose goals and movements differ significantly from those of conservationist environmentalism aimed at preserving natural ecosystems.

The elements of the urban environment must be organized according to their balance, including productive activities and all factors that shape the urban space. Movements advocating for the restoration of balance in urban ecosystems will call for *predominantly redistributive* public policies, whose economic instruments will be more suitable than mere regulation for inducing sustainable behavior in constantly changing urban environments. As urban-industrial expansion continues (and has continued) to concentrate energy and population at an intensive pace driven by the market, natural environments decrease, allowing demands for the *preservation* of natural ecosystems to emerge alongside demands for the *recovery* of degraded artificial (urban) ecosystems.

Urban areas that display ecological imbalances, such as material degradation, contamination of vital resources, and high levels of noise, are likely to give rise to conflicts among stakeholders. These conflicts will not only pit interests linked to pollution against those related to environmental restoration, but also opposing demands corresponding to the plurality of feasible solutions in view of environmental degradation. This will be accomplished through *policies* that go beyond regulatory frameworks.

Redistributive policies can be classified into two types: those that *concentrate benefits and socialize costs*, and those that *concentrate costs and socialize benefits* (Lowi, 1967: 708-712). The former type is carried out through the provision of subsidies (such as financing, goods or services) by the state, mainly in response to the demands of market agents affected by the depletion of resources resulting from environmental degradation.

The provision of recycling equipment is essential for business segments that compete with predatory market segments. Due to occupying favorable market positions, the established and predatory segments tend to maintain their dominance by relying exclusively on their concentration logic, which typically favors those with greater resources[6]. Redistributive environmental policies that concentrate benefits and socialize costs also meet the demands of environmental management professionals who rely on funding for research and anti-pollution equipment to carry out their work and protect themselves.

Therefore, market agents and corresponding professionals are in favor of policies that contain the depletion of resources, leading to a limited (as it is restricted to sustainability considerations) but effective process of *ecologization* through the market. Another example of the importance of state clientelism in meeting demands lies in providing affected

[5] Philosophically pioneering, against both environmental predation and with a dynamic understanding of sustainability is the ecocentric bias of Ludwig Feuerbach (1804-1872): "Our world [...] is an inverted world. The triumph of our culture, of our civilization, resided for the most part only in withdrawing and deviating as much as possible from nature, and the triumph of our science [...] in withdrawing and deviating as far as possible of simple and evident truth." Unlike natural conservationism, then emerging, it postulated development, but in alliance with nature: "Our task is to avoid extremes [...] of considering, treating and venerating nature as what it is – as our mother [...] not, however, with the eyes of a religious child, but rather with the eyes of an adult, self-conscious man." Vorlesungen über das Wesen der Religion (Gesammelte Werke) (Feuerbach, 1967). As to conceive of nature (planetary) as active omnipresence, by environmental science, see Lovelock (1995). In an interdisciplinary scientific perspective, fusions between humanities and nature are analyzed by Lopes (2023).

[6] The *green market* — consisting of activities and products composed exclusively or mainly of items renewed through natural and/or artificial processes — requires government support to compete with the *gray market*, which is characterized by its inability to renew resources in the short or medium term (Conti, 1986: 981).

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communities with adequate tools for restoring degraded areas.

The impact of urban ecosystem degradation is not only widespread, affecting diverse population groups and immobilizing heterogeneous interests due to environmental pollution, but also *regressive*. This is because it *disproportionately* affects different population segments based on their resources, with income being an obviously relevant variable for their protection. In other words, the *costs* of negative externalities arising from urban environmental pollution will be borne by various segments, especially those who are economically and environmentally less privileged and lack private resources for protection.

The *aggregate* and *differential* impact of urban environmental degradation will link heterogeneous and previously unrelated (if not hostile) interests together, deprived of a common good: the ecologically balanced environment constituted by urban space.

The organization and association of these individuals will be their main resource in the conflict aimed at distributing the costs of degradation and restoring the environmental balance of the urban ecosystem. These movements will identify responsibility for environmental harm and assign the resulting costs of damage to polluters to prevent the generalization of the harm facilitated by the scenario of urban interdependence, which primarily affects the various majority and unprotected population segments.

The following table relates both aspects of environmental degradation to the market and its eventual solutions:

Environmental Degradation	Market	Solutions
Exhaustion	Negative Internality	Intercompany Cooperation
Pollution	Negative Externality	User Cooperation

Redistributive environmental policies that concentrate costs and socialize benefits will meet the demands of movements in favor of environmental protection as *a collective good*, specifically in the conversion of an ecologically balanced environment from a *necessity* to a *right*. These movements are composed of individuals from various segments of the population, mobilized in response to the diffuse and differential impact of urban degradation. They are *urban* movements because it is in this context that negative externalities of environmental degradation are generalized. The presence and relevance of these movements in associative life is a fundamental factor in converting the environment from a private and localized issue (the second perception of conservationist environmentalism) into a *social issue* (involving diverse interests, particularly of those lacking private resources for their protection) and a *public issue* (by advocating for the establishment of state environmental protection agencies).

The redistributive and cost-concentrating policies that aim to *democratize the costs* of negative environmental impacts advocated by these movements will be expressed through the incorporation of the polluter-pays principle into national environmental legislations (Bessa, 1992: 245). The polluter-pays principle, as the polluter assumes responsibility for pollution, will enable the emergence of two mechanisms: a *compensatory* one, which obligates the polluting agent to bear the cost of destruction or repair; and a *redistributive* one, to the extent that costs are imposed that go beyond the compensatory line of penal and administrative sanctions, thus inhibiting polluting activities. The legal principle of polluter pays extends beyond the monetary obligation to clean up, but also entails the assignment of responsibility (regardless of fault) to those who engage in risky activities that may cause harm, both in terms of cleaning up and *preventing pollution*.

This is a redistributive policy in the *classical* sense (as argued by Löwy, 1967: 715), in that these redistributive environmental policies concentrate costs and socialize benefits, characterized by their impact on the level of class, revealing *a division between owners and non-owners* in the case of economic activities whose environmental predation affects broad segments of the population. Such policies will directly affect segments of the population in terms of their income and property. Once a payment is established in the *short term* that exceeds the perceived level of services — another classical redistributive characteristic (Idem) — and the affected target group can be grouped as a class, it is possible to identify redistributive aspects in this type of environmental *policy*.

The emergence of demands for environmental balance due to the degradation of artificial ecosystems did not imply a decline or displacement of demands for preservation of the balance of non-urbanized areas. Alongside these demands, there are claims for the preservation of the balance of urban ecosystems, calling for regulatory improvements (mainly through the extension of Environmental Impact Assessment requirements and their increasing complexity). Environmental protection movements in urban ecosystems - as in rural ecosystems - will advocate for preventive measures against environmental degradation, calling for increased state intervention in urban environments and the establishment or expansion of regulation of its components.

Therefore, the environmental protection movements in urban ecosystems represent the key variable for introducing the environment into the public policy agenda, by advocating for the *institutionalization* of the environmental issue through the establishment of state environmental agencies. The importance of these

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movements in associational life will determine the presence (which will be peripheral, important, or central) of the environmental issue on government agendas. The strength of these movements to combat urban pollution in the developed countries of the North and their recent and incipient emergence in the industrialized countries of the South explain the effective incorporation of redistributive aspects into national environmental legislation in the former and their weakness in the latter. However, in the latter, there is a growing number of urban environmentalist demands and the presence of the environmental issue in public life.

Even the formulation of distributive environmental policies (Löwy, 1967: 708) is conditioned, sometimes by distributions focused on non-consumer individuals or universalized for the construction of new collective habits[7].

The evolution of public environmental policies, from mainly regulatory instruments to its recent incorporation into redistributive aspects, is not only observed in national environmental legislations but also in the innovations regarding the perception of the environmental issue in the international agenda.

Although the topic of the environment had been relevant within the United Nations' sphere, as all thematic meetings organized by the organization dealt with issues related to the environment, it was not until the Stockholm Conference in 1972 and, particularly, the Rio de Janeiro Conference in 1992 that the environmental issue definitively entered the international agenda. The former highlighted the environment as the focal point of the North-South divide. While the developed North was already affected by transboundary environmental problems such as toxic waste transportation, acid rain, chronic smog, nuclear control, pesticide use, waste disposal, and marine pollution, the South promoted or consolidated industrialization processes. The debates were deadlocked, with the North advocating for the adoption of environmental commitments to limit economic growth, which was identified as the source of environmental problems. This proposal was promptly rejected, along with the environmental issue itself, by the countries of the South. The primary outcomes of the Stockholm Conference were the implementation of strict internal environmental controls by developed Northern countries and the large-scale migration of polluting and high environmental impact industries to developing Southern countries (Viola, 1992, p 7-8).

The context of Rio-92 (also known as *UNCED*) was entirely different, as global environmental problems had already emerged or intensified (depletion of the ozone layer, greenhouse effect, and reduction of biodiversity), composing *the global disorder of the biosphere*, that foster international conflicts regarding the distribution of *costs* of degradation and recovery of the planetary environment. This environment had become essentially urban, due to the accelerated urbanization of the main developing countries in the 1970s and 1980s, presenting relations of interdependence, alongside communication mechanisms and financial globalization (Viola, 1992: 10-12).

The end of the Cold War and the breakdown of the East/West polarization allowed for the full expression of the North/South cleavage, with the environment becoming a central focus of attention in the development strategies of both hemispheres. The North aims to prevent the depletion of the South's biological resources by its populations, ensuring their flow to the emerging *bio-industry*, while the South seeks access to the North's more energy-efficient technologies (and therefore less environmentally harmful) due to the high vulnerability of its development strategies, which lack the *North's sciences of new materials* and natural resources. At this conference, the South is presented as a hemisphere affected by environmental degradation, primarily resulting from the intensive and polluting activities that migrated from the North in the 1970s. Furthermore, the *megalopolization is* worse in developing countries, particularly in Latin America, where a quarter of the population resides in cities, and most of its population lack proper sanitation, deals with polluted air and water conditions, and are vulnerable to natural disasters (Viola, 1992: 13).

Thus, Rio 92 took place in a context where the costs of global environmental degradation became a subject of international conflict due to their distribution. The strategy of the North was to assign these costs to the international community as a whole, committing to recycling their urban-industrial processes and demanding from the South the limitation of the use of natural resource deposits, which are mostly located below the Equator. The strategy of the South will be to differentiate the responsibilities for the planet's environmental crisis, committing to the preservation of natural resources and demanding from the North mechanisms for the transfer of technologies that allow for *sustainable* development on a non-commercial basis, ensuring its recyclability. The perception of the lack of sustainability of development (and not of development itself) as the source of environmental problems will be the main consequence of the active presence of the G-77 in the preparation and progress of the Conference (Viola, 1992: 13-14).

The formulation of intergovernmental environmental policies will be marked by a conflict between the *preferably regulatory strategies* of the North, which aim to conserve natural reserves (primarily biological) located mainly in Southern countries, and the *preferably redistributive strategies* of the South, which

[7] This is the case of Portuguese Law 69/2018, which proposes to reward consumers for returning packaging, sometimes with eco-friendly products, sometimes with new forms of consumption.

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aim to transfer resources (primarily technological) that promote energy efficiency, held by northern hemisphere countries, to implement *sustainable development*. This conflict was evident during the Conventions on Climate Change and Biodiversity.

During the Climate Change Convention, there was a dilemma on how to address the issue of carbon dioxide concentration in the atmosphere. The South nations proposed the reduction of emissions resulting from the use of fossil fuels through the imposition of taxes, which would predominantly affect wealthy nations. The revenue generated would be used to finance sustainable development, primarily benefiting peripheral countries. On the other hand, the North suggested the preservation of existing forests in Southern countries, as their vegetation can absorb excess carbon dioxide. Eventually, the Convention established long deadlines for the reduction of emissions, and there was a commitment to cooperate in the preservation of areas with high biological diversity through the World Bank (United Nations, 1993: 41-45).

In the Biodiversity Convention, the impasse between Northern *regulatory* approaches and Southern *redistributive* approaches, which pitted holders of scientific knowledge against those of genetic material, both necessary for the advancement of emerging *biotechnology*, was resolved. The North advocated for preserving forests, designating them as a *heritage of humanity* and guaranteeing free access for researchers. Meanwhile, the South asserted its right to benefit from the *bioindustry* to enable access to research and forest preservation, rejecting patents from multinational laboratories. Due to the isolation imposed on the United States by the European Economic Community (EEC) and Japan, possibly aiming to undermine the current almost exclusive U.S. dominance in biotechnology, which voted with the G-77, the latter position prevailed in the final text[8] (United Nations, 1993: 50-54).

The table below summarizes the impacts of conservationist and sustainability guidelines on environmental policies:

Environmental Bias	Regulatory Policy	Distributive Policy	Redistributive Policy
Conservacionist	Hard Alternatives	Focused	Concentration of Benefits
Sustainabilityist	Flexible Alternatives	Universalists	Socialization of Benefits

The Amazonian case or the viability of its forest continuity currently exemplifies the same double environmentalist orientation. Both offer redistributive policies that concentrate benefits on forest users, socializing diffuse burdens (conservationist solution) or socialize benefits to sustainable production and consumption in the region, concentrating burdens on predatory segments of the forest (sustainability solution).

Recently, a mechanism adopted by the United Nations Economic Commission for Europe (UNECE), therefore, for a (European) region of the Planet in which forests are no longer territorially capillarized, it has been postulated for their maintenance. It is a redistributive public policy that confers economic benefits to populations settled in forested (or forested) areas and provided by the community interested in the continuity of the current forest magnitude, even if it does not reside in it.: "Payments for Ecosystem Services (PES) describes the situation where the user of an environmental service (…) pays the landowners who provide that service. For PES to exist, it requires a clear definition of ecosystem users, and their payers. The range of forest environment, with political and public relations implications of PES are discussed at length, and recommendations include the need for clarity about where PES may be a useful tool in moving towards a green economy and where other methods may be more appropriate (UNECE, 2014: 10-12).

However, transplanting such a mechanism to the Amazon forest, whose biome has a complexity and dimension that makes it, notoriously and directly, a fundamental variable for the planet's climate stability, ignores its population and forest diversity, causing problems that would not even exist if not implemented PES:

> *Landless people will not be able to participate in PES schemes where ownership of land, natural resources, or ecosystem services is a formal requirement*. A possibility might be to refer not exclusively to ownership as a PES requirement but also to allow for participation of holders of use rights. [...] *In practice, the establishing and tracking of property rights records is a recurring difficulty in PES*. In Bolivia, for instance, the legal obligation to register such activities exists. *However, implementation has proven slow*. In addition, registration during the development of PES schemes will most likely raise transaction costs. (IUCN, 2009: 32-33).

In theory, ecosystem service servitude could be granted by the landowner. In practice, this will depend on how much the landowner is offered for giving up his use rights. However, *a servitude may also be implied or acquired by the government, as is the case in Brazil where conservation easements/servitudes permanently restrict specific activities* on a piece of land in order to protect its natural resources. As a consequence, servitude could be deliberated, if a certain land use, established by a PES contract, created some kind of practice (IUCN, 2009: 34).

Another solution for forest continuity (more viable and recent), would be the establishment of an Amazonian bioindustry, as the economic potential

[8] Such an impasse on the financing of sustainable development, in the South and North of the Planet, remains the main global challenge, blocking even the effectiveness of the recent global decisions on climate control and adopted by the international Summits of Kyoto (1997) and Paris (2016) (Juniper: 318-321).

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(medicinal, food, ornamental and cosmetic) of its flora and fauna biodiversity are obvious, including – at least partially – already the object of research. regional traditional knowledge. In this sense, the Paiter Suruí tribe has shown, since the end of the last century, that tribal integration with national and even international integration is possible, as in the village coffee production without pesticides and with unique flavors in relation to similar products.

His own tribal self-definition highlights the economic content of the indigenous integration he seeks: "The Paiter Suruí people's main objective *is the sustainable development of their community*, focusing on autonomy and the search for a better quality of life for all its members. To achieve this goal, we work *with planning, professionalism and a lot of effort"*. (Paiter Suruí, [2022])

> *"Ecotourism is already benefiting the PaiterSurui families through the purchase of products such as Bananas, Yams, Cassava, Sweet Potatoes, Oranges and others, in addition to the urine made by women, which are offered to tourists in the Complex Yabnaby". (Paiter Suruí, [2022]).* Tourists are served traditional products: "Moqueado fish in patois leaf, the *traditional way* of the Paiter to roast fish."

Indigenous-oriented social participation in sustainable development also qualifies the process: "Last Thursday, January 5, 2023, the Paiter-Suruí People's Governance System, was carried out through its largest institution, the General Cacique [...] discussion and deliberations on the most emerging issues that involve national, state and municipal politics, mainly on those that directly affect indigenous rights. Among the highlighted guidelines were:

- Strengthening and Making recognized by authorities around the world the Governance System of the Paiter-Suruí People;
- Dialogue and Participation in the transition of the new government of Brazil, SESAI, FUNAI, MEC and MPI and other related bodies;
- *Infrastructure* and Investment policy *for the Villages* through socioeconomic, productive and environmental projects" (Paiter Suruí, [2022])

Its third tribal directive (after indigenous rights and tribal health) is "Strengthening the Economy of the Paiter Surui People: Supports the general activities of indigenous workers, seeking partnerships and training for *better performance and productivity*. (Paiter Suruí, [2022]) The content of the second directive is "Valuing *traditional and non-indigenous medicines*, ensuring health and quality of life also by valuing *traditional food Paiter*." (Paiter Suruí, [2022]).

Coffee, harvested by indigenous villages and farmers of the Suruí ethnic group, has already achieved relevance in the Brazilian and international market: "His persistence made him the first Indian to reach the shortlist of the award. In 1982, Nakodah started tending the coffee and planting more trees, but the crop devaluation discouraged him. "The price was very low. The bag was being sold for BRL 15-20 (USD 4-5), so I stopped planting for a while," he recalled. In 2013, when he discovered local varieties, the so-called "clonal coffee," he tried planting again. "We learned about clonal coffee online," explained he, who also produces peach palms, nuts and bananas. "Around the crops, there are areas of capoeira and forest. *It's a sustainable production. When the focus became coffee, deforestation declined. This year, which saw a coffee recovery, deforestation was almost zero,*" Funai coordination stressed. [...] They are Amazon fermented robusta coffees. *The Suruí coffee is an Amazon delicacy*, is very fruity, have 88 points," says Janderson Dalazen with Brazilian Agricultural Research Company (Embrapa) in Rondônia and one of the only Brazilian tasters who specialize in canephora coffee who call themselves Q-Robusta Grader (ANBA, 2019).

The municipality itself close to the Suruí villages is already known as the "regional capital of coffee": "The indigenous people's relationship with *the practice and planting began with the homologation of the Sete de Setembro Indigenous Land*, in the 1980s. Over the years, *the Paiter-Suruí contributed to consolidate the success of the cultivation of specialty coffee*. The partnership with the private sector crowned the sustainable experience *in 2018* when, with the support of Funai, the production of indigenous coffee began to be sold to the 3Corações group, through an agreement that *provides for increased productivity* with a focus on coffee quality especially sustainable. [...] Coffee growing became a source of income for the communities. In the Sete de Setembro Indigenous Land alone, 115 indigenous families from 15 villages organize themselves into cooperatives to gain scale and distribute the crop, special fertilizer or irrigation, with care to harvest at the right time, treat and store the grains of coffee produced" (FUNAI, 2022).

Therefore, the coffee experience of the Suruí proves that government investments in technical training, for traditional or just differentiated products, would socialize benefits to forest populations, in terms of regional and even Brazilian. Thus, it would be a traditional economic expansion that would strength their role as "guardians of the forest", including against predatory incursions and begins to receive recent government attention:

III. Conclusions

Environmental degradation, due to its inherent conflict of interests, gives rise to multiple social cleavages. Those who benefit or promote environmental degradation are opposed by those who suffer from it. Similarly, those who benefit from environmental preservation are in opposition to those who are

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disadvantaged by it. Moreover, those who seek to restore environmental equilibrium are opposed by those who are held responsible for environmental damage. Finally, the different beneficiaries of corresponding approaches to restoring environmental damage may have conflicting interests.

In order to assess the complexity of the interests involved, it is necessary to consider the *dual nature* of environmental degradation once again: first, the depletion of resources resulting from the market's incapacity to anticipate and provide adequate mechanisms for resource replenishment that match their expansion. Consequently, companies that deal with scarce resources are forced to focus on the sustainability of their production processes to maintain or improve their market position. This phenomenon has led to the emergence of a *green market* that demands organic farming, high energy-efficient cars and appliances, reusable containers, recycling of materials (such as paper, metal, and glass), and products made exclusively or predominantly from renewable items produced through natural or artificial processes. This market is growing in developed countries and is emerging in industrialized countries located in the periphery.

The depletion of natural resources in the Western societies of the North has triggered an impetus for the acceleration of the technological revolution in energy conservation. This has been facilitated by the development of innovative heat recovery devices, combustion gas utilization, co-generation of electricity from boiler steam (previously wasted), as well as material recycling programs and enhancements in engine energy performance. Additionally, a group of administrators has emerged who implement a management paradigm for production processes that prioritizes efficiency, material usage, energy conservation, pollution reduction, and total quality control (Viola, 1992).

On the other hand, environmental degradation that results in pollution mobilizes a variety of interests. It impacts individuals whose well-being, health, or subsistence depend on natural or urban ecosystems that are affected by pollution generated from waste that is incapable of natural or artificial assimilation or processing. As a result of this association, several social movements have emerged with the aim of combating different types of pollution, particularly those focused on the preservation and restoration of urban ecosystems. These movements advocate for environmental protection as a social right and a condition for the common good of the environment. As environmental deprivation in urban contexts potentially affects diverse segments of the population, these movements are attributed to the creation or strengthening of state environmental agencies and the incorporation of ecological issues into the public agenda as objects of *policy-making*.

The *ecological* transformation of society, resulting from the institutionalization of the environment as an intrinsic variable in social dynamics, will emerge from the resolution of the conflicts of interest to which it is subject. The *ecologization* of society is likely to be most successful when different agents working towards environmental balance can effectively coordinate and collaborate. Achieving this outcome relies on anti-pollution social movements recognizing the inherent ambiguity of the market and distinguishing between its relationships with predatory and sustainable segments. By aligning themselves with the latter and politically isolating the former, these movements can help implement redistributive environmental policies.

However, a successful coalition of agents also depends on acknowledging the strength of the market's predatory tradition and the urban-industrial process. The level of institutionalization of the environmental issue as a marginal, relevant, or priority dimension of social life will ultimately depend on how conflicts of interest arising from negative externalities resulting from environmental damage are resolved. For example, if electrifying cars and electric public transport are both solutions against urban air pollution, allying social segments interested in each of them is, in addition to being necessary against polluting segments, made possible by the broad consensus of urban capillarization of non-polluting public transport, as its capillarity would satisfy individual car owners.

But environmentalist theoretical frameworks (environmental conservation or sustainable development) are the main constraints of policies: while the conservationist bias favors *alternatives* to the market to prevent or compensate for its negative environmental externalities, sustainable development implies *reforming the market* so that it adopts sustainability in *its usual operation*.

Under conservationist bias, in which the global dimension is the parameter of the local:

- The Amazon rainforest is maintained by national or global payment to the regional population for forest maintenance (IUCN, 2009);
- Oceans are preserved, preferably, by banning their fishing activity, given the (literally) immensity necessarily covered by international inspection (Juniper, 2019: 267-268);
- The reuse of products in a circular economy is a priority (or even exclusivity), as the circulation of existing ones has less ecological impact than any production (NEA, 2021: 38-45);
- Industrial energy generation must be contained as much as possible, also because its subsequent expenditure also disseminates heat (Wackernagel & Rees, 1996: 58);

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- Human consumption of animals should ideally be immediately banned, as strict agricultural production (no pesticides denounced by Carson, 2015) entails less ecological impact (Henriques and Gorvett, 2022);
- Urban sprawl must end immediately, as cities are hotbeds of temperature rises (White, 2013: 63);
- The world population can no longer grow, due to current consumption exceeding planetary finiteness (Meadows, 1972);
- Economic degrowth is the general solution to the planetary environmental crisis: conclusion drawn from the indisputable fact that environmental imbalances are negative externalities of the market *tout court* (Roegen, 2006).

Under sustainability bias, in which the local dimension is the parameter of the global one:

- The Amazon rainforest would be maintained by regional *bioindustry* in medicine, cosmetics, ornaments and food (SEDAM, 2010);
- Oceans can be better supplied by the dissemination of sustainable fishing, internationally promoted (Mail & Guardian, 2013);
- Recycling of products in a circular economy is guaranteed (although never exclusively), as current economic waste has already *reached as much magnitude as recyclable materiality* (EU, 2020)
- Energy generation must *correspond to renewable sources and the cleanest* content as soon as possible, also because they tend to be fed back *between alternating energies* (Juniper, 2019: 302);
- Organic animal production can be as diversified as articulated in agroforestry complexes (Nandhini and Suganthi, 2018)
- Urban expansion should prioritize smaller cities (preferably medium-sized, whose attractiveness exceeds that of small ones), *especially in metropolitan areas*, alleviating their systemic overload (OECD, 2009);
- The world population needs to spread out through regulated migrations, given that it currently occupies *around 60%* of the globe, concentrated *in some* planetary quadrants, there is *a lack of populations in several developed nations* and the global perspective is of population *deceleration* in the immediate future (UN Population, 2018; UN Desa, 2019);
- The economic growth of immaterial and renewable goods (superseding that of material and non-renewable goods) is the general solution to the planetary environmental crisis: a conclusion drawn from the fact that the negative externalities of the market, which lead to environmental imbalances, can be *positively internalized through policies that strengthen their cooperative or collaborative* competition (Anand & Sen, 1994; Lopes, 2012: 22-26, 147-156).

It is urgent to overcome the conservationist bias, while recognizing its pioneering contributions, especially to the visibility of environmental degradation. The current magnitude of which is (always) growing globally, requires an environmentalist approach that, still a minority in environmental policies, needs to be recognized as the one that can ensure sustainable *development* (and therefore, economic regularity) for life in environments where things and beings are interdependent with the human.

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Amazon and Brazilian Foreign Policy: Analysis of Deforestation Index in the Lula and Bolsonaro Governments

By Gabriela da Silva Cavalcante & Jodival Mauricio da Costa

Federal University of Amapá

Abstract- The international protagonist of the Amazon has gained ground in Brazil's foreign policy, and the rate of deforestation in the region is one of the indicators of this importance. Due to the current focus on the Amazon, the federal government needs to justify the increase in deforestation and present plans to reduce these rates. Realizing the need to better understand the topic, this paper aims to analyze the foreign policy actions developed for the Amazon in the Lula (2003-2010) and Bolsonaro (2019-2022) governments, focusing on forest management, considering the beginning of historical monitoring, in 1988, made by the Amazon Deforestation Monitoring Program. In addition, the discussion also contemplates Brazil's performance within the Paris Agreement and the 2030 Agenda. The results of this survey show that the lowest continuous rates of deforestation occurred between 2005 and 2011, while the highest deforestation rates were registered between 2019 to 2021.

Keywords: *amazon. bolsonaro government. lula government. foreign policy. deforestation.*

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Gabriela da Silva Cavalcante [α] & Jodival Mauricio da Costa [σ]

Abstract- The international protagonist of the Amazon has gained ground in Brazil's foreign policy, and the rate of deforestation in the region is one of the indicators of this importance. Due to the current focus on the Amazon, the federal government needs to justify the increase in deforestation and present plans to reduce these rates. Realizing the need to better understand the topic, this paper aims to analyze the foreign policy actions developed for the Amazon in the Lula (2003-2010) and Bolsonaro (2019-2022) governments, focusing on forest management, considering the beginning of historical monitoring, in 1988, made by the Amazon Deforestation Monitoring Program. In addition, the discussion also contemplates Brazil's performance within the Paris Agreement and the 2030 Agenda. The results of this survey show that the lowest continuous rates of deforestation occurred between 2005 and 2011, while the highest deforestation rates were registered between 2019 to 2021.

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I. Introduction

The Amazon covers an immense amount of resources and natural areas, and is divided between nine different countries, which demands an ecological interdependence between them. Brazil has 60% of the largest preserved area on the planet, which, according to Filho (2013), gives the country the leading role in exercising the region's sovereignty. As the holder of most of the Amazon rainforest, Brazil is an international highlight when it comes to protecting this biome. However, the highlight is not always positive: the high rates of deforestation draw the attention of the international community and the Brazilian population, who have seen in recent years the numbers grow without a plausible justification and without a plan to control deforestation.

This article presents the history of the Brazilian Foreign Policy (PEB) for the Amazon, starting in 1958 with the increase of migration to the region, passing through the main PEB actions over the years – focusing on the governments of Presidents Luiz Inácio Lula da Silva and Jair Messias Bolsonaro. The administrations of Lula and Bolsonaro meet at a central point, with the increase in deforestation rates in the Legal Amazon, and they distance themselves when Lula manages to reduce these rates during his administration, as opposed to Bolsonaro.

Considering the above, the objective of this article is to analyze the actions of PEB by the governments mentioned above, from the beginning of the historical monitoring in 1988, made by the Amazon Deforestation Calculation Program (PRODES), which presented the lowest continuous rates of deforestation between 2005 and 2011 and the most discrepant rates in the years 2019 to 2021.

The work is exploratory research made from bibliographic analysis, covering scientific articles, books, academic papers, and analysis of statistical data from the consolidated deforestation annual rates published by PRODES. After consulting the sources above, it was possible to observe that several actions influenced the decrease of the indexes, such as creating the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm) in 2004, which was discontinued in 2019. In addition, it was possible to note that the reduction of resources of the control bodies and the easing of environmental laws were factors that contributed to the increase in deforestation in the Amazon.

Thus, the article is structured as follows: the first part addresses the historical role of the PEB for the Amazon between 1958 and 2002; the second part addresses the historical series of PRODES data, focusing on the governments of Lula and Bolsonaro and, finally, we present future projections for the fight against deforestation in the Legal Amazon through Brazil's commitment to the Paris Agreement and the 2030 Agenda.

II. The Historical Role of Brazilian Foreign Policy towards the Amazon

Regional integration intensifies in South America as governments align their foreign policies (FP). According to Antiquera (2006), in the 1970s, most of the Amazonian countries were concentrating on development programs for their respective forest areas. In Brazil, for example, in 1958, due to the need to expand the industrialization and unification of the national market, President Juscelino Kubitschek

Author α: Master's Student at Federal University of Amapá/Brazil.
e-mail: gabscav@hotmail.com
Author σ: Professor at Federal University of Amapá/Brazil.
e-mail: jodival.costa@gmail.com

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implemented highways for access to the region, which accelerated migration to northern Brazil, which, according to Becker (2001), caused the population to increase from 1 (one) to 5 (five) million in ten years. That same year, the Legal Amazon region was established – the area that was appointed by the Superintendence for the Amazon Economic Valuation Plan (SPVEA) and is divided between nine Brazilian states: Amazonas, Amapá, Acre, Rondônia, Roraima, Pará, Maranhão, Tocantins and Mato Grosso.

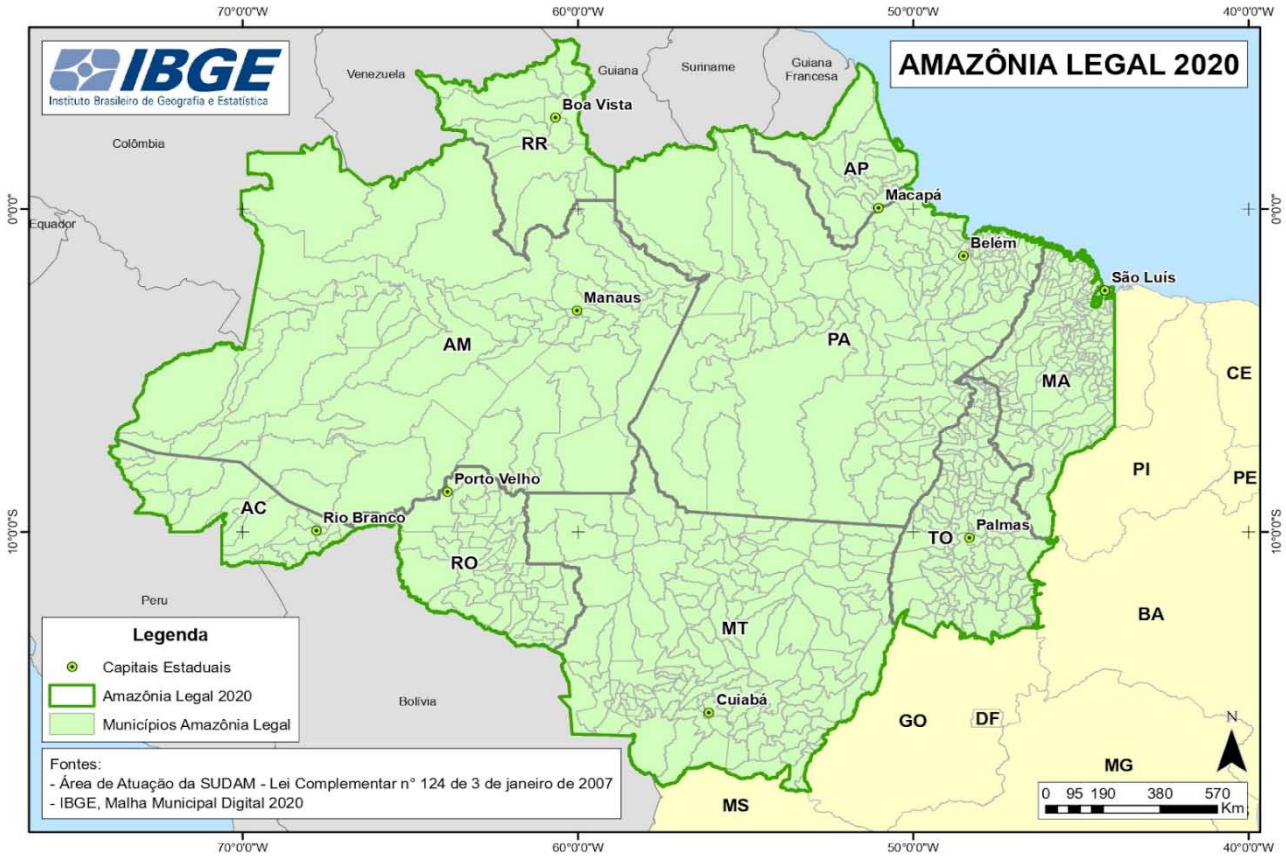


Fig. 1: Legal Amazon Area - Brazilian Institute of Geography and Statistics – IBGE

Shortly after that, in 1966, according to Repetto (1988), tax incentives were created for Amazon development policies through the Amazon Investment Fund (FINAM), favoring companies with discounts on federal taxes. Externally, in the early 1970s, the ecological debate broke out from the report '*The Limits to Growth*', commissioned by the Club of Rome, which, according to Oliveira (2012), had a catastrophic, almost apocalyptic character, indicating that without the containment of birth and the adoption of the zero-growth policy, the world would suffer with overpopulation, pollution, and hunger.

It is essential to mention that the report presented the exact solution for all countries: birth control and natural resources. However, Furtado (1998) writes that the report leaves out an essential issue: there is no concern about not making central countries dependent on the natural resources of peripheral countries, allowing the latter to become even more susceptible to the predatory use of these resources. The report presented a significant impact on the world from the most realistic projections.

In 1972, the United Nations (UN) promoted the first United Nations Conference on Human Environment in Sweden, having as one of its pillars and main argument of the central countries the report "*The Limits to Growth"* – which promoted the idea of environmental conservation and birth control for peripheral countries, while the central countries would not change their capitalist consumption and production pattern. According to Figueiredo and Cruz (2013), Brazil strongly opposed the unequal proposals during the conference, recognizing that there is an environmental contamination produced by the central countries, therefore it needs to be restored by them. This attitude is compatible with the development policy adopted by Brazil, which made the Amazon a breeding ground for large projects. The conference ended without a clear consensus among the participating countries on the new directions of global environmental policy.

The end of the conference resulted in the creation of the United Nations Environment Program (UNEP), which became the principal global agent promoting environmental conservation and the rational

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use of natural resources. Also resulting from the conference was the Stockholm Declaration on the Human Environment, which contains 26 (twenty-six) principles, divided between encouraging the preservation of the human environment, birth control, cooperation between states, technological development, and environmental education.

According to Antiquera (2006), Brazil formulated a project that was presented in 1977 by President Ernesto Geisel to the possible countries that are members of a new treaty: Amazon Cooperation Treaty (ACT). However, Venezuela, which was experiencing significative economic growth due to the rise in the price of oil, was cautious about the possible leadership of Brazil in South America. The agreement was signed in 1978, fifteen months after the beginning of negotiations, and according to Ricupero (1984), to defend the Amazonian countries' sovereignty over their territories. The treaty was characterized as a "Framework Agreement", that is, it is flexible enough to be amended according to future relations. In addition, the ACT also proposes not to interfere in other treaties – considering that the Andean Pact was being created and it was not feasible to dispute a place among the other Amazonian countries: Bolivia, Peru, Colombia, and Ecuador.

The importance of Brazilian policies for the environment was intensified with the 1988 Federal Constitution (CF). The elaboration of the new Constitution was driven by pressures from civil society and international environmental campaigns, which denounced neglect situations with the Amazon Forest, including deforestation and the reduction of indigenous areas (ALBERT, 1991). That same year, the increase of fires in the Amazon led to headlines in TIME magazine, and the death of the great environmental activist Chico Mendes – who always denounced that Brazil was not able to care for the Amazon rainforest efficiently, raised the international focus to combat deforestation.

To try to bypass this international vision of the country, President José Sarney set up, together with Itamaraty, an agenda of interests in which Sarney offered Brazil to host the first United Nations Conference on Environment and Development (Rio-92) and, according to Bezerra (2013) and Mello (2006), it was in the late 1980s that Brazil launched some programs as a response to the international community to prove that the country could to perform well in managing environmental concerns:

1) Creation of the Our Nature Program: adoption of a policy to address deforestation in the Amazon.
2) Creation of the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA).
3) Creation of the Pesticides Law: according to arts. 23 and 24 of the CF: legislate on the use, production, consumption, trade and storage of pesticides, and their components, as well as supervise the use, consumption, work, storage and internal transport.
4) Creation of the National Center for Prevention and Fight against Forest Fires (Prevfogo): responsible for the prevention policy that combats forest fires throughout the Brazilian territory.

Amazon Deforestation Calculation Program (PRODES) was also created during that period and, since 1988, uses images from the American satellite of the Landsat series to monitor deforestation in the Legal Amazon.

Already in the 1990s, the international scenario was changed by the post-Cold War, and Brazil – initially ruled by Collor de Mello – had a new opportunity to present its policies for the Amazon in the Agenda of Rio-92, which related to development and environment issues. Considering that Brazil treated environmental problems as a consequence of the lack of social and economic development, therefore, the topics needed to be discussed together. Alves (2018) emphasizes that: "It is important to note, however, that the right to development consensually established by Rio92 is not the human right to development, according to the Declaration on the Right to Development from the United Nations Commission on Human Rights and proclaimed, without consensus, by the General Assembly in 1986. It concerns the right of every human to participate in economic, social, cultural and political development, in which all human rights and fundamental freedom can be fully accomplished."

Thus, the right to development discussed during Rio-92 aims to defend the sovereignty and interest of countries through the attribution of environmental responsibilities, that it is a right of development for all states. The conference opened space for the beginning of a global cycle of debate and conferences of various aspects in the 1990s and, unlike the Stockholm Conference in 1972, there was no clash between the central and peripheral countries.

In addition to hosting the Rio-92 event, Brazil also presented more objective issues during the conference, pointed out new paths for development aligned with the preservation of the environment and opened space for new agendas. At the end of the conference, Agenda 21 and the Rio Declaration were signed, which boosted a new expectation of ordering environmental and social issues (ALVES, 2018).

On the eve of the new millennium, Brazilian President Fernando Henrique Cardoso (FHC) represented Brazil at the first edition of the Conference of the Parties at the United Nations Framework Convention on Climate Change (COP-1), in 1995. Unlike the last meetings related to the environment, the topic became more polarized in Brazil, being discussed both by Non-Governmental Organizations (NGOs) and by the Legislative Branch. According to Santos (2016), in

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general, FHC was the most stable democratically elected government in the country after a long time, giving Brazil a Foreign Policy agenda that had the opportunity to be, in fact, fulfilled.

During COP-1, the country reaffirmed the objectives of Rio-92, and with Law No. 9.985 of July 18, 2000, the National System of Conservation Units (SNUC) was created, promoting biodiversity conservation in all regions of Brazil, to ensure compliance with international commitments made during the UN conventions.

In 2002, the World Summit on Sustainable Development (Rio+10) took place in Johannesburg, South Africa, which dealt with issues such as climate change, biodiversity and pollution (FIGUEIREDO & CRUZ, 2013), and Brazil, with its soft power diplomacy, managed to act in defense of interests on protected areas of the Amazon, which increased the country's international credibility in environmental matters.

III. INPE Historical Data Collection Series - Prodes

The creation of the National Institute for Space Research (INPE) in 1961, was an essential milestone in Brazilian history. According to Câmara (2011), the institute brought visibility to the country regarding space research, considering that the Soviet Union, for example, launched satellites into Earth a few years earlier and had great results. One of the main programs launched by INPE was PRODES, which since 1988 has measured the annual rate of clear-cut deforestation in the Amazon.

According to Câmara (2011), the first consolidated deforestation rate was 21,050 km², in 1988, and the lowest rate found in this period was in 1991. For Fearnside (2005) this decrease is justified by the confiscation of savings made in March 1990, by President Fernando Collor de Mello, which affected the resources of many farmers who invested in the timber sector in the Amazon.

The data remained low until 1995, when the rate began to rise and reached 29,059 km², being the highest rate recorded to date. According to Fearnside (2005), the peak of 1995 was probably caused by the implementation of the Plano Real ("Real Plan", in English), which increased the availability of capital and influenced the value of durable goods, such as land, for example. The following year, 1996, rates fell again and remained without drastic increases until 2002, according to Figure 2.

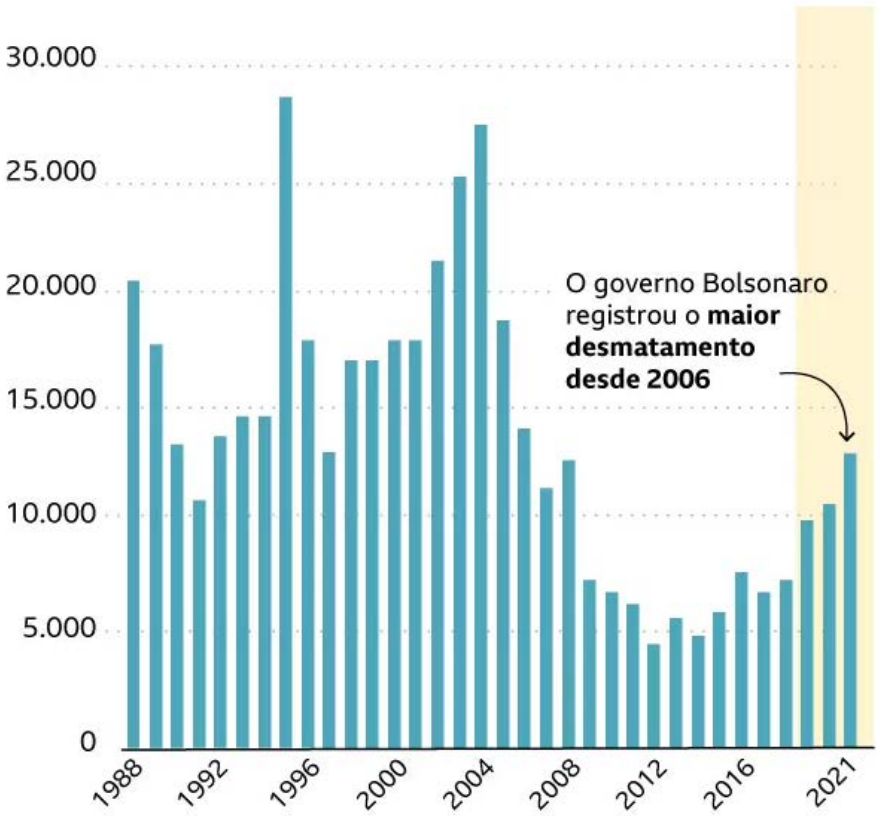


Fig. 2: Annual deforestation of the Legal Amazon in km² - INPE/PRODES – BBC, 2021

Between 2002 and 2004, the indexes rose again along with the increase in the price of agricultural export commodities, such as soybeans and meat. The index decrease was mainly due to creating the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm) to stop deforestation.

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For Fearnside (2020), starting in 2008, raw material prices recovered, but the Central Bank of Brazil adopted a resolution that granted agriculture and livestock credits only to people who did not have pending fines for illegal deforestation, which contributed to maintaining the drop in deforestation until 2012.

In 2012, the lowest deforestation rate in the history of the Legal Amazon was observed: 4,571 km^2. In the same year, Law 12,651/2012, known as the "New Forest Code", was approved, which: reduced the number of legal reserves in the Amazon (from 80% to 50%) and made it difficult to identify differences between Conservation Units and approved Indigenous Lands (§ 4 and 5 of art. 12); made it possible to merge native and exotic plants for the reforestation of Legal Reserve areas, changing local biodiversity (§ 3 of art. 66); agricultural credit was authorized with registration in the Rural Environmental Registry (CAR) regardless of proof of environmental regularity (art. 78-A).

The impeachment of President Dilma Rousseff, in 2016, presented a new phase for policies aimed at the Legal Amazon. The vice-president, Michel Temer, took on as President of Brazil, and some measures were then sanctioned, which corroborated the increase in deforestation, including the approval of the Proposed Amendment to the Constitution (PEC 65) in April/2016, exempting environmental licenses for construction, requiring only a previous environmental impact study. In the same year, PEC 241 was approved, which froze for 20 years the budget of the Ministry of the Environment (MMA), threatening the functioning of the agencies that act to monitor and control deforestation in the Legal Amazon (PEREIRA *et al*, 2019).

As a result, deforestation rates rose again in 2016, 2017 and 2018. During the election in 2018, presidential candidate Jair Bolsonaro promised to abolish MMA and moved its functions to the Ministry of Agriculture, Livestock and Supply (MAPA). However, during his term, Bolsonaro did not extinguish MMA, but transferred the functions of monitoring and controlling deforestation to MAPA – initially directed by ruralist Tereza Cristina. This was one of the actions that influenced the increase in deforestation rates, along with actions to dismantle the inspection and control bodies. In the first year of his government (2019), the rate consolidated by PRODES was 10,129 km^2, the highest recorded in ten years. In 2021, the consolidated rate was 13,038 km^2, the highest registered since 2006.

a) Government of President Luiz Inácio Lula da Silva - 2003 to 2010

The 2002 elections brought former union leader Luiz Inácio Lula da Silva to the Presidency of the Republic, which ruled Brazil from 2003 to 2010. Lula's foreign policy was based on global multilateralism, focusing on the Global South countries. With this, the government participated intensively in creating projects aimed at integrating the neighboring countries of South America (reactivation of the South Common Market - MERCOSUR) and economically emerging countries (creation of BRICS - Brazil, Russia, India, China and South Africa).

In the environmental area, the Lula government was marked by continuing FHC's international environmental strategy, as it engaged in international conferences and meetings in the environment sphere (SANTOS, 2016). The beginning of the government was marked by high and continuous rates of deforestation in the Legal Amazon – between 2002 and 2004, and the rates totaled 72,200 km^2, and the highest annual rate of this period was in 2004 (27,772 km^2), that is, the second highest rate consolidated in the historical series already registered by PRODES.

According to Svampa (2019), at the beginning of the 21st century, Latin America was strongly influenced by the international increase in prices of primary products (commodities). In Brazil, in the early years of Lula's government, traditional Amazonian populations lost space for large soybean plantations and cattle raising, decreasing the original area of the forest and favoring deforestation. Araújo *et al*. (2009) states that the record deforestation index in 2004 is related to the *boom* in primary products, focusing on the high price of commodities, especially soybeans.

Despite the relationship between the increase in deforestation and the high price of commodities, Bezerra (2013) points out that externally, during the COP, Brazil presented its goals (without specifying how it would be done) to reduce harmful gas emissions. Complementary Law No. 12/2003 was also discussed, which boosted deforestation and degradation of the environment with the dismantling of IBAMA. That is, the increasing rates of deforestation in the early years of the Lula government were not only the result of the increase in the price of agricultural products, but also of the dismantling actions of inspection bodies.

Marina Silva led the Ministry of the Environment (MMA) between 2003 and 2008. According to Santos (2016), she was well-received by the community of environmentalists, and she had a consolidated career in the environmental area: teacher, environmental activist, and born in Acre with a historical relationship with Chico Mendes, which allowed her to know the problems of the region deeply.

To reduce deforestation rates, Marina Silva implemented some projects, including the PPCDAm, which, according to Castelo (2015), helped to enable a new development model for the Amazon region, based on social inclusion, respect for cultural diversity and the feasibility of sustainable use of natural resources. The PPCDAm was part of the development strategies of the Pluriannual Plan (PPA) and the Sustainable Amazon Plan (PAS) of the Lula government.

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According to Assunção *et al.* (2015), the PPCDAm worked together with INPE, IBAMA, Federal Police, Highway Police and the Brazilian Army in monitoring the program developed by INPE, the Environmental Monitoring Center (CEMAM), and DETER – which delivers real-time data on deforestation in the Legal Amazon. Within the Lula government, the PPCDAm went through two phases: the first between 2004 and 2008, and the second between 2009 and 2011. The first phase of the project showed a positive result, between 2004 and 2008 deforestation was reduced by 53%, while between the beginning of the first phase (2004) and the last year of the second phase (2012), the drop was 84% in deforestation of the Legal Amazon.

When the PPCDAm began to show a positive result, President Lula adopted the measure art. 152 of Decree No. 6,514 of July 22, 2008, which prevented IBAMA from collecting deforestation fines within a year from landowners who submitted the protocol requesting regularization of legal reserves. However, to "balance" the situation, IBAMA adopted an essential measure in 2008 by creating a list of restrictions with the name of the Legal Amazon municipalities with high rates of deforestation. These municipalities suffered credit restrictions, increased IBAMA inspections, and as well as requirements to obtain licenses for legal deforestation (COSTA, 2013).

In terms of controlling deforestation, we can conclude that the Lula government presented a positive balance, as a result of the environmental policy implemented by Minister Ms. Marina Silva.

b) Government of President Jair Messias Bolsonaro – 2019 to 2022

Jair Messias Bolsonaro, was a federal deputy for the state of Rio de Janeiro between 1991 and 2018, was elected in 2018 as President of Brazil. According to Casarões *et al*. (2019), Bolsonaro's foreign policy was based on the opposition of the so-called "globalist theory", that is, anti-globalism. Within the Bolsonarist ideology, in a lecture at the Federation of Industries of the State of Rio de Janeiro in 2019, former Foreign Minister Ernesto Araújo defined the environmental movement as coming from a "Marxist cultural analysis".

Regarding the Legal Amazon, the region's deforestation rates grew before Bolsonaro's inauguration. Fearnside (2021) argues that when polls of voting intent pointed to the former military's victory, deforestation increased from September 2018 by 36%, most likely due to the relaxation of inspections that were part of Bolsonaro's campaign promises.

In 2019, the first year of his government, the rate ended with consolidated deforestation of 10,129 km², an increase of 34.4% compared to the previous year recorded by PRODES. The former minister of MMA, Ricardo Salles, acted vehemently to repeal the measures of several decrees related to environmental policies to reduce the chairs of the National Environment Council (CONAMA) from 96 to 23. Salles, as the pressure of public opinion regarding deforestation increased, attributed the problem to the ineffectiveness of the monitoring done by INPE and announced the hiring of a private company to do the monitoring. Still, in 2019, Bolsonaro stated that INPE data were manipulated and announced the dismissal of the institute's president, scientist Ricardo Galvão, who had been in office since 2016. After Galvão's exoneration, the data continued to rise (AVILA; TIERNO, 2020).

One of the most organized actions by farmers around the state of Pará (BR-163) to jointly deforest the Legal Amazon took place on August 10, 2019, known as the "Fire Day", which made the hotspots increase by about 300%. The event was "encouraged" by Bolsonaro, based on the threat of French President Emmanuel Macron not to ratify the agreement between MERCOSUR and the European Union (BRAGA; MARINHO, 2022).

The following year, 2020, presented a consolidated deforestation rate of 10,851 km². During that year, the president approved a change in Decree No. 8,974, of 01/24/2017, which changed the regimental structure, the demonstration framework and the trust functions of the Chico Mendes Institute for Biodiversity Conservation (ICMBio), relocating trust functions and replacing positions on the institute's committee.

The changes within the environmental inspection bodies were significant in aggravating deforestation. The president of IBAMA, Olivaldi Azevedo, was exonerated in April 2020, after a report that showed an operation of the institute on indigenous lands to combat illegal mining in Pará and prevent the transmission of Covid-19 to indigenous people. According to Avila and Tierno (2020), after the release of deforestation data before the middle of the year by INPE, career servant Lubia Vinhas was exonerated from the position of General Coordinator of Earth Observation of the institute.

In 2021, the third year of office, PRODES recorded a consolidated deforestation rate of 13,038 km², an increase of 22% compared to the previous year. According to the Report of the Climate Observatory entitled "*A Conta Chegou"*, published in 2022, IBAMA changed its president again, but this time Eduardo Bim was removed from office after being accused by the Federal Police (PF) within the "Akuanduba Operation" of favoring environmental criminals. Operation Akuanduba also investigated former MMA minister Ricardo Salles for environmental crimes.

In November 2021, the 26th UN Climate Change Conference occurred in Glasgow – Scotland. At the time, the MMA minister stated that he held 24 (twenty-four) meetings with ministers from other

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countries, however, he omitted an important information disclosed by INPE in October of the same year: deforestation in the Legal Amazon between August 2020 and July 2021 reached the highest rate (13,235 km²) ever recorded for the period since 2006 (PONTES, 2019).

Scantinburg (2022) states that the budget for environmental inspection in 2021 was the lowest in the last 20 years, culminating in a record increase in deforestation in the Legal Amazon. INPE, for example, had a reduced budget to R$2.6 million - the lowest amount in 10 years.

We conclude that the increase in deforestation rates in the Bolsonaro government result from an anti-environmentalist ideological policy, a dismantling of inspection & control bodies as well as the incentive to occupy protected areas, Conservation Units and Indigenous Lands. It's incorrect to say that the Bolsonaro government did not have an environmental policy. It was an environmental policy based on exploiting natural resources safeguarded by a developmentalist ideology.

IV. Future Prospects for Combating Deforestation in the Legal Amazon

The international treaties and agreements ratified by Brazil are a way of maintaining a commitment to the international community to solve common issues. According to Feldmann (1997), international environmental treaties usually deal with situations related to transboundary pollution, marine pollution, climate change, airspace contamination, Antarctic region, common aquifer resources, international wildlife trade, areas under special protection regime, pest control, among others.

Within the agreements and treaties ratified by Brazil, the Paris Agreement (2015), which aims to avoid reaching a maximum of 2°C of global temperature increase, stands out when combating the effects of climate change. The Paris Agreement allowed countries to set their targets to meet the overall goal of avoiding a rise in global temperature. Faccin (2019) complements the operation of the agreement "To act with the Nationally Determined Contribution (NDCs), each country must adopt a series of public policies to achieve the goal of reducing temperature rise. Any government, when thinking about implementing public policies, needs to consider other impacts that are indirectly affected. These policies will not only impact the environment, but also the economy, for example. Every policy has its costs and benefits, and it is up to the government to measure them to make the promotion of these policies efficient."

According to Pinsky; Gomes; and Kruglianskas (2019) the Brazilian goals are to reduce pollutant emissions in 37% by 2025. Part of the goals by the year 2030 are related to the energy sector, aiming to reach 45% of renewable energy, and, concerning the forest area, the goals are to zero illegal deforestation in the Amazon and reforest 12 million hectares.

Deforestation in the Legal Amazon increased immensely in 2019, a factor that contributed to the increase in the amount of greenhouse gas emissions released into the atmosphere. The report published at the end of 2021 by the Climate Observatory on the analysis of Brazilian greenhouse gas emissions states that, in 2020, emissions from the biome (Amazon) were up to seven times higher than in the Cerrado, the second biome that emitted the most gases, due to the largest deforested area and carbon stock in the forests.

The data above goes against Law No. 12.187/2009, which deals with the National Policy on Climate Change (PNMC), aiming to reduce by 80% the dismantling of the Legal Amazon in relation to the average verified between 1996 and 2005, until 2020. However, according to the Climate Observatory report (2021), Brazil failed to meet this objective: the goal was deforestation limited to 3.925 km² in 2020, but the index measured by PRODES was 10.851 km².

In April 2021, during the leaders' summit on climate change held in the United States, Brazilian President Jair Bolsonaro promised zero net carbon emissions by 2050, anticipating by ten years the initial deadline, and zero illegal deforestation by 2030. However, Brazil has never officially presented these goals related to Bolsonaro's promises within the Paris Agreement.

Also in 2015, Brazil assumed, during the UN General Assembly, the responsibility of collaborating with the Sustainable Development Goals (SDGs) – Agenda 2030. Moreira et al. (2020) complements the objective of the SDGs "It proposes a global pact for sustainable development. Its main purpose is to ensure human development and meet the basic needs of citizens through an economic, political and social process that respects the environment and sustainability. Ratified in 2015 by 193 countries, this Agenda is distributed by 17 Goals – the 'SDGs, Sustainable Development Goals' – composed of 169 goals that must be met by 2030. The proposed goals are broad, and diverse, and require interaction, which involves a diversity of fields of action that move towards: the eradication of poverty and hunger; health and well-being; education; gender equality; access to drinking water and sanitation; clean energy; decent work; sustainable economic growth; reduction of social inequalities; sustainability of life; innovations in infrastructure; responsible consumption; healthy cities; climate responsibility; reduction of inequalities; effective institutions; and social peace."

To comply with the 2030 Agenda, Brazil established the Social Articulation Secretariat (SEAS) as responsible for the implementation of the 2030 Agenda through Decree No. 9.980, of August 20, 2019. With this,

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deforestation of the Amazon falls mainly within SDG 15 – Land Life: protect, restore and promote the sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, cease and reverse soil degradation and cease biodiversity loss.

SDG 15 had some goals by 2020, among them the 15.2 goal: until 2020, promote the implementation of sustainable management of all types of forests, stop deforestation, restore degraded forests and substantially increase afforestation, and reforestation globally. However, Brazil has been unable to reduce the deforestation rate or apply measures to meet the target by the established deadline. However, like the Paris Agreement, Brazil can still achieve some SDGs by 2030, such as "15.3 Until 2030, combat desertification, restore degraded land and soil, including lands affected by desertification, droughts and floods, and strive to achieve a land degradation-neutral world. 15.4 Until 2030, ensure the conservation of mountain ecosystems, including their biodiversity, to improve their ability to provide essential benefits for sustainable development. 15.6 Ensure fair and equitable sharing of benefits derived from using genetic resources and promote adequate access to these resources. 15.7 Take urgent measures to end illegal hunting and trafficking in species of Brazil's flora & fauna. Address both the demand and supply of illegal wildlife products. 15.a Mobilize and significantly increase, from all sources, financial resources for the conservation and sustainable use of biodiversity and ecosystems. 15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives for developing countries aiming to promote it, including conservation and reforestation. 15.c Strengthen global support for efforts to combat illegal hunting and trafficking of protected species, by increasing the capacity of local communities to pursue sustainable livelihood opportunities (UN BRAZIL, 2022)."

Therefore, despite the high rates of deforestation in the Amazon observed by the Bolsonaro government, the goals are achievable if the federal government develops projects to reduce deforestation (and eventually zero it), considering that the current government does not have plans to meet these goals and deforestation rates fully have increased greatly in recent years. However, both the Paris Agreement and the 2030 Agenda bring, in a positive way, a commitment from Brazil to reduce deforestation in the Legal Amazon.

A perspective of decreasing the rate of deforestation lies in the change of government itself, with the advent of the third term of President Luiz Inácio Lula da Silva. The resumption of a Foreign Policy with an environmental commitment will lead to active action by Brazil in the international environmental agenda, which can strengthen programs aimed at investing in an economy with environmental responsibility. In the political field, the return of Marina Silva as Minister of the Environment and Climate Change also gives Brazil the possibility of a favorable environmental policy to control deforestation in the Amazon.

V. Conclusion

The Amazon Forest is treated as the solution for the environmental issue by the international community. Since the first environmental convention, the biome has been on an exclusive list: the only forest in the world to undergo international intervention. Because of this pressure, Amazon must be an essential part of Brazilian Foreign Policy. In the 1950s, the objective was to develop through the creation of roads and the stimulation of human migration to the region. The need to propose development to preserve the environment arose from international pressure on environmental conventions. Brazil was slow to change policies for the Amazon, and, as we can observe, the region is still neglected by the government. Although belatedly, Brazil has become an important player regarding environmental preservation in international agreements and treaties.

Lula's government, for example, showed very high deforestation rates at first, but they began to fall after implementing the PPCDAm. From the multilateral action of the government, the changes of policies directed to the Amazon attracted positively other states that began to credibility the use of the forest by Brazil. However, when rates stabilized, the president made room for people to deforest again, the one-year amnesty on fines for deforestation applied by IBAMA is a clear example. Thus, control over some parts of the Amazon and permission to deforest others became a way of internally balancing deforestation rates. If the Lula government hadn't relaxed some means of control, the rates would have been even lower.

Between the Lula and Bolsonaro government were Dilma Rousseff and Michel Temer, who maintained the PPCDAm. Dilma achieved the lowest rate of deforestation recorded by PRODES, but following the attitudes of her predecessor, she also approved laws that made environmental legislation more flexible. Temer had no significant decreases in deforestation rates during his tenure and approved the easing of regulations and froze the supervising bodies' budget.

Thus, it seems that most Brazilian presidents of the 21st century took advantage of a decrease in deforestation rates to show other countries that they were taking good care of the biome, but, internally, the easing of laws favored only a tiny part of the population: those who practiced deforestation.

However, not all presidents have waited for rates to drop to encourage deforestation. Bolsonaro, for example, has achieved the highest deforestation rates after several years of decline and stabilization. He began

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his government by filing the PPCDAm without putting any project in place, revoked several decrees for environmental protection, exonerated presidents and directors of supervisory bodies, cut the budget and publicly stated that the data published by INPE were manipulated. The neglect of the Amazon region is also reflected in Brazil's discredit internationally. Bolsonaro received several criticisms that culminated in cuts in international donations for the protection of the Amazon. Internally, Bolsonaro's environmental action received support from the ruralist community (which gained a "free pass" to deforest through the relaxation of laws) and severe criticism from the Brazilian civil and scientific society.

Despite Brazil's international commitment to reduce deforestation with the Paris Agreement and the 2030 Agenda in previous governments, with Bolsonaro's inauguration the federal government decreased internal mobilization to try to meet - even minimally, the goals of the agreements. Bolsonaro's speech at the leaders' summit in 2021 was only to try to lessen the impact of the Amazon's high deforestation rates and show a commitment that was not stimulated internally.

Therefore, it was possible to observe the importance of the data disclosed by INPE through PRODES, which denounces the lack of commitment to the Legal Amazon region. In addition, we also observed the pattern followed by Brazilian presidents: the easing of environmental laws after deforestation rates falling, which shows that these policies lack rigidity. Bolsonaro was the only president to go contrary to the statistics, and, although deforestation rates were not decreasing, he still eased the laws on this important matter.

The importance of the Amazon region goes beyond the borders of the Amazon countries: “The standing forest” contributes positively to the climate balance. Thus, the deforestation of the region negatively impacts the global climate situation.

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The Asymmetric Arrows of Space-Time in the Evolution of Planet and the Anthropocene

By Luís Henrique Ramos de Camargo
Universidade do Estado do Rio de Janeiro

Abstract- This article aims to verify the relationship of society with nature, and its thermodynamic energy flows, as an evolutionary element, generating totalization and being analyzed by the arrow(s) of space-time. This article will also verify how this process influences the formation of the Anthropocene. In this sense, the principles born after the advent of quantum mechanics will be applied to the spatial-temporal analysis of physis (which integrates society-nature). The article also verifies how each formcontent, in a unique way, contributes energetically to the development of its arrow of space-time. Thus, it will also be verified, as, the current production process, is associated, in general, with the disruption of the states of homeotase, in the energetic balance of the process of exchange between energy and matter, and as the old pattern of relative stability, which characterized the Holocene, has been replaced by disorder, which is at the basis of the emergence of the Anthropocene.

Keywords: *thermodynamics, anthropocene, holocene, evolution, form-content.*

GJHSS-B Classification: *GE1-350*



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The Asymmetric Arrows of Space-Time in the Evolution of Planet and the Anthropocene

Luís Henrique Ramos de Camargo

Abstract- **This article aims to verify the relationship of society with nature, and its thermodynamic energy flows, as an evolutionary element, generating totalization and being analyzed by the arrow(s) of space-time. This article will also verify how this process influences the formation of the Anthropocene. In this sense, the principles born after the advent of quantum mechanics will be applied to the spatial-temporal analysis of physis (which integrates society-nature). The article also verifies how each formcontent, in a unique way, contributes energetically to the development of its arrow of space-time. Thus, it will also be verified, as, the current production process, is associated, in general, with the disruption of the states of homeotase, in the energetic balance of the process of exchange between energy and matter, and as the old pattern of relative stability, which characterized the Holocene, has been replaced by disorder, which is at the basis of the emergence of the Anthropocene.**

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I. Introduction

This article, constructed from bibliographic research, has as its central objective, to debate the planetary evolution, presenting as an explanation for the understanding of its spatio-temporal evolutionary mechanism, the systemic-quantum epistemological field. The choice of this paradigm is justified because it presents logics that are associated with how the Anthropocene emerges from its self-organization. This work aims to develop the hypothesis, which is associated with this constellation of ideas. In our assumption, we think of the planet as evolutionary, from achronic thermodynamic paths, which involve the society-nature relationship in constant exchanges, explained by the application of Bertalanffy's General Systems Theory (1968).

We believe, from research published in Camargo (2021), that each form-content, from its singularity, generates a certain energetic flow, in its contribution to the maintenance of the patterns of planetary balance. We call this the arrow of space-time. Therefore, we seek, in this article, the knowledge of why the current arrow (s) of space-time presents great asymmetry, and what is the relationship of this issue with the Anthropocene. Therefore, for this reason, the text has as its "backbone", to bring to the scientific debate, the dilemma: evolution by mutability and self-organization X mechanistic cyclic repetition, that is, the dilemma existing between the classical X quantum systemic paradigms.

From the systemic-quantum field, breaking with the idea of constant loss that guides the arrow of time, the concept of the arrow of space-time, going beyond the arrow of linear time, Cartesian-Newtonian, represents a demonstration, which seeks to explain, how we can understand the achronic evolutionary process planetary. The arrow of space-time is the dialectical development of time, from the different variables that any space presents, and, for this reason, singularizes it.

The concept of the space-time arrow may demonstrate how the Holocene, which was characterized by its relative, but almost constant stability, maintained a tenuous balance with each other; and how a new geological-ecological stage has been emerging, due to our productive logic, which for different reasons, fragments from nature, not realizing how thermodynamic equilibrium is the driving element of change, because it relates to the basic exchange mechanism, existing between all systems that make up the Earth. In this sense, the conceptual paradox between classical science and quantum systems thinking is manifested in the analysis that refers to reality itself, and how research and models are created.

To achieve our goal, the text will refer to the verification of how the human being, in his short path on the planet, became a driving element of states of imbalance, associated with the genesis of new geological and ecological patterns. In this sense, this research is developed in three specific moments and that are integrated. Initially, the article will follow the steps of our ancestors, in a brief analysis, verifying the dynamics humanity - environment, thus aiming to understand how the Holocene arises; in a second stage, seeking to understand that the Holocene was characterized by an almost regular stability, it was carried out, a comparison of paradigms, aiming to explain, how classical science, easily justifies a world without major changes, and how it is lost epistemologically with the reality of our days. In this sense, a brief analysis of classical science was made, however, we believe as fundamental, to be confused with the common sense of reality. In the final stage, after bringing the reader to systemic-quantum thinking, we present how the content-forms, from their different arrows of space time, collaborate with the

Author: UERJ/Brazil. e-mail: geocamargo64@yahoo.com

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thermodynamics of the planet and thus generate the evolution in disorder that is associated with the Anthropocene.

a) Man's First Steps on Earth

The first steps of our ancestors on Earth were taken by Australopithecus. Its fossils have been found in geological strata on the African continent, from the relative scale of time. These studies have dated the emergence of these bipeds to something around 4 million years, which brings us to the Pliocene (6 M.a. to 1.6 M.a.) (ASIMOV, 1990; WAR, 1969; SALGADO-LABOURIAU, 1994). Os Australopithecus teriam surgido, em conjunto com uma série de outras mudanças ambientais, ocasião que trouxe uma nova demanda ecológica (do padrão de organização), alterando o clima, a flora e a fauna. Surge, por exemplo, na África, uma savana arborizada, bem como também, diferentes espécies evoluíram, dentre elas carnívoros e onívoros, entre os quais, os ancestrais do Homo sapiens sapiens (SCHINEIDER, 1998; SALGADO-LABOURIAU, 1994).

The first hominids spread across the African and Eurasian continent, and among the most important species, two, which preceded Homo sapiens sapiens stand out, Homo erectus, which inhabited Asia, and Homo neanderthalensis, which inhabited Europe (ASIMOV, 1990). The Homos erectus, appears around 2 million years, and this species lasted for another 1.5 million years, and it was she who would dominate the fire 500,000 years ago (ASIMOV, 1990). During the European glaciation, around 200,000, Homo sapiens neanderthalensis (Neanderthals) would emerge (ASIMOV, 1990).

Neanderthals were stronger and more robust than other known hominids, thus being better able to live through the glaciation of the Pleistocene. They would be better suited to hunting, fishing and the cold they would face in times of glaciation. Neanderthals are believed to have gone extinct 28,000 years ago, and therefore coexisted on Earth with homo sapiens sapiens durante um certo período, até a sua extinção como espécie, ainda no Pleistoceno. Ambas espécies, possuíam um ancestral em comum, o Homo heidelbergensis, que viveu de 500 mil anos, até cerca de 250.000 anos atrás, portanto, também no Pleistoceno (TRINKAUS e SHIPMAN, 1993).

There are several dates that define the emergence of the first archaeological records of Homo sapiens sapiens, this variation is between 100,000 and 30,000 years. But what is certain, is that our species emerged in the Pleistocene, during the glaciation that would last until 12,000 years ago. And, we also know that, of all the hominid species that emerged on the planet, Homo sapiens sapiens, was the only one to survive glaciation, and reach a new stage of ecological organization in the Holocene (SCHNEIDER, 1998). During the glaciation, in the Pleistocene, the retreat of the waters (it is estimated that the sea level fell between 70 and 80 meters), widened the continental shelf. That means greater will be your weather extremes, colder winters and hotter summers. Due to climatic extremes, many animals and plants began to coexist with other species, reconfiguring the perspectives that emerged in new levels of ecological organization, both of plants and animals. It is estimated, for example, that the deciduous forest of Great Britain altered its structural ensemble in each of the four glaciations of the Quaternary (SALGADO-LABOURIAU, 1994).

Salgado-Labouriau (1994), alerts us to the understanding that the transition from the Pleistocene to the Holocene did not happen quickly. In general, the determination of the boundary between two geological-ecological periods is made from the study of paleogeography, and thus, the differentiation between species, perspective of geographical location, among other processes of analysis are used facilitating the delimitation. However, although the megafauna has become extinct, the Quaternary did not present large appreciable extinctions of plants and other elements of nature, such as microorganisms, which would make this differentiation difficult for stratigraphic analysis.

What we can characterize of the Quaternary, are its different glacial periods, the last one having ended approximately 12,000 years ago, beginning the Holocene. Salgado-Labouriau (1994), also tells us, that many geologists consider the Quaternary, due to its low extinction rates, as the same being a single epoch, so the Holocene would not exist as a geological stage.

Seeking to define the emergence of the Holocene, we can say that it can be represented by some factors such as: end of the most recent glaciation, beginning of marine transgression and, the epoch that presented a great alteration of the environment, initiating a period of relative amenities (climatic-environmental) (SALGADO LABOURIAU, 1994).

The Holocene, represented, thus, a change in the macrostructure of the combination of variables of nature, issues such as sea level rise, for example, were related to the restructuring of both flora and fauna, in the sense that species seek new areas as a result of transformations, and the possible weathering through which certain areas have passed in this transition. Therefore, there is a restructuring in the sense of ecological combinations. This mechanism alters ecosystems and old patterns are restructured (SALGADO-LABOURIAU, 1994). Thus, the Holocene, due to its variation in ecological and climatic organization, also presented major changes in the whole of its organization. Thus, new deserts were formed, in addition to temperate and tropical forests (SCHNEIDER, 1990).

In this way, there was the arrival of a period of greater stability, where plants and animals did not need

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to constantly migrate in search of refuge areas, among other things, providing a new adaptability or even mutation, by evolution, of plants and animals (SALGADO-LABOURIAU, 1994).

i. *Normality and the common sense of reality*

And, despite some climatic variations found throughout this period, if we were to look for the main feature of the Holocene, this definition would be its incredible, more relative, stability of environmental patterns (VEIGA, 2019).

About 12,000 years ago, this more stable state favored the domestication of animals and, later, 8,000 years ago, the same state of relative equilibrium provided the cultivation of plants, initiating agriculture (ASIMOV, 1990).

It happens that, among different other factors, agriculture, made its production much more vulnerable to theft and looting of other tribes, thus leading to the search for the formation of cities for protection, from places, where the farmer could take refuge and, if necessary, store water to war. This process, associated with other different factors, such as Mesopotamia being formed by two rivers, and by having volcanic soils, favored agricultural practice, and started civilization with the emergence of the city of your, around the Tigris and Euphrates rivers (ASIMOV, 1990).

Thus, the Holocene, and its relative stability, made possible an entirely different society from the nomads in their glaciation in the Pleistocene. Over different centuries, this stability was still confused with beliefs linked to the extra-physical universe. However, with the technical-scientific revolution of the sixteenth and seventeenth centuries, science began to create a new paradigm about reality, based on the machine-like universe. The hegemony, achieved by the mechanistic model, made it possible for his reading of the planet and its phisys, to integrate into the old state of climatic-ecological stability that was lived. Living on a planet, in which the guarantee of its predictability in a scientific way, would provide the control of nature (without needing divine help), represented the human control over nature.

The technical-scientific revolution of the sixteenth and seventeenth centuries, which emerged from the Copernican Revolution, would have in Newton (1643-1727), the consecration of a model of planet that lasted for centuries, guaranteeing in common sense the idea of a machine universe, with relative balance and easy understanding of what will occur in the future (CAMARGO, 2012).

This logic reproduces, in the common sense of reality of physis, the rules inherent in classical science. For, we think of nature as formed of different parts of a gear (BHOM, 1980). In this metaphor of reality, the planet would be formed of immovable pieces, being three-dimensional, similar to a machine, which has no external influence. Its gear, in structural behavior, consists of different integrated parts, and develops its movement in a synchronic and linear way. In this machine, as no external force acts, its movement, if its current position is known, makes its future easily known (NEWTON, 1987).

The classical method floods our sense of reality with processes that are no longer scientifically based. For example, by fragmenting and isolating an element for its analysis, one loses the essence of connectivity, which is governed and dialectically governs the rule itself. Society, by fragmenting space of time, loses the possibility of analytically understanding change, because it occurs in space and is found in the relativity of time of each place.

As the Baconian Cartesian-Newtonian universe fragments time from space, analyses based on its paradigm will follow its rules, limited to the repetitive and cyclical machine universe, where, for this very reason, talking about creative evolution is the same as inventing something impossible to happen. For, as time separates from space, it (space) does not evolve, does not undergo mutabilities with time (CAMARGO, 2005).

This dynamic, stable and that everyone still expects, is what common sense calls normality, that is, a time when environmental systems were in relative stability, ensuring that the great natural phenomena did not harm people's lives, as it has been harming.

We call normality, that which is associated with the planet we want, not that we have... And what we seek as a planet is nothing different from what is usually learned in school with Newtonian physics.

The mechanical model of the universe, which is associated with the idea of Laplacian Newtonian certainty, gave mechanistic predictability something that is undone from Heisenberg (1901 —1976) and Schroedinger (1887 —1961). Uncertainty, verified under scientific judgment, came to be seen as a real element, and thus, new interpretive and empirically explained possibilities emerged.

Thus, the reading of a new planet is opened, which can rebuild and evolve, because it no longer has the totality, as a simple sum of all its internal parts. Uncertainty, when referred to totality, in turn, can only be seen, as the whole, always being superior to the internal sum of its parts (where in truth there are no parts at all, only links of interconnectivity). Therefore, by being creative, in the emergence of unpredictability and uncertainty, the whole reinvents itself and evolves. Thus, the path to understand the analysis of the reality of space-time and its applicability is broadened, in the sense of understanding the events of nature in relation to society (CAMARGO, 2005).

Being evolutionary, by self-organization of its variables, the planet, demonstrates its creativity, which becomes reality, totally making impossible the analysis

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made by the classical paradigm. This article, dedicated to the understanding of this evolutionary mechanism, involves how the spatio-temporal syntropy of the society-nature relationship relates to the development of the Anthropocene.

Our current search for the meaning of the "normal" is nothing more than the metaphorical representation of reality, presented by the Scientific Revolution, which occurred in the sixteenth and seventeenth centuries, under the "baton" of thinkers such as Copernicus, Bacon, Descartes, Galilei Galileo, Kepler, Titus Brache and Newton.

Living in a world in relative balance, following a daily logic appropriate to a controlled planet, would be wonderful, this would be what is expected, of what people call normal, however, stability does not seem to be the characteristic presented by the planet in our days.

b) Planet Earth and the integrated society-nature dynamics

In the nineteenth century, the philosophy of nature in Schelling (1775-1854), and the work of Humboldt (1769-1859), already demonstrated the perspective of the perception of the most energetic look at the man-nature relationship, where Descartes' conception of machine nature ends up not being dominant (CAPEL, 1981).

Schelling (2015), in his first project of a system of philosophy of nature, which sought to understand the relationship between man and his environment, demonstrated a clear departure from the existing reductionism. Schelling (2015) thought of nature, where there was evolution of matter, he conceived the chemical and biological connection, seeking, for example, the existing interconnectivity between biochemical phenomena and neurological functioning that influences the way of feeling and thinking. Schelling (2015) enabled the non-linear vision of the future, by understanding that there is a meeting of the natural spheres, and that this brought the very idea of evolution, in a world dominated by the machine universe. And just as William Blake (1757-1827) demonstrated the dehumanization existing in the work of Newton (1643-1727), Romanticism also positioned itself, showed that there was something that went beyond the mechanistic universe.

His theory for nature was a (re)encounter that dialectically involved magnetism, electricity, sound, light, heat, and chemical processes. Pure syntropy. Humboldt, influenced by Schelling, also suggested a logic of understanding wholeness that involved elements of nature, and of human society.

Just as Morin (1977), who fosters a critique of the General Systems Theory, verifying that it needs to be inserted in a broader context of "organization with emergent properties", Dutra-Gomes and Vitte (2017) provide this creative perspective to it, thus dimensioning the movement of integration into the natural spheres, generating the emergence of new patterns. This, was what was missing to complete what was in the genesis of this integration sought by Romanticism.

This integration guides what the planet is. The Earth, is a macro system consisting of different subsystems governed by their interactions (SILVA, 2008). This dynamic characteristic is linked to the interdependence of the parts, which form the whole of the planet, and which have a direct or tenuous connection, being impossible to understand any isolated aspect without reference to its function as part of a larger set (CAPRA and STAND-RAST, 1991).

In this dynamic, each subsystem, in a unique way, has different scales of space-time, and act by exchanging energy and matter with each other. In this mechanism, involving the entire planet at different scales, the natural spheres (hydrosphere, lithosphere, cryosphere, atmosphere and biosphere), act in interaction with the technosphere, which suggests a dynamic that is in the genesis of the movement, breaking with the three-dimensional Cartesian-Newtonian idea. Thus, the processes are referred to as a fourth dimension of space-time and that is linked to the possibility of change, which can be understood by the General Systems Theory (CAMARGO, 2012 and 2021).

And this is because interconceivability is general, and scales achronic flows, which reproduce the Copenhagen Interpretation. The mental design of this structure is the four-dimensional drawing of the totality in totalization, from its processes, actions and the movement of flow. With each increase in complexity, emergent relationships occur, from one or more syntropic processes, that lead the whole to evolve.

In this sense, the research believes that, has intensified the changes in the flows of energy and matter in excess on the planet. We know that nowadays, human activities have reached a level that, according to Veiga (2019), can damage the systems that keep the Earth in the desirable holocene state. In Safe Operating Space for humanity, the 29 authors added that since 2009 there was already a lot of evidence that some of the Earth's "subsystems" were moving out of their stable Holocene patterns, and thus verified, that the Earth System could not be operating in stable conditions like those of the Holocene (VEIGA, 2019).

To better understand this evolutionary dynamics, driven by the constant exchanges of energy and matter, which is energized throughout the planet Earth, it is necessary to understand the basic principles of Thermodynamics, expressed in the arrow of space-time. The essence of the society-nature relationship can thus be demonstrated, bearing in mind that the exchange relationship between human beings on the surrounding environment, in general, transmits a high degree of external energy input into natural systems,

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thus causing a local imbalance and discontinuous and often unpredictable feedbacks.

The asymmetric arrows of space-time as a tool of analysis Verifying the discontinuity of planetary systems, different scientists seek a stewardship of the Earth System, compatible with the desired habitable stability. However, perhaps, because they still "drink" too much of the classical influence, the models have difficulty understanding the society-nature coevolution, issues such as uncertainty, so common in our days, for example, do not have mechanisms for their scope (VEIGA, 2019).

Seeking a reading of the planetary evolutionary process, from a systemic-quantum epistemological view, Camargo (2021), effectuates the term arrow of space time to redefine the meaning, linear and fragmented, that was associated with the arrow of time.

Essentially, the arrow of time did not verify the discontinuity and achronic disharmony that surrounds all systems on the planet. For her, past, present and future are sequences, but tomorrow is the fruit of the complexity of today, so it cannot be repetitive and monotonous. However, when we list space as a fundamental element for the understanding of time, we find that the flow of time cannot be linear and predictable, considering the variables that differentiate and singularize space.

In seeking to prove the existence of the arrow of space-time, Camargo (2021) verifying that agriculture, being the art of disturbing the balance of nature in a safer way for human benefit (Wigglesworth) (DREW, 2002), presents how the human being directly interferes in the planetary balance, deliberately causing thermodynamic imbalances.

Thus, it proposes a comparison between an agricultural area, which uses a high degree of the use of pesticides, tractors, artificial irrigation, among other elements, in contrast to ecological agriculture. Camargo (2021), demonstrates that due to the high degree of external energy input in the areas of non-ecological agriculture, it ends up generating systemic imbalance in the spheres that surround it, and in some cases, these mechanisms provoke unpredictable responses, which arise at random, and may create new irreversible patterns.

That is, soils that have non-ecological management, in contrast to ecological soils, due to their technical and spatial organizational apparatus, measure greater energy exchanges with natural spheres, thus bringing greater instabilities, and often causing irreversible processes to the systemic set. In turn, ecological agricultural systems size structures closer to natural systems, causing little change in the dynamics that involve natural spheres in their processes.

According to Drew (2002, p. 146):

> The effects of agriculture on the environment relate directly to the scale at which it is undertaken. There are two aspects to consider: the intensity and degree of alteration caused in the soil and in the pre-existing vegetation; and the area where the change took place.

Therefore, it is a spatio-temporal question of easy understanding. The natural cycles of energy and mass function to some extent as closed systems, as nutrients are retained within the soil-vegetation system. Here the equilibrium is maintained unchanged, however, as agriculture deliberately transforms this dynamic, with the intention of manipulating certain aspects to obtain the maximum yield and foodstuffs, a large external energy input is then generated in the system, creating a lot of entropy in the agricultural processes. Therefore, Drew (2002) states that one of the traits of modern and intensive agriculture is the very high deformation of natural energy currents and the application of external energy to the earth.

The essence of this mechanism is in, when they import and export energy, linked to the process of agricultural production, energy development is achieved and, often, change in its cyclical characteristic that caused the energy that was sent to a subsystem, to return without high entropy rates (LORENTZ, 1996).

Therefore, when we compare both agricultural models, we will find different arrows of space-time, and in the form-content, linked to the agricultural areas of high yield, the arrow ends up presenting constant asymmetries.

According to Prigogine (2008), close to equilibrium, linear dynamics is possible, is the case of ecological agriculture, in which the cycles occur closer to that of semi-closed systems, with low loss rates, or low entropy, therefore, remaining relatively permanent. However, when the system receives a high degree of external energy, a non-linearity occurs, where new patterns emerge, new behaviors that would be impossible near equilibrium. Nonlinearity can thus describe new irreversible realities, generating within the system a differentiation from its outer universe. Far from equilibrium, matter acquires new properties, that is, from different probabilities of responses, caused by an energetic stress, the system can acquire a new irreversible pattern (PRIGOGINE, 2008).

The rule is: If an isolated system in equilibrium is disturbed, in the negative feedback, it returns successively to equilibrium and can control future operations in the system; however, in dynamical systems perturbations, linked to positive feedback, lead to the emergence of new possibilities, and, new levels of organization can be created, which give rise to new irreversible structures. An example, on a given scale, is the development of a ravine (PRIGOGINE and STENGERLS, 1984; Christofoletti, 1999).

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Thus, due to its spatial productive process, an open system can actively tend towards a state of higher organization. A feedback mechanism can reactively reach a state of higher organization, due to learning (positive feedback), that is, the information introduced into the system, coming from another subsystem, leading it to modify and evolve together with the new pattern that has been formed.

The arrow of space-time is thus associated with how the content forms develop, because depending on it, its asymmetry will be something common, and often exponential, collaborating to the constant imbalances that mark the Anthropocene.

c) Anthropocene: an evolutionary nonlinear response

In this section, we seek to demonstrate that the Anthropocene is linked to the emergence of chance by self-organization and increased complexity. Thus, we verified the proximity of our hypotheses with the studies developed linked to Earth Systems Science (ESS).

Defining the Anthropocene is still something very controversial, some consider it from the second world war, others from the Industrial Revolution, others from when man began to cultivate, and therefore ceased to be sedentary.

Thus, in this phase of our research, we will try to demonstrate that the Anthropocene is the result of the movement of exchanges of energy and matter with its means, this being a process and not an end, bearing in mind that the same has been forming over time, where new space-time dimensions, relative to the technical-technological environment of humanity, has been constantly intensifying planetary thermodynamic exchanges.

Therefore, and still seeking to understand the Anthropocene, we verified that this movement, if seen from the process of totalization of each form-content, due to its uniqueness, also demonstrates that it has its flows of exchanges between energy and matter relative to the very specificity of each place and, Therefore, each form-content will have its own thermodynamic characteristic, thus contributing, in a unique way, to the generation of the evolutionary totalization of society-planetary nature.

This means that there is a spatio-temporal evolutionary contribution proper to each form-content. There is the contribution of the areas of agribusiness, in a high degree of energy stress, and also of the areas of low spatio-temporal content of exchanges, where natural systems suffer little or almost no external energy input, such as ecological agriculture. Each one thus possesses a totalization relative to its space (its space-time).

This totalization, whether of the place or the planetary, can be understood from the application of the General Theory of Systems (BERTALANFFY, 1968), and can be visualized, for example, in a similar way to that explained by the Copenhagen experience, because each place collaborates in a unique spatio-temporal way with the totality in its totalization process.

Thus, the totality is here constituted of the society-nature integration, from the syntropy of the natural spheres (hydrosphere, lithosphere, atmosphere, biosphere and cryosphere) with the technological sphere (technosphere), which generates its totalization process. This process, interpreted by the principles of Prigoginian thermodynamics, believes that, depending on the degree of energetic stress that is involved in events that become dynamic, old patterns of natural organization (in any of the spheres) can be broken, generating the appearance of a new level of complexity at random, unexpectedly, reproducing the experience of Schroedinger's cat, explaining, too, the great state of disorder that "populates" the Anthropocene.

d) The Anthropocene

The beginning of the debate about the emergence of the Anthropocene occurred in the year 2000, when the Nobel Prize in chemistry Paul Crutzen, popularized the term Anthropocene that had been believed by Eugene Stoemer in 1980. For Crutzen, this new era had emerged from the analysis of air trapped in polar ice, which had a large concentration of CO2 and NH4. These analyses portray the accumulation of these gases, which coincided with the emergence of the steam engine created by James Watt in 1784, and which started the industrial revolution (MENDES, 2020). Therefore, many authors such as Pellogia (2015), relate this time to the beginning of this new geological-ecological era.

In defense of the emergence of the Anthropocene, from the industrial revolution, for Crutzen the pre-industrial societies did not alter in great magnitude the ecosystems nor did their economic and social productive forces alter nature so much (PAULA and MELLO, 2019).

In relation to the Industrial Revolution, we can warn that in the following three centuries the global population increased tenfold reaching six billion. The cattle population has risen to 1.4 million, producing methane gas and about 30 to 50 percent of the planet's surface today is exploited. As well as also, energy use has grown 10 times in the last century, causing 160 million tons of CO2 emission (MENDES, 2020).

To what was put in the previous paragraph, different issues could be raised, therefore, taking into account the constant network exchanges that exist on the planet, when we apply to these data the syntropic logic of the society-nature relationship, we will verify that new and greater energetic exchanges have arisen throughout the planet.

If we empirically verify climate change, and part of the processes that have been resizing old environmental realities, we will observe patterns that are

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part of a new set of properties, which represent the Anthropocene.

For this reason, and escaping from Cartesian fragmentation, the Anthropocene is energized in a non-structuralist way, but in an evolutionary way involving all spheres of the Earth, including, as Capra and Standl-Rast (1991, p. 11) teach, because there are no parts at all, only "patterns in an inseparable web of relations".

Another characteristic of the new geological-ecological era, and that goes beyond greenhouse gas emissions, is associated with some authors who, to define the Anthropocene, bring the idea of technofossils, resulting from the unprecedented combination of plastics, fibers, metals, concrete and pesticides, among other elements that are presented in the stratigraphy of the planet. For these authors, this characteristic is a direct result of the rapid growth of humanity in number and exploitation of natural resources and that has over the last three centuries grown exponentially (NASCIMENTO, 2020).

As an example, Cerreata et.al. (2019) state that the Anthropocene differs from other epochs because it is a chronostratigraphic unit, and that it is contained completely within human history. The elements generated by humanity have the potential to persist in the long term in the stratigraphic layers, resulting in a robust range of evidence from this geological-ecological period, delimited from the eighteenth century.

In its less structuralist reading, and corroborating our hypotheses, according to Vianna (2019), the new geomorphological landscapes would also be a characteristic of the Anthropocene, because human interference has expanded the surface processes of the relief, greatly increasing the rates of sediment transport, also unbalancing the flow of matter and energy between the continents and altering the surface water resources.

For Vianna (2019, p. 358), different anthropogenic evidences about the relief and stratigraphic layer are also related to various human activities. "Parameters include lake sediments, greenhouse gas concentrations, artificial isotopes produced by nuclear weapon detonations," among others.

For this author (2019, p.356), who relates the expansion of greenhouse gases on the planet with the new geological-ecological epoch, the main characteristics of the Anthropocene would be: "1) appearance and increase of anthropogenic deposits; 2) change in biota volume; 3) geochemical change in sediments; 4) climate change; and 5) catastrophic events."

Human influence on the environment has caused dramatic transformations due to the acceleration of our actions. This generated a series of spatio-temporal discontinuities, which led to the suggestion of the arrival of a new geological-ecological era. In this sense, corroborating our hypothesis, humanity would represent a driving force responsible for the exit of the Holocene and its arrival at the Anthropocene (FIGUEIREDO, et.al., 2020).

It is true that exponential economic growth, which links the development of modern science to Baconian logic and humus economicus, has increasingly made nature a hostage object of its valuation and exploitation. The dynamics of systemic exchanges, which involve the entire planet, ends up raising increasingly intense and achronic reformulations in space-time. They are always linked to much broader biogeophysicochemical processes than the dominant economic system can explain. Syntropy, born of the society-nature relationship, generated a new "natural" evolutionary systemic dynamic, filled with the artificial that became naturalized and that is the question.

The transition from the Holocene to the Anthropocene represents a radical discontinuity in natural flows, and demonstrates the planet's departure from expected behavior. Cearreta et.al. (2019), also believe that, from the Anthropocene, human action generated irreversible changes on the planet, changing the dynamics of the environment, where its consequences will be perceived for many centuries ahead (MENDES, 2020a).

The new era has, as well as a characteristic, the mark left by humanity on the earth's surface, making it humanized. Therefore, the transformations generated in natural systems, by creating non-existent patterns, also bring new species, structures, processes and natural forms that are installed and evolve, establishing new dynamics of varying proportions and scales (PONTE & SZLAFSZTEIN, 2019).

Affirming this perspective of innovation, generated from human action, Nascimento (2020), referring to the Anthropocene, presents the Covid-19 pandemic as a didactic element, which demonstrates the interdependence of humanity with nature; Drew (2002), states that deforestation is responsible for the emergence of new viruses; Letcher (2021), in turn, links the rise in global temperature to the emergence of Covid-19.

Therefore, our research approaches the planetary systemic view or Earth Systems Science (ESS). This vision involves the natural spheres, associated with the dynamics of the so-called technosphere (MENDES, 2020a).

We thus corroborate the concepts linked to the SSE. The ESS is based on the concept that the planet is a large system interconnected between physical, chemical and biological processes, maintaining complicated relationships that involve feedbacks, with transfer and transformations of matter and energy. Therefore, the transition from the Holocene to the Anthropocene represents a radical discontinuity in natural flows, going beyond linear causality. The

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technosphere today, for the SSE is hybrid, that is, it has syntropy dialectically integrating society and nature (MENDES, 2020a).

II. Final Considerations

We live in an environmental panopticon, fed by classical science so intensely that it is already part of a dangerous common sense of reality. Dangerous, because it is necessary to develop research escaping, both from the static sense of space, and in planning from the reading of a linear time. To think of nature as a repetitive and easily controlled element in the twenty-first century is fearful in the face of the necessary dialectical analysis of reality.

Our research found that the Holocene presented a relative stability, linked to little productive energy demand, however, from the last century, probably as a result of the interconnectivity of humanity with nature, increasingly the natural environment presented unpredictable and achronic phenomena, where chance is made, every day, more present in our lives.

The Anthropocene is itself this new reality, which has its genesis, a web of interconnectedness, which goes far beyond global warming and climate change. Being part of the totality, the atmosphere participates dialectically in all mechanisms of exchange, where the energetic demands happen, involving all spheres.

Ayoade (1986) defines climate as the usual succession of weather types and, therefore, the type of weather, is directly associated with different geographical factors, either in macro scale (Latitude, altitude, continentality, maritimity) or in the local scale. Therefore, the climate, being a component of the atmosphere, participates dialectically, along with the other spheres, in the mechanisms brought by the local influence of the technosphere. Where each place, through its arrow of space-time, effectively participates in the general processes of the planet.

Global changes are the result of a dynamic of complex human actions, involving all natural spheres, where the technosphere is a driving and dissipating element, thus generating flows of energy and matter, which have become naturalized, and which are part of our spatio-temporal evolutionary mechanism. Therefore, change is not only climatic, it is dialectically of totality.

In this sense, it is not only necessary to review the production process, adopting sustainable energies and technologies, but, however, to embrace a new scientific and conceptual perspective, which understands the planet as it really is, that is, a continuous spatio-temporal evolutionary mechanism, which self-organizes, determining its future often in an unpredictable way.

Recently, different patterns have been broken, not only climate changes, but ecosystems and water behaviors, have also undergone changes. These changes, even if hierarchical and fragmented, by the common sense of reality, demonstrate the joint evolution, and that has no end, where with each imbalance, a new order of (re)balance manifests itself spontaneously, evolving as a spiral of space-time, developing increasingly asymmetrical arrows.

This new planetary epoch, where disorder, and the generation of new patterns, is more present than in the Holocene, and which already presents empirical data of its existence, we call the Anthropocene.

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Densification vs Environmental Sustainability: A Study of the Residential Areas of Dhaka

By Syeda Jafrina Nancy & Roxana Hafiz
Military Institute of Science and Technology (MIST)

Abstract- The fast-evolving scenario of the global economy of the past few decades has contributed to the transformation of cities into prime economic hubs providing sustenance for the growing urban populace. In keeping pace with economic development and subsequent demand for shelter, cities are densifying through vertical expansion to avoid urban sprawl. Given the rapid urbanization along with the scarcity of developable urban land, open spaces have become a highly contested commodity, particularly in the residential of the Dhaka megacity. Driven by the profit-maximizing agenda of the developers the ongoing process of residential densification is exacerbating the situation. Urban densification of Dhaka is faced with the challenge in keeping the residential areas sustainable and environmentally friendly. This study attempts to investigate the impact of the densification process on the spatial quality of the residential built environment of Dhaka through the lens of environmental sustainability. The explorative research was conducted through a questionnaire survey, informal interviews, and field survey across seven residential areas of Dhaka undergoing the densification process.

Keywords: environmental sustainability, urban densification, open spaces, dhaka megacity, spatial quality.

GJHSS-B Classification: LCC: HT241



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Densification vs Environmental Sustainability: A Study of the Residential Areas of Dhaka

Syeda Jafrina Nancy [α] & Roxana Hafiz [σ]

Abstract- The fast-evolving scenario of the global economy of the past few decades has contributed to the transformation of cities into prime economic hubs providing sustenance for the growing urban populace. In keeping pace with economic development and subsequent demand for shelter, cities are densifying through vertical expansion to avoid urban sprawl. Given the rapid urbanization along with the scarcity of developable urban land, open spaces have become a highly contested commodity, particularly in the residential of the Dhaka megacity. Driven by the profit-maximizing agenda of the developers the ongoing process of residential densification is exacerbating the situation. Urban densification of Dhaka is faced with the challenge in keeping the residential areas sustainable and environmentally friendly. This study attempts to investigate the impact of the densification process on the spatial quality of the residential built environment of Dhaka through the lens of environmental sustainability. The explorative research was conducted through a questionnaire survey, informal interviews, and field survey across seven residential areas of Dhaka undergoing the densification process. The primary data collected from the survey were categorized under four selected environmental aspects. Data collected through the questionnaire survey was analyzed with SPSS and Microsoft Excel. In the second phase, a correlation test was run to investigate the relationship between environmental sustainability and density. The findings revealed that the residential areas under densification intervention are facing an acute shortage of adequate accessible open spaces and the built environment is deprived of solar access, acoustic and visual privacy. But despite these shortcomings the overall livability was reported to be satisfactory from the resident perspective, which indicates a lack of awareness of the inhabitants about the long term environmental and health implications from living under such conditions.

Keywords: environmental sustainability, urban densification, open spaces, dhaka megacity, spatial quality.

I. Introduction

Dhaka, the capital city of Bangladesh witnessed a rapid population growth in the post-independence period mostly due to the high rate of rural migration. Since then, the continuing steady growth of population has contributed to making Dhaka one of the most densely populated cities of the world in the following decades. According to the report of World Population Review 2022, Dhaka ranked the sixth most populous city of the world with a density of 23,234 people per square kilometer within a total area of 300 square kilometers. Given the limited land resource, urban densification was adopted as a key solution to face the challenge of habitat crisis for the growing population of Dhaka. Over the past decades, urban residential areas have undergone densification through vertical and to a lesser extent horizontal expansion claiming most of the vacant land of the city. The reservation of open space for the provision of green infrastructure is severely ignored in the development process due to the vague planning guidelines, lack of public awareness, and the vested interest of the landowners and property developers for profit maximization. UNEP recommends that cities should dedicate at least 25% of their total area to green spaces to promote healthy living. According to the Dhaka Metropolitan Development Plan (DMDP 1995), Dhaka comprises of 17% open space of which Old Dhaka has only 5% and New Dhaka has 12% respectively. A study by Dewan and Yamaguchi (2009) indicated the alarming decline in urban green space of Dhaka city where vegetation coverage decreased from 15% in 1975 to 9.6% in 2003. The green spaces further reduced from 19.97% in 1989 to 8.53% in 2009 (Ahmed et al., 2013). The increase in the built up areas accounted for a substantial loss in green space (around 20%) from 1975 to 2005 (Byomkesh et al., 2012). Green open space is broadly defined as any "green space", "public open space", or "park" in an urban setting. Despite the subtle qualitative differences between these terminologies, the terms have been used synonymously for the purpose of this study. Numerous studies have shown that green space is associated with a large number of environmental, social and health benefits. Integration of urban green space with the built environment has proven to boost up the physical and mental health of the city residents by facilitating physical exercise and reduce stress respectively by providing a respite from the claustrophobia and crowdedness of the city (Macintyre et al., 2008; Mytonn et al., 2012; Haq, 2011). In addition to the recreational facilities, open spaces also help to create a sense of community in a city by providing social spaces where people can gather and interact with others (Lo et al., 2010; Seaman et al., 2010). From the perspective of environmental benefits green space counteracts the urban heat island effect, reduces energy cost of cooling buildings, minimizes air, water, and noise pollution (Haq, 2011; Strohbach, et al., 2012). To ensure healthy living the World Health

Author α: Military Institute of Science and Technology (MIST), Dhaka, Bangladesh. e-mail: nancy1976bd@yahoo.com

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Organization (WHO) has set the minimum standard of 9 sq. meter green space per city dweller whereas Dhaka offers less than 0.5 square meter per person (DMDP 1995). Consequently, city dwellers are deprived of the physical and mental health benefits accrued from reconnecting with nature through the inclusion of an array of diversified urban open spaces in terms of their scale and function. This compromising situation has put the environmental sustainability of the residential areas of Dhaka under question. However, to understand the impact of densification from the residents' perspective, the way urban density is conceptualized needs to be clarified. The concept of 'density' in urban planning can be defined through its physical and psychological dimensions denoted by the terms "physical density" and "perceived density" respectively. Physical density is a numerical measure of the concentration of individuals or physical structures within a given geographical unit (Cheng, 2009). On the other hand, perceived density is the subjective measurement of density identified by the residents' perception of their neighborhood in terms of space between buildings. In this study the physical density is measured by the parameter of ward-wise 'gross residential density' as the 'net residential density' data of study areas were not readily available while two parameters i.e., 'perceived neighbourhood density' and 'perceived density within the dwelling' were selected to study the notion of perceived density. This paper attempts to investigate the impact on the environmental sustainability of the residential neighborhoods undergoing the densification operation and further examines the relationship between the parameters of density (physical and perceived) and various environmental aspects of sustainability.

II. Methodology

The study is explorative research. For conducting the study residential areas with varied densities across seven locations in Dhaka were selected. Among these study areas, two (Luxmi Bazar and Wari) are from Old Dhaka the rest of the five are from New Dhaka (Dhanmondi, Banani, Gulshan, Mirpur, and Uttara).

The study areas were selected based on their location, density, layout pattern and age of the settlements. Wari and Luxmi Bazaar are the oldest settlements with medium and high gross population density respectively and are situated in the Old city core. Dhanmondi, Banani and Gulshan are relatively newer settlements and are in the central part while Pallabi and Uttara were more recent developments and lie along the remote part of the city. Dhanmondi, Banani and Gulshan are characterized by low gross population density while the density of Pallabi is regarded medium (DAP 2010). The older residential area like Luxmi Bazaar has an organic road network pattern while the newer settlements have grid iron pattern (Dhanmondi, Banani, Gulshan and Uttara). However, Pallabi has a mixed type of road network system. Based on their location and density these sample study areas provide a virtual slice through the city and therefore are representative of the city's overall trend of densification. Primary data was collected through a random sampling household questionnaire survey, informal interviews, and extensive field survey. The questionnaire was structured to gain an insight into the residents' perception regarding the prevailing density and the selected environmental aspects which were corroborated by responses from the informal qualitative interviews with the residents. A total of 1623 responses out of a sample size of 1842 households were gathered. The questionnaire survey was conducted from March 2015 to May 2015. An extensive field survey was undertaken to gather spatial information regarding the quality, typology, and usage of the neighbourhood open spaces and the built environment. Secondary data was obtained from various published literature and relevant government records (density profiles, plans of the study areas, planning documents) were collected from municipal regulatory bodies (RAJUK, PWD, Dhaka North, and South City Corporations). The analysis was done in two phases. Firstly, the primary data collected related to the four selected environmental aspects namely, access to open space, sense of acoustic and visual privacy, access to daylight, and overall living condition of the built environment were analyzed using SPSS and Microsoft Excel and presented in the form of tables and charts. Secondly, to assess the impact of density (physical and perceived) on environmental sustainability, a Pearson's correlation analysis was carried out in the second phase. Due to the lack of ready data, the Gross population density of study areas has been selected for assessing the physical density attributes. Perceived density is evaluated through two parameters: perception of neighborhood density and perception of dwelling density. Findings are then interpreted and discussed in light of theoretical literature on tensions between densification and environmental sustainability to provide an insight into the consequences of the ongoing densification operation in the residential areas of Dhaka that might assist in the formulation of a site and context-appropriate density standards and effective densification policies for future development.

III. Aspects of Environmental Sustainability

The environmental sustainability of the study areas is studied in terms of four aspects: accessibility to open space, access to daylight, environmental protection, and satisfaction with the livability condition which are discussed in the following:

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a) Accessibility to open space

According to Gallion (1963) neighborhood open spaces function as outdoor living rooms offering various recreational facilities as well as breathing space for people where they can take a break free from the monotony of urban life and relax. Cities can have a wide variety of open spaces such as parks, plazas, squares, playgrounds, botanical gardens, zoological gardens, and green belts that provide passive as well as active recreational facilities. Urban open spaces should be accessible to the public and remain open for at least 16 hours a day, and 7 days a week. Dhaka in general has a lack of open spaces where people can retreat and socialize. The standard suggested for Dhaka city in Dhaka Metropolitan Development Plan (DMDP 1995), is an average of at least 0.052 square meters for parks and 0.5 square meters for open green spaces per person. The recommendations of the World Health Organisation (WHO) and Leadership in Energy Environmental are 9 and 20 square meters receptively for neighborhood design. In comparison with the global practice, the standards recommended in DMDP for open space are far below the practiced standards of any megacity.





Fig. 1: Dhanmondi lakeside park *Fig. 2:* Residents exercising in outdoor open space, Dhanmondi

Table 1: Types of open space available in the neighborhood

Types of open space available in the neighborhood					
Location	For Sitting	Social interaction	Park	Playground	Other Open Spaces
Wari	-	-	-	-	v
Luxmi Bazaar	-	-	-	-	v
Dhanmondi	v	-	-	v	v
Banani	-	-	v	v	v
Gulshan	v	-	v	-	v
Pallabi	-	-	-	v	-
Uttara	v	-	v	v	v

Source: Field Survey, 2015

Healthy leisure activities in open spaces keep youngsters engaged and prevent them from getting derailed. "The 1950s were marked by a major campaign against juvenile delinquency, and advocates of recreational open space often claimed that access to nature would help to ensure the healthy social development of children" (Rome, 1998). According to DMDP, 650 sq. m. of park or open space should be provided for 1000 people (DMDP, 1997b; pp – 14). The Urban Area Plan of DMDP recommends a general space requirement of 4 acres/25000 persons for parks while no space standards have been suggested for other typologies of open spaces. The open spaces available in the study areas are mostly parks and playgrounds (Table 1). Pallabi has only two playgrounds and no parks for the community. Access to these playgrounds is restricted and generally used for tournaments and practice grounds of various sports clubs. The playgrounds are also occasionally rented for organizing various musical concerts. Field survey revealed that the dense residential areas of old Dhaka (Luxmi Bazaar and Wari) have no open spaces at all. The only parks available in Wari and Luxmi Bazaar are Baldah Garden and Bahadur Shah Park respectively which are part of the national heritage with controlled access and are visited by the residents occasionally. Therefore, they cannot meet the demand for neighborhood open spaces in terms of scale and number. Earlier the absence of public open spaces in the planned residential area of Wari was not felt because according to the original master plan of the area, the plot sizes of each house were quite large leaving ample space within the perimeter serving as an outdoor play area for children. But later with the subsequent subdivisions of the plots, these domestic open spaces ceased to exist. In addition, the old houses of Luxmi Bazar and Wari were low-rise structures with introverted courtyards serving as open spaces for the

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residents. This could be one of the reasons for not considering the inclusion of community open spaces in the initial plan of these older settlements. The types of open spaces found at Dhanmondi, Gulshan, Banani, and Uttara are a couple of parks, playgrounds, and lakeside development. But except for Dhanmondi, the major portion of the lakeside of Gulshan, Banani, and Uttara are not properly designed for public use, therefore remain unutilized. The serpentine lakeside park of Dhanmondi was developed for the inhabitants but now many access points of the lakeside have been closed to keep the drug addicts and vendors at bay.



Figure 3: Rickshaw stand inside the park, Banani



Figure 4: Gulshan park maintained but lacks visual appeal.

Being under the illegal control of various sports clubs, the existing playgrounds remain inaccessible to the general public most of the time. The 5 parks in Uttara serve only a small portion of the residents who reside within the perimeter of 500 meters to 1 kilometer around these places. In the initial master plan of Uttara 47% of the land area was designated for civic and open spaces but to accommodate more area for residential use open spaces were compromised. The primary threat to the existing public open spaces is their encroachment by public and private enterprises. The example of this practice is evident in the case of Uttara Sector 1 park which had been sold out to private developers by the authority (Nilufar, 2001). Moreover, illegal encroachment of the lakeside and canals continues in form of claiming the land by building tin-shaded mosques and other semi-permanent structures in the newly developing sectors of Uttara. The parks and playgrounds that can be reached by walking and do not require any vehicular road crossing were found to be preferred by the residents. While residents residing beyond the 1/4-mile radius of a park do not frequent these places and usually use rickshaws or cars to get there which takes about 10-20 minutes depending on the traffic situation (Chart 1). However, it takes around 11-20 minutes to reach the nearest park and playground in most of the study areas as the survey findings indicate.



Figure 5: Lakeside sitting arrangement, Dhanmondi

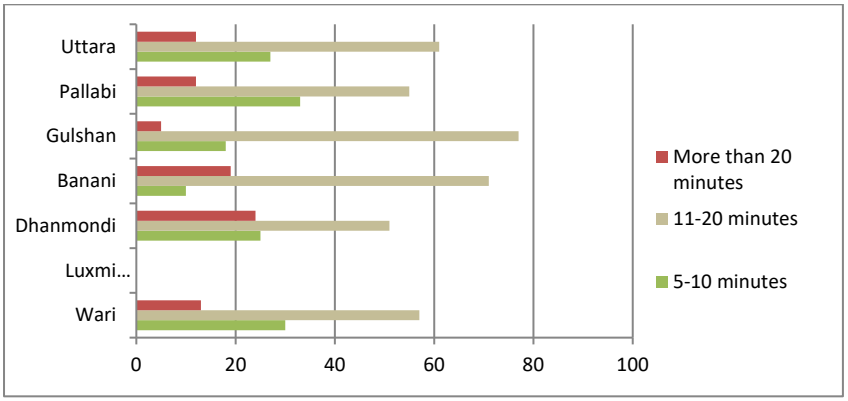


Figure 6: Properly maintained park, Uttara

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Chart 1: Required time to reach the nearby park or playground (residents' responses)

(Percentage)



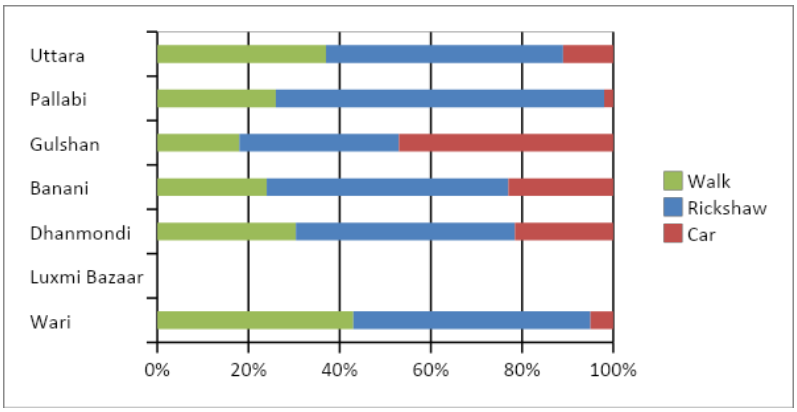
The percentage is based on the number of responses.

Source: Field Survey, 2015

In Uttara, due to improper maintenance and uncleanliness, it is found that in some areas residents avoid going to their designated sector park and prefer to go to the next nearest neighborhood park. If the park is beyond walking distance, residents usually take rickshaws, and the travel time depends on the route they take. These open spaces are mainly used by teenagers, middle-aged male and female residents, and children. Most of the parks lack adequate lighting, park furniture, and shaded pavilions to take shelter from rain and sun. Most access roads of these parks lack crossing aids such as zebra crossing, speed bumper, and speed limit signboards.

Chart 2: Mode of transport to reach the nearby park or playground (residents' responses)

(Percentage)



The percentage is based on the number of responses.

Source: Field Survey, 2015

The total existing open spaces of the study areas of new Dhaka are far below the standard prescribed in DAP and DMDP. Even the prescribed standard, which is 0.052-0.5 acres of open space for 1000 population is also much lower than the international standards practiced in other Megacities of the world. Due to the shortfall of open spaces, youngsters are found gathering in the tea stalls at the street corners and the entry plazas of the neighborhood shopping malls of the residential areas of new Dhaka. The elderly residents use the lakeside trail for a morning walk. The children and women are the most deprived ones as an acute shortage of playgrounds prevails across the study areas. In response to the lack of adequate open spaces, building premises, rooftops, and nearby access roads are increasingly chosen as alternative outdoor play spaces for children (Table 2). Even the existing accessible playgrounds are not frequently used by the children as 93.8% of the parents reported not sending their kids out there due to the lack of passive surveillance opportunities (Field survey, 2015). Another reason is the fear of accidents as reaching the playgrounds requires the crossing of one or two intersections of vehicular roads. The recent trend of refurbishing an entire apartment as a kids' play zone has proved to be a profitable private business in areas like Dhanmondi and Uttara which highlights the desperate need for quality and secured playgrounds for the neighborhood children.

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Table 2: Percentage of children using various outdoor spaces for playing

Age	Inside the building premise	On the roof	In the neighborhood playground	On the nearby road	Others
Below 5 years	-	11	4	-	83
5 - 10 years	65	9	12	21	-
11-16 years	15	2	11	14	-
16 – 18 years	3	-	10	15	-

The percentage is based on the number of responses.

Source: Field Survey, 2015

Around 78.2% of inhabitants of the study areas reported not being engaged in any kind of physical exercise. Only 21.8% reported taking part in physical activities among which a significant percentage were elderly people both male and female. A majority of the residents avoiding the neighborhood open space for physical exercise complained of not having appropriate open space in terms of size and quality for jogging or other activities. In Dhanmondi, 34% of the respondents complained about the uneasiness caused by the presence of too many outsiders in places like Rabindra Shorobor and lakeside recreational areas (Table 3). According to 22% of respondents of Uttara, the presence of drug addicts and drug peddlers inhibits them from using the nearby parks and other open spaces.

Table 3: Residents' responses regarding not using the neighborhood open spaces for exercise.

Location	Lack of appropriate open space	Fear of snatch theft	Too many outsiders	Eve Teasing	Presence of drug addicts and drug peddlers
Uttara	63	11	3	1	22
Mirpur	67	8	3	5	12
Dhanmondi	37	12	34	8	9
Banani	53	18	21	4	4
Gulshan	58	18	13	3	8
Wari	100	-	-	-	-
Luxmi Bazaar	100	-	-	-	-

Source: Field survey, 2015

b) Access to daylight

The survey revealed that the rooms of the dwellings which are devoid of adequate daylight usually have window façades overshadowed by adjacent high-rise structures. As a result, the incident angle of solar radiation cannot provide the desired amount of ambient light in the interior rooms. Therefore, these rooms require artificial light sources to get properly illuminated. This situation is commonplace, particularly in building blocks located in the second and third row from the road front. The obstruction of proper solar access is not limited only to service spaces but also habitable spaces such as living rooms, dining, and bedrooms. But interestingly on average, 86% of the inhabitants do not have a serious complaint about it. This might be partly because most of the households remain vacant during the daytime as most of the inhabitants comprise of working couples, students, or service holders who spend the better half of the day away from home. The households are, therefore, occupied by the housemaids or senior citizens during the daytime who are generally found not very bothered by this.

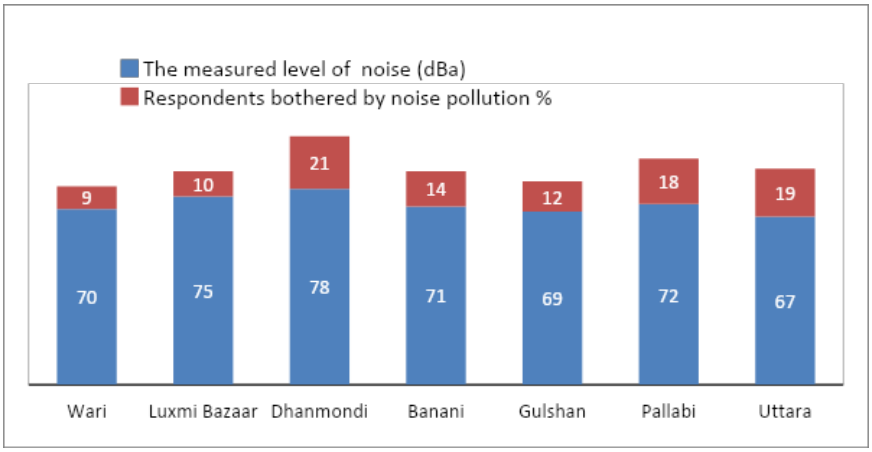
c) Sense of Privacy

The closely packed building layout of the study areas is found to cause noticeable visual obstruction and auditory intrusion to the residents. Hence, both acoustic privacy and visual privacy have been considered to examine the sense of privacy in residential areas.

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Acoustic Privacy

Chart 3: Respondents' opinion regarding noise pollution in the neighborhood



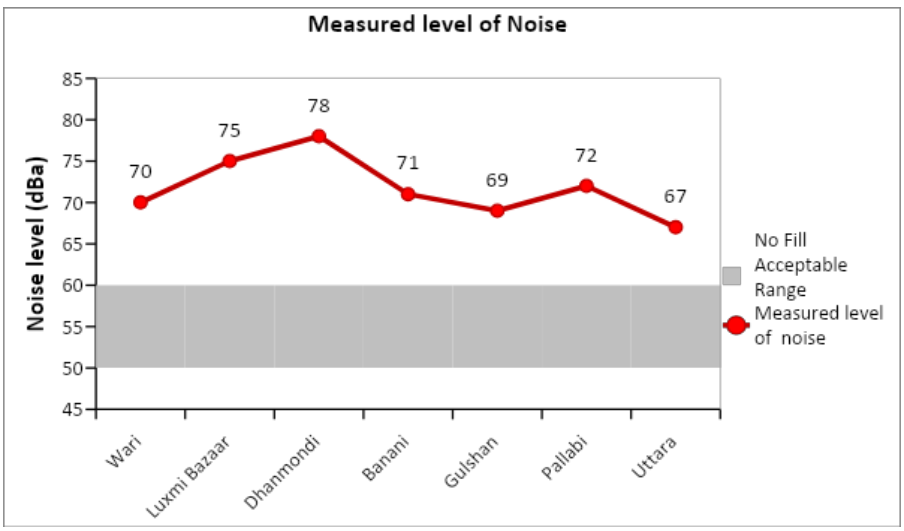
The percentage is based on the number of responses.

Source: Field Survey, 2015

According to the Environmental Protection Agency (EPA) in the United States of America, a 24-hour exposure level of 70 decibels is the highest allowable level of environmental noise for all areas which will prevent any measurable hearing loss over a lifetime. Noise crossing this threshold may cause various health problems like hearing problems, hypertension, heart disease, etc. However, the Department of Environment, of Bangladesh has set the standard for allowable noise levels even lower i.e., for residential areas 50 dBa and mixed-use areas 60 dBa respectively. The field survey indicates the average daytime noise level of the study areas was found to be exceeding the prescribed level shown in Chart 4. But interestingly on average only 9% and 12% of the residents of the study areas of Old Dhaka and New Dhaka respectively complained about noise pollution. Among the respondents bothered about the noise issue, around 65% of the New Dhaka respondents were found disturbed by the auditory intrusion caused by the non-residential uses, particularly by the peak hour traffic of nearby schools, colleges, and universities. Apart from this around 10% of the dwellers of street-facing apartments report the noise generated from the traffic of the adjacent streets as very annoying.

Other sources of noise mentioned by the residents were the noise generated from the construction work undergoing in the nearby plots and the noise of the generators during load shading. The traffic generated noise least concerned the residents of Old Dhaka, rather they identified the noise of generators and construction works to be most disturbing. Though the close spacing of the buildings allows a significant portion of the dwellers to overhear their neighbors' conservation, most of them did not consider auditory privacy as a big issue.

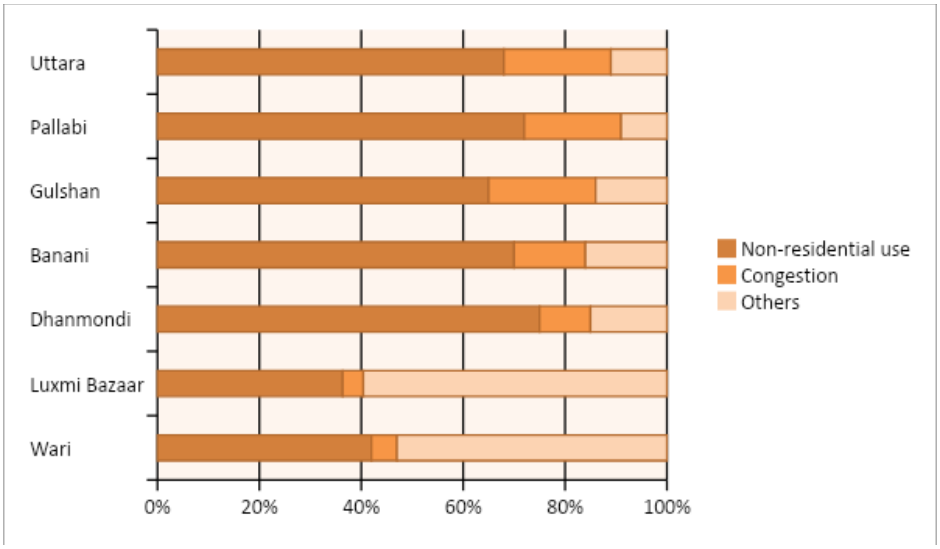
Chart 4: The measured and acceptable range of noise in the study residential areas



Source: Field Survey, 2015

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Chart 5: Respondents' opinions about the sources of noise in the neighborhood



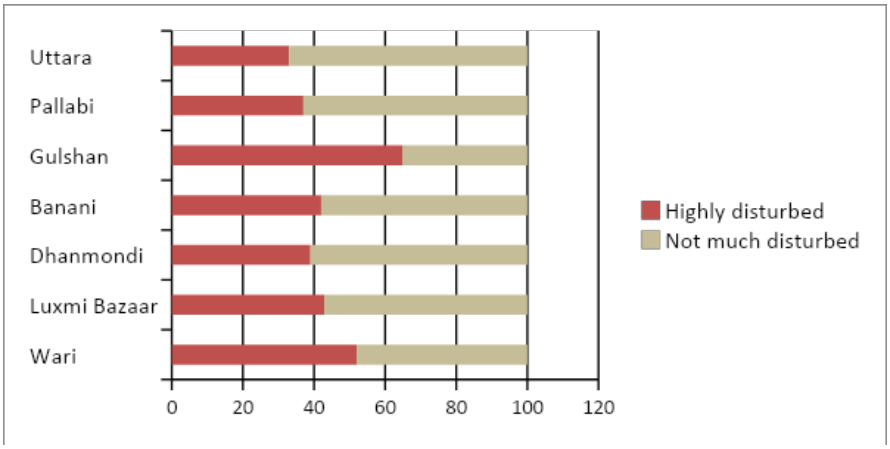
The percentage is based on the number of responses.

Source: Field Survey, 2015

Visual Privacy

An interesting observation was found regarding visual privacy in the study areas. The aspect of visual privacy was examined through the parameters of visual obstruction and access to daylight (Charts 6 & 7).

Chart 6: Respondents' perception of visual obstruction



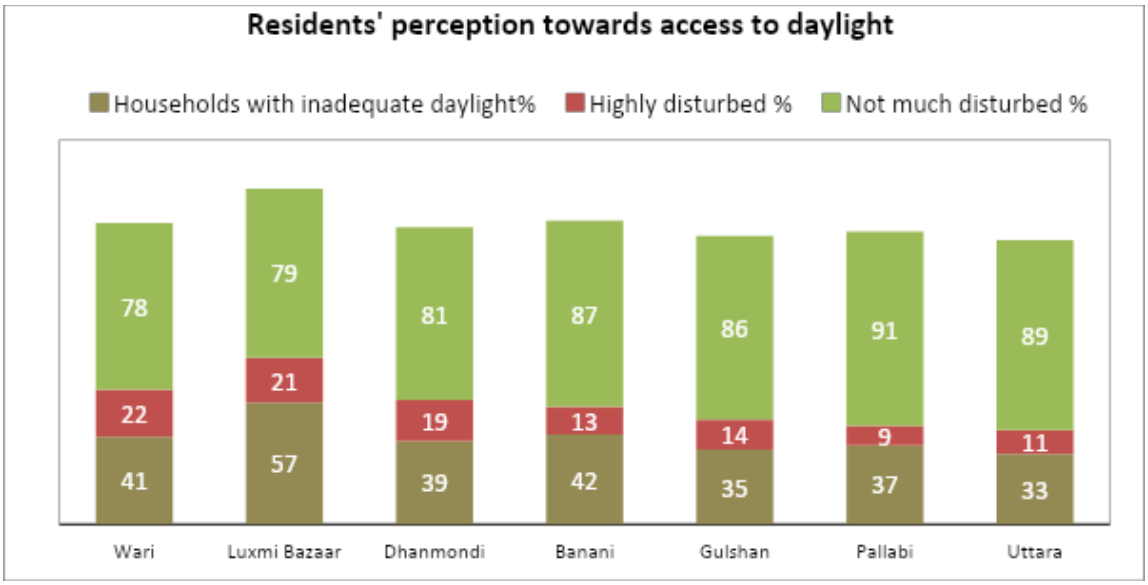
The percentage is based on the number of responses.

Source: Field Survey, 2015

Both visual obstruction and access to daylight are interrelated issues and show a negative relationship between them as most of the participants were found to be least bothered about the deprivation of daylight and view (Chart 7).

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Chart 7: Percentage of households having inadequate daylight and percentage of highly disturbed residents due to inadequate daylight.



Source: Field survey, 2015

Around 90% of buildings in Wari and Old Dhaka are so closely packed that visual intrusion of privacy and visual obstruction are commonplace to the residents but most of the respondents displayed a surprisingly unexpected degree of adaptability towards the situation and hardly acknowledge it as a problem from their perspective. This notion of indifference was more prevalent in the responses of the newly migrated people particularly the tenants and newly built apartment owners of Old Dhaka. Part of this desensitized attitude towards privacy concerns might be due to the cultural and educational background of these migrants. Most of these migrants are less educated rural people employed in small businesses and petty jobs. They naturally tend to be less sensitive toward the quality of the living environment and are somehow also overwhelmed by the sudden transition from a rural to an urban living pattern. Therefore, they do not feel much troubled by these issues. But on the other hand, many original inhabitants have expressed their resentment regarding the issue of privacy, as a housewife who has been living in Wari since her childhood commented:

"I have been living in this area since my childhood in our 3-story high ancestral house. Earlier we had two-storied buildings in the adjacent plots but now they are replaced by 10 and 8-story buildings which are mostly rented to the newcomers. The windows of the flat of the adjacent buildings are so close to my verandah that when someone spits out the chewed paan (Betel leaf) from the window it sometimes reaches my verandah and often splatters over the wet clothes hanging on the drying rail, which is very annoying. I cannot use the roof for drying clothes either as most of the migrant people living in the upper stories lack civic sense and frequently throw garbage on my rooftop. My young girls need to keep the windows of their rooms drawn with curtains most of the time to maintain the visual privacy from the apartment of the adjacent building next to their windows." (Interview with a resident of Wari, November 2015)

"Our family has been living in Luxmi Bazaar for over 3 decades. Our 3 storied house used to be the highest in this lane. We could see the rooftops of other houses from our windows and enjoyed the gust of wind. But now the neighbors had built high-rise buildings on both sides of our plot. We do not have the views anymore and lack airflow too. Furthermore, one of their bathrooms faces our kitchen which is the most irritating thing." (Interview with a resident of Luxmi Bazaar, November 2015)

Interestingly both the original and migrant residents of New Dhaka residential areas have displayed a high level of acceptance regarding the lack of visual access. Studies have shown that visual obstruction experienced by the inhabitants of densely built environments through blocking the eye from looking far away eventually causes myopic vision deficiency. In general, there is a lack of concern among the residents about issues like the implicit ill effects of visual obstruction, the paucity of daylight, and noise pollution of an unacceptable level.

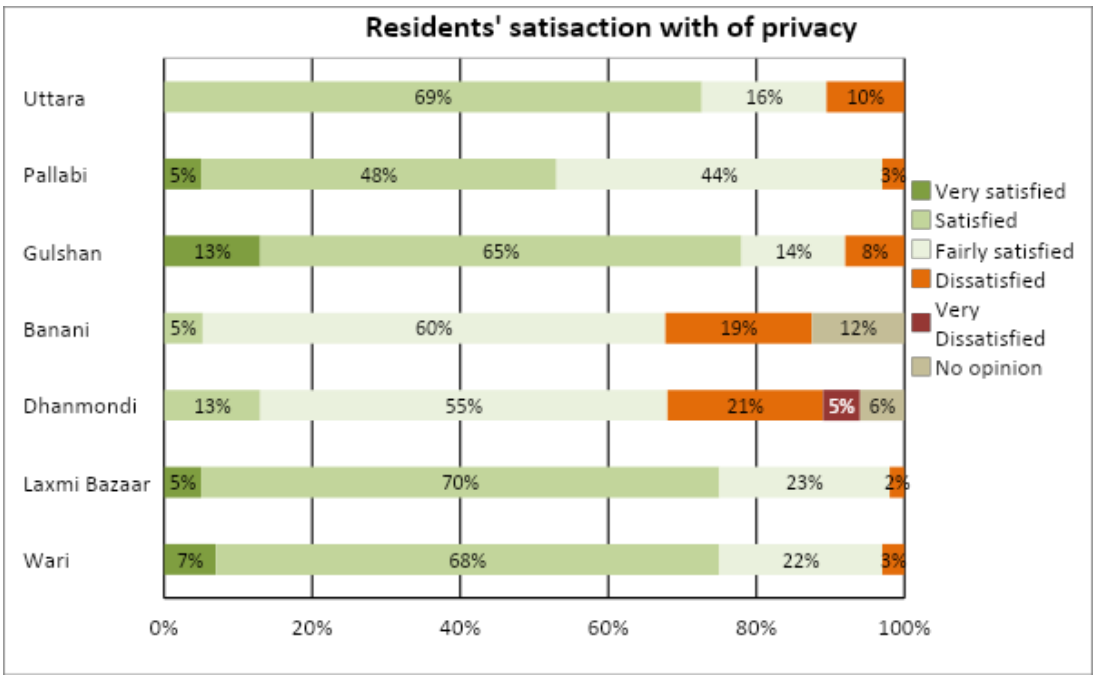
d) Satisfaction level of privacy

Despite living in such closely-knit dwellings, the residents of Luxmi Bazaar have shown the highest degree of (70%) satisfaction regarding privacy while Wari takes the second place (Chart 8). The higher incidence of satisfaction could be attributed to the prolonged stay in the neighborhood and the consequential social cohesion resulting from that. Among the residential areas of New Dhaka, Uttara ranks first while Gulshan and Pallabi are second and third respectively in terms of satisfaction. The lack of

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awareness, relatively lower density and similar social status could be the reason for the rise in satisfaction levels. On the other hand, the residents of Banani and Dhanmondi expressed moderate satisfaction. Only a quartile (19% and 26%) of them were found dissatisfied with the prevailing privacy. When asked about the reason most of them have reported the hampering of privacy caused by the regular incoming of commuters to these areas for work, education, and shopping. Besides, the original landowners have their privacy concern from the growing number of new tenants and apartment owners in these areas. The percentage of dissatisfaction found in the rest of the study areas is statistically insignificant. Overall, the level of privacy seems to be acceptable in most of the residential areas, both planned and unplanned, except in some portions where there is a greater concentration of commercial activities.

Chart 8: Respondents' opinion about the satisfaction level of privacy



The percentage is based on the number of responses.

Source: Field Survey, 2015

e) *Residents' satisfaction with the livability condition of residential areas*

Apart from the functional aspects of design, the livability of any neighborhood also depends on the perception of the built environment in terms of perceived attractiveness, maintenance, cleanliness, and privacy. The survey findings regarding the perceived aspects of the study areas are presented in Table 4.

High-density residential areas like Wari and Luxmi Bazaar were rated as less attractive by 79% and 87% of the respondents respectively in terms of architectural characteristics/style. Despite being older settlements Wari and Luxmi Bazaar differ in their road layout system. Luxmi Bazaar has an organic pattern of street network with a labyrinth of narrow alleys while Wari was the first planned residential area with grid iron road network. The multi-storied (5-7 storied) buildings flanking the narrow alleys on both sides with scanty and often no setbacks make Luxmi Bazaar visually more chaotic and crowded. Furthermore, Luxmi Bazaar has a good number of old derelict building stock. On the other hand, Wari, with its fair share of high-rise (8-9 storied) buildings not commensurable with their adjoining road widths projects an equally intimidating congested image of the neighbourhood. These residential areas are largely tenant occupied and most of them reside here for better connectivity with workplaces and proximity to educational facilities as well as affordable house rents and safety. All these factors contribute to the negative responses about the attractiveness of these residential areas.

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Table 4: Perceived quality of the local residential neighborhood environment

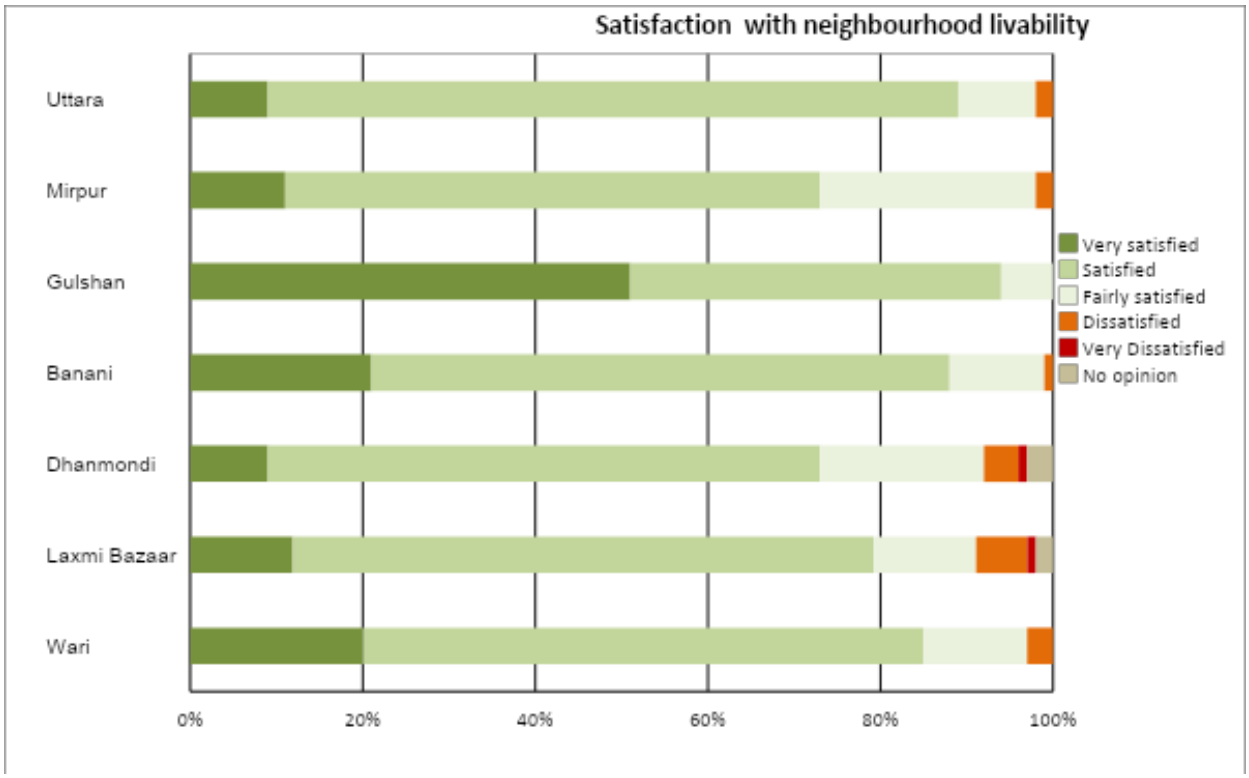
(Percentage)

Location	Cleanliness	Better connectivity	Attractiveness	Well maintained
Wari	17	47	21	15
Luxmi Bazaar	9	67	13	11
Dhanmondi	14	30	52	4
Banani	10	17	62	11
Gulshan	11	12	68	9
Pallabi	8	73	15	4
Uttara	15	54	21	10

The percentage is based on the number of responses.

Source: Field Survey, 2015

Chart 9: Satisfaction level of residents regarding the livability condition of their residential areas



The percentage is based on the number of responses.

Source: Field Survey, 2015

High density is also found to have a positive relationship with connectivity which implies that high-density areas are well supported by public transport. Factors like cleanliness and maintenance of the built environment are associated with the socio-economic status of the occupants. In support of this, it was also found that residential areas with higher family income (Dhanmondi, Banani, Gulshan, and Uttara) have better maintenance and cleaner environment than the residential areas with lower family income and lower social status (Luxmi Bazaar, Wari, and Pallabi). In addition, the building stock of Dhanmondi, Banani, Gulshan conforms to modern design style making the streetscape visually appealing. Most of the residents of these areas own cars and thereby do not feel the inadequacy of public transport facilities. Regardless of the shortage of public transport facilities a higher percentile of the respondents of these areas finds their neighbourhood visually attractive. Even perceived density is found to have a negative association with perceived attractiveness, maintenance of buildings, and cleanliness of the residential area which reflects in case of medium density area like Pallabi. Around 70% of the inhabitants who perceived their residential area as crowded also expressed their dissatisfaction regarding its maintenance, cleanliness, and attractiveness. However, regardless of the varied density the overall satisfaction level of the residents of the study areas was found surprisingly quite high (Chart 9). Subtle variations were observed in terms of the level of satisfaction where

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a higher percentile of the residents of upscale neighborhoods with moderate density (i.e. Gulshan 52%, Banani 21%) exhibited a high level of satisfaction in comparison with the high-density areas of Wari and Luxmi Bazar. The variation in the proportion of unsatisfied residents among the residential areas of both Old and New Dhaka is statistically insignificant. The relationship between density and the selected aspects of environmental sustainability is assessed through Pearson's correlation analysis and presented in Table 5.

Table 5: Relationship between density and aspects of environmental sustainability

	List of indicators	Physical density relationship (ward wise - gross population density	Perceived density relationship		The overall impact of density
			Perceived neighborhood density	Perceived density within the dwelling	
Environmental sustainability					
Accessibility to open space	The average number of parks per 1000 people	negative			negative relationship- higher-density residential areas have less accessibility to open space.
Access to daylight	Percentage of plots which does not get adequate daylight and need to keep lights on during daytime	negative			Negative relationship- higher-density residential areas have less daylight and need more artificial lighting during the daytime.
Sense of privacy (Acoustic & Visual)	Perceived noise pollution	no impact	no impact	no impact	positive relationship- higher density residential areas have more noise pollution and visual obstruction, but perceived acoustic and visual privacy displays no impact.
	The measured intensity of noise pollution	positive	no impact		
	Visual Obstruction by surrounding buildings	positive	no impact	no impact	
Satisfaction with the living condition of their residential area	Perceived residential area in terms of attractiveness	negative	negative	no impact	negative relationship – higher density residential areas were found less preferable in terms of attractiveness, architectural character, maintenance, and cleanliness.
	Architectural character/Style	negative	no impact	no impact	
	Well maintained buildings	negative	negative	no impact	
	Clean environment	negative	no impact	no impact	

Source: Questionnaire survey 2015

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The relationship of density was examined against four aspects of environmental sustainability which are accessibility to open space, access to daylight, sense of privacy, and satisfaction with the living condition of the neighborhoods. From the correlation analysis (Table 5) it can be seen that the accessibility to open space and satisfaction with the living condition of the neighborhoods display negative associations with density while the other aspects had a positive relationship. The negative relationships imply that higher-density residential areas have less open space and are less preferable in terms of attractiveness, cleanliness, architectural style, and privacy. Density displaying a positive association with access to daylight signifies that dense residential areas require more artificial lights to be put on during daytime and are subjected to a higher degree of visual obstruction. The measured intensity of noise is positively associated with physical density, but no significant correlation was found between the perceived level of noise and both physical and perceived density.

IV. Summary Findings and Discussion

The results of the statistical analysis provide limited insight into the dynamics between density and environmental sustainability as it does not consider subjective parameters like people's habitual inclination, emotional state, cultural practice, tradition, and beliefs that usually shape their perception of their surrounding environment. Therefore, some contradictions emerged when comparing the results of the correlation analysis with the interviews collected from the residents. Therefore, the contradictions associated with each selected aspect of environmental sustainability are discussed and interpreted with the findings of the statistical analysis (Tabel 5) below:

a) Privacy

Regarding the acoustic privacy the measured level of noise of the study areas varied from 69dBa to 75dBa which is far beyond the acceptable level of noise (residential areas 50 dBa and mixed-use areas 60 dBa) set by the Department of Environment, Bangladesh. Despite the persistent high-level noise found in the residential areas most of the residents did not acknowledge it as a problem. However, to prevent noise-induced hearing loss, the U.S. Environmental Protection Agency (EPA) and the World Health Organization (WHO) recommend maintaining environmental noises below 70 dBA over 24-hours (75 dBA over 8-hours). Similar responses were also found regarding visual obstruction and loss of privacy caused by the compactness of the dwelling units with inadequate setback spaces in between. The situation is more acute in the case of Luxmi Bazaar. But due to the rich social bonding prevailing in this locality residents were found not duly concerned about the lack of visual and acoustic privacy. A probable reason for the residents' insensitivity towards the necessity of acoustic and visual privacy might be rooted in their lack of awareness regarding the health problems caused by these factors. Prolonged exposure to such conditions is deemed to impart serious physical and psychological impairment to the residents as well as future generations putting the overall sustainability of the community at stake.

b) Access to daylight

The statistical analysis showed a negative association of density with access to daylight where most of the apartments depend on artificial lighting during the daytime. This scenario is more acute in the dense residential areas of Luxmi Bazaar and Wari than in the residential areas of New Dhaka. But the residents of these areas again did not express any serious discomfort concerning this issue. In the case of Old Dhaka, this could be attributed to the emotional adaptability of the residents caused by the longer duration of staying in such an environment. On the other hand, most of the occupants of New Dhaka remain away from their homes during daytime due to jobs, education, and other commitments and therefore, do not feel much bothered about the paucity of solar access.

c) Accessibility to open spaces

The research findings indicate a negative association of gross population density with the accessibility to open space. The higher-density residential areas were found to have less or almost no accessibility to open spaces. Owing to the insufficient and unviable development control strategies and open space protection laws together with the ubiquitous encroachment of the open spaces by market forces, Dhaka has the lowest amount of open space available for residential areas. The existing open spaces are inadequate in number, and size and unevenly distributed across the residential areas. Furthermore, they lack proper maintenance and, in many cases, have restricted access. Literature confirms the importance of open spaces for our overall mental and physical well-being. Spending time in open and green spaces is crucial for people to relax, reduce stress and restore their health. (Greenspace Scotland 2008). Several studies have investigated the impact of green space on mental health. In one of the earlier studies of 1979, Ulrich found that there is a significant reduction in the stress levels of Americans after exposure to nature scenes, compared with urban scenes. Furthermore, living in an urban landscape devoid of vegetation and other natural elements tends to react adversely to the emotional well-being of people leading to a considerable increase in depression, anger, aggression, and fear (Ulrich RS. 1991). Besides, a diversified range of social contacts and leisure activities can take place in

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the open spaces enhancing the community's health and well-being. Green spaces not only allow people to reconnect with nature but also foster wildlife. Residential neighborhoods without proper breathing spaces will degrade the social, emotional, and environmental well-being of the community making it vulnerable in the long run. This type of planning will lead the residential areas toward unsustainability.

V. Conclusion

From the findings in the study, it is evident that the ongoing densification operation has a significant impact on residential areas of differing densities. The most explicit implications of the densification intervention appeared to be the lack of accessible open space and daylight while implications on aspects like visual and acoustic privacy were more implicit. Regardless of the degree of impact, the current densification interventions are found to have negative consequences on community life which are adversely affecting the environmental sustainability of the residential areas. If this trend of unguided densification continues to prevail the problems would accentuate further putting environmental sustainability at stake. Measures like area-wise density mapping, building height restrictions, promotion of green façade, roof top garden and other green infrastructure could be helpful in mitigating the situation. Therefore, densification operations should be undertaken considering the existing condition of the environmental and urban context and assessing the site-specific constraints and opportunities.

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Planetary Evolution and the Asymmetric Arrows of Space-Time in the Self-Organization of the Anthropocene

By Luis Henrique Ramos de Camargo
Universidade do Estado do Rio de Janeiro

Summery- This article aims to verify the relationship of society with nature, and its thermodynamic energy flows, as an evolutionary element, generating totalization and being analyzed by the arrow(s) of space-time. This article will also verify how this process influences the formation of the Anthropocene. In this sense, the principles born after the advent of quantum mechanics will be applied to the spatial-temporal analysis of physis (which integrates society-nature). The article also verifies how each formcontent, in a unique way, contributes energetically to the development of its arrow of space-time. Thus, it will also be verified, as, the current production process, is associated, in general, with the disruption of the states of homeotase, in the energetic balance of the process of exchange between energy and matter, and as the old pattern of relative stability, which characterized the Holocene, has been replaced by disorder, which is at the basis of the emergence of the Anthropocene.

Keywords: thermodynamics, anthropocene, holocene, evolution, form-content.

GJHSS-B Classification: LCC Code: QC311-350



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Planetary Evolution and the Asymmetric Arrows of Space-Time in the Self-Organization of the Anthropocene

Evolução Planetária e as Assimétricas Flechas do Espaço-Tempo na Auto-Organização do Antropoceno

Luis Henrique Ramos de Camargo

Summary- This article aims to verify the relationship of society with nature, and its thermodynamic energy flows, as an evolutionary element, generating totalization and being analyzed by the arrow(s) of space-time. This article will also verify how this process influences the formation of the Anthropocene. In this sense, the principles born after the advent of quantum mechanics will be applied to the spatial-temporal analysis of physis (which integrates society-nature). The article also verifies how each formcontent, in a unique way, contributes energetically to the development of its arrow of space-time. Thus, it will also be verified, as, the current production process, is associated, in general, with the disruption of the states of homeotase, in the energetic balance of the process of exchange between energy and matter, and as the old pattern of relative stability, which characterized the Holocene, has been replaced by disorder, which is at the basis of the emergence of the Anthropocene.

Keywords: thermodynamics, anthropocene, holocene, evolution, form-content.

Resumo- Este artigo objetiva verificar a relação da sociedade com a natureza, e os seus fluxos energéticos termodinâmicos, como elemento evolutivo, gerando totalização e sendo analisados pela(s) flecha(s) do espaço-tempo. Este artigo verificará também, como este processo influencia na formação do Antropoceno. Neste sentido, serão aplicados os princípios nascidos após o advento da mecânica quântica, à análise espaçotemporal da physis (que integra sociedade-natureza). O artigo verifica, também, como cada forma-conteúdo, de forma singular, contribui energeticamente para o desenvolvimento da sua flecha do espaço-tempo. Assim, será verificado também como o processo produtivo atual associa-se, em geral, ao rompimento dos estados de homeostase, no balanço energético do processo de troca entre energia e matéria, e como o antigo padrão de relativa estabilidade, que caracterizava o Holoceno, vem sendo substituído pela desordem, que está na base do surgimento do Antropoceno.

Palavras-chave: termodinâmica, antropoceno, holoceno, evolução, forma-conteúdo.

Author: Ph.D and Post-Doctorate in Geography from the Federal University of Rio de Janeiro – UFRJ; Master of Science in Environmental Management from Universidade Estácio de Sá – UNESA; Teacher and geographer at the Fluminense Federal University – UFF and Associate Professor at the State University of Rio de Janeiro – UERJ. Universidade do Estado do Rio de Janeiro – Rio de Janeiro – Brazil
e-mail: geocamargo64@yahoo.com

I. Introduction

This article, constructed from bibliographic research, has as its central objective, to debate the planetary evolution, presenting as an explanation for the understanding of its spatio-temporal evolutionary mechanism, the systemic-quantum epistemological field. The choice of this paradigm is justified because it presents logics that are associated with how the Anthropocene emerges from its self-organization. This work aims to develop the hypothesis, which is associated with this constellation of ideas. In our assumption, we think of the planet as evolutionary, from achronic thermodynamic paths, which involve the society-nature relationship in constant exchanges, explained by the application of Bertalanffy's General Systems Theory (1968).

We believe, from research published in Camargo (2021), that each form-content, from its singularity, generates a certain energetic flow, in its contribution to the maintenance of the patterns of planetary balance. We call this the arrow of space-time. Therefore, we seek, in this article, the knowledge of why the current arrow (s) of space-time presents great asymmetry, and what is the relationship of this issue with the Anthropocene. Therefore, for this reason, the text has as its "backbone", to bring to the scientific debate, the dilemma: evolution by mutability and self-organization X mechanistic cyclic repetition, that is, the dilemma existing between the classical X quantum systemic paradigms.

From the systemic-quantum field, breaking with the idea of constant loss that guides the arrow of time, the concept of the arrow of space-time, going beyond the arrow of linear time, Cartesian-Newtonian, represents a demonstration, which seeks to explain, how we can understand the achronic evolutionary process planetary. The arrow of space-time is the dialectical development of time, from the different variables that any space presents, and, for this reason, singularizes it.

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The concept of the space-time arrow may demonstrate how the Holocene, which was characterized by its relative, but almost constant stability, maintained a tenuous balance with each other; and how a new geological-ecological stage has been emerging, due to our productive logic, which for different reasons, fragments from nature, not realizing how thermodynamic equilibrium is the driving element of change, because it relates to the basic exchange mechanism, existing between all systems that make up the Earth. In this sense, the conceptual paradox between classical science and quantum systems thinking is manifested in the analysis that refers to reality itself, and how research and models are created.

To achieve our goal, the text will refer to the verification of how the human being, in his short path on the planet, became a driving element of states of imbalance, associated with the genesis of new geological and ecological patterns. In this sense, this research is developed in three specific moments and that are integrated. Initially, the article will follow the steps of our ancestors, in a brief analysis, verifying the dynamics humanity - environment, thus aiming to understand how the Holocene arises; in a second stage, seeking to understand that the Holocene was characterized by an almost regular stability, it was carried out, a comparison of paradigms, aiming to explain, how classical science, easily justifies a world without major changes, and how it is lost epistemologically with the reality of our days. In this sense, a brief analysis of classical science was made, however, we believe as fundamental, to be confused with the common sense of reality. In the final stage, after bringing the reader to systemic-quantum thinking, we present how the content-forms, from their different arrows of space time, collaborate with the thermodynamics of the planet and thus generate the evolution in disorder that is associated with the Anthropocene.

II. Man's First Steps on Earth

The first steps of our ancestors on Earth were taken by Australopithecus. Its fossils have been found in geological strata on the African continent, from the relative scale of time. These studies have dated the emergence of these bipeds to something around 4 million years, which brings us to the Pliocene (6 M.a. to 1.6 M.a.) (ASIMOV, 1990; WAR, 1969; SALGADO-LABOURIAU, 1994). Os Australopithecus teriam surgido, em conjunto com uma série de outras mudanças ambientais, ocasião que trouxe uma nova demanda ecológica (do padrão de organização), alterando o clima, a flora e a fauna. Surge, por exemplo, na África, uma savana arborizada, bem como também, diferentes espécies evoluíram, dentre elas carnívoros e onívoros, entre os quais, os ancestrais do Homo sapiens sapiens (SCHINEIDER, 1998; SALGADO-LABOURIAU, 1994).

The first hominids spread across the African and Eurasian continent, and among the most important species, two, which preceded Homo sapiens sapiens stand out, Homo erectus, which inhabited Asia, and Homo neanderthalensis, which inhabited Europe (ASIMOV, 1990). The Homos erectus, appears around 2 million years, and this species lasted for another 1.5 million years, and it was she who would dominate the fire 500,000 years ago (ASIMOV, 1990). During the European glaciation, around 200,000, Homo sapiens neanderthalensis (Neanderthals) would emerge (ASIMOV, 1990).

Neanderthals were stronger and more robust than other known hominids, thus being better able to live through the glaciation of the Pleistocene. They would be better suited to hunting, fishing and the cold they would face in times of glaciation. Neanderthals are believed to have gone extinct 28,000 years ago, and therefore coexisted on Earth with homo sapiens sapiens durante um certo período, até a sua extinção como espécie, ainda no Pleistoceno. Ambas espécies, possuíam um ancestral em comum, o Homo heidelbergensis, que viveu de 500 mil anos, até cerca de 250.000 anos atrás, portanto, também no Pleistoceno (TRINKAUS e SHIPMAN, 1993).

There are several dates that define the emergence of the first archaeological records of Homo sapiens sapiens, this variation is between 100,000 and 30,000 years. But what is certain, is that our species emerged in the Pleistocene, during the glaciation that would last until 12,000 years ago. And, we also know that, of all the hominid species that emerged on the planet, Homo sapiens sapiens, was the only one to survive glaciation, and reach a new stage of ecological organization in the Holocene (SCHNEIDER, 1998). During the glaciation, in the Pleistocene, the retreat of the waters (it is estimated that the sea level fell between 70 and 80 meters), widened the continental shelf. That means greater will be your weather extremes, colder winters and hotter summers. Due to climatic extremes, many animals and plants began to coexist with other species, reconfiguring the perspectives that emerged in new levels of ecological organization, both of plants and animals. It is estimated, for example, that the deciduous forest of Great Britain altered its structural ensemble in each of the four glaciations of the Quaternary (SALGADO-LABOURIAU, 1994).

Salgado-Labouriau (1994), alerts us to the understanding that the transition from the Pleistocene to the Holocene did not happen quickly. In general, the determination of the boundary between two geological-ecological periods is made from the study of paleogeography, and thus, the differentiation between species, perspective of geographical location, among

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other processes of analysis are used facilitating the delimitation. However, although the megafauna has become extinct, the Quaternary did not present large appreciable extinctions of plants and other elements of nature, such as microorganisms, which would make this differentiation difficult for stratigraphic analysis.

What we can characterize of the Quaternary, are its different glacial periods, the last one having ended approximately 12,000 years ago, beginning the Holocene. Salgado-Labouriau (1994), also tells us, that many geologists consider the Quaternary, due to its low extinction rates, as the same being a single epoch, so the Holocene would not exist as a geological stage.

Seeking to define the emergence of the Holocene, we can say that it can be represented by some factors such as: end of the most recent glaciation, beginning of marine transgression and, the epoch that presented a great alteration of the environment, initiating a period of relative amenities (climatic-environmental) (SALGADO LABOURIAU, 1994).

The Holocene, represented, thus, a change in the macrostructure of the combination of variables of nature, issues such as sea level rise, for example, were related to the restructuring of both flora and fauna, in the sense that species seek new areas as a result of transformations, and the possible weathering through which certain areas have passed in this transition. Therefore, there is a restructuring in the sense of ecological combinations. This mechanism alters ecosystems and old patterns are restructured (SALGADO-LABOURIAU, 1994). Thus, the Holocene, due to its variation in ecological and climatic organization, also presented major changes in the whole of its organization. Thus, new deserts were formed, in addition to temperate and tropical forests (SCHNEIDER, 1990).

In this way, there was the arrival of a period of greater stability, where plants and animals did not need to constantly migrate in search of refuge areas, among other things, providing a new adaptability or even mutation, by evolution, of plants and animals (SALGADO-LABOURIAU, 1994).

III. Normality and the Common Sense of Reality

And, despite some climatic variations found throughout this period, if we were to look for the main feature of the Holocene, this definition would be its incredible, more relative, stability of environmental patterns (VEIGA, 2019).

About 12,000 years ago, this more stable state favored the domestication of animals and, later, 8,000 years ago, the same state of relative equilibrium provided the cultivation of plants, initiating agriculture (ASIMOV, 1990).

It happens that, among different other factors, agriculture, made its production much more vulnerable to theft and looting of other tribes, thus leading to the search for the formation of cities for protection, from places, where the farmer could take refuge and, if necessary, store water to war. This process, associated with other different factors, such as Mesopotamia being formed by two rivers, and by having volcanic soils, favored agricultural practice, and started civilization with the emergence of the city of your, around the Tigris and Euphrates rivers (ASIMOV, 1990).

Thus, the Holocene, and its relative stability, made possible an entirely different society from the nomads in their glaciation in the Pleistocene. Over different centuries, this stability was still confused with beliefs linked to the extra-physical universe. However, with the technical-scientific revolution of the sixteenth and seventeenth centuries, science began to create a new paradigm about reality, based on the machine-like universe. The hegemony, achieved by the mechanistic model, made it possible for his reading of the planet and its phisys, to integrate into the old state of climatic-ecological stability that was lived. Living on a planet, in which the guarantee of its predictability in a scientific way, would provide the control of nature (without needing divine help), represented the human control over nature.

The technical-scientific revolution of the sixteenth and seventeenth centuries, which emerged from the Copernican Revolution, would have in Newton (1643-1727), the consecration of a model of planet that lasted for centuries, guaranteeing in common sense the idea of a machine universe, with relative balance and easy understanding of what will occur in the future (CAMARGO, 2012).

This logic reproduces, in the common sense of reality of physis, the rules inherent in classical science. For, we think of nature as formed of different parts of a gear (BHOM, 1980). In this metaphor of reality, the planet would be formed of immovable pieces, being three-dimensional, similar to a machine, which has no external influence. Its gear, in structural behavior, consists of different integrated parts, and develops its movement in a synchronic and linear way. In this machine, as no external force acts, its movement, if its current position is known, makes its future easily known (NEWTON, 1987).

The classical method floods our sense of reality with processes that are no longer scientifically based. For example, by fragmenting and isolating an element for its analysis, one loses the essence of connectivity, which is governed and dialectically governs the rule itself. Society, by fragmenting space of time, loses the possibility of analytically understanding change, because it occurs in space and is found in the relativity of time of each place.

As the Baconian Cartesian-Newtonian universe fragments time from space, analyses based on its paradigm will follow its rules, limited to the repetitive and

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cyclical machine universe, where, for this very reason, talking about creative evolution is the same as inventing something impossible to happen. For, as time separates from space, it (space) does not evolve, does not undergo mutabilities with time (CAMARGO, 2005).

This dynamic, stable and that everyone still expects, is what common sense calls normality, that is, a time when environmental systems were in relative stability, ensuring that the great natural phenomena did not harm people's lives, as it has been harming.

We call normality, that which is associated with the planet we want, not that we have... And what we seek as a planet is nothing different from what is usually learned in school with Newtonian physics.

The mechanical model of the universe, which is associated with the idea of Laplacian Newtonian certainty, gave mechanistic predictability something that is undone from Heisenberg (1901 —1976) and Schroedinger (1887 —1961). Uncertainty, verified under scientific judgment, came to be seen as a real element, and thus, new interpretive and empirically explained possibilities emerged.

Thus, the reading of a new planet is opened, which can rebuild and evolve, because it no longer has the totality, as a simple sum of all its internal parts. Uncertainty, when referred to totality, in turn, can only be seen, as the whole, always being superior to the internal sum of its parts (where in truth there are no parts at all, only links of interconnectivity). Therefore, by being creative, in the emergence of unpredictability and uncertainty, the whole reinvents itself and evolves. Thus, the path to understand the analysis of the reality of space-time and its applicability is broadened, in the sense of understanding the events of nature in relation to society (CAMARGO, 2005).

Being evolutionary, by self-organization of its variables, the planet, demonstrates its creativity, which becomes reality, totally making impossible the analysis made by the classical paradigm. This article, dedicated to the understanding of this evolutionary mechanism, involves how the spatio-temporal syntropy of the society-nature relationship relates to the development of the Anthropocene.

Our current search for the meaning of the "normal" is nothing more than the metaphorical representation of reality, presented by the Scientific Revolution, which occurred in the sixteenth and seventeenth centuries, under the "baton" of thinkers such as Copernicus, Bacon, Descartes, Galilei Galileo, Kepler, Titus Brache and Newton.

Living in a world in relative balance, following a daily logic appropriate to a controlled planet, would be wonderful, this would be what is expected, of what people call normal, however, stability does not seem to be the characteristic presented by the planet in our days.

IV. Planet Earth and the Integrated Society-Nature Dynamics

In the nineteenth century, the philosophy of nature in Schelling (1775-1854), and the work of Humboldt (1769-1859), already demonstrated the perspective of the perception of the most energetic look at the man-nature relationship, where Descartes' conception of machine nature ends up not being dominant (CAPEL, 1981).

Schelling (2015), in his first project of a system of philosophy of nature, which sought to understand the relationship between man and his environment, demonstrated a clear departure from the existing reductionism. Schelling (2015) thought of nature, where there was evolution of matter, he conceived the chemical and biological connection, seeking, for example, the existing interconnectivity between biochemical phenomena and neurological functioning that influences the way of feeling and thinking. Schelling (2015) enabled the non-linear vision of the future, by understanding that there is a meeting of the natural spheres, and that this brought the very idea of evolution, in a world dominated by the machine universe. And just as William Blake (1757-1827) demonstrated the dehumanization existing in the work of Newton (1643-1727), Romanticism also positioned itself, showed that there was something that went beyond the mechanistic universe.

His theory for nature was a (re)encounter that dialectically involved magnetism, electricity, sound, light, heat, and chemical processes. Pure syntropy. Humboldt, influenced by Schelling, also suggested a logic of understanding wholeness that involved elements of nature, and of human society.

Just as Morin (1977), who fosters a critique of the General Systems Theory, verifying that it needs to be inserted in a broader context of "organization with emergent properties", Dutra-Gomes and Vitte (2017) provide this creative perspective to it, thus dimensioning the movement of integration into the natural spheres, generating the emergence of new patterns. This, was what was missing to complete what was in the genesis of this integration sought by Romanticism.

This integration guides what the planet is. The Earth, is a macro system consisting of different subsystems governed by their interactions (SILVA, 2008). This dynamic characteristic is linked to the interdependence of the parts, which form the whole of the planet, and which have a direct or tenuous connection, being impossible to understand any isolated aspect without reference to its function as part of a larger set (CAPRA and STAND-RAST, 1991).

In this dynamic, each subsystem, in a unique way, has different scales of space-time, and act by exchanging energy and matter with each other. In this mechanism, involving the entire planet at different

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scales, the natural spheres (hydrosphere, lithosphere, cryosphere, atmosphere and biosphere), act in interaction with the technosphere, which suggests a dynamic that is in the genesis of the movement, breaking with the three-dimensional Cartesian-Newtonian idea. Thus, the processes are referred to as a fourth dimension of space-time and that is linked to the possibility of change, which can be understood by the General Systems Theory (CAMARGO, 2012 and 2021).

And this is because interconceivability is general, and scales achronic flows, which reproduce the Copenhagen Interpretation. The mental design of this structure is the four-dimensional drawing of the totality in totalization, from its processes, actions and the movement of flow. With each increase in complexity, emergent relationships occur, from one or more syntropic processes, that lead the whole to evolve.

In this sense, the research believes that, has intensified the changes in the flows of energy and matter in excess on the planet. We know that nowadays, human activities have reached a level that, according to Veiga (2019), can damage the systems that keep the Earth in the desirable holocene state. In Safe Operating Space for humanity, the 29 authors added that since 2009 there was already a lot of evidence that some of the Earth's "subsystems" were moving out of their stable Holocene patterns, and thus verified, that the Earth System could not be operating in stable conditions like those of the Holocene (VEIGA, 2019).

To better understand this evolutionary dynamics, driven by the constant exchanges of energy and matter, which is energized throughout the planet Earth, it is necessary to understand the basic principles of Thermodynamics, expressed in the arrow of space-time. The essence of the society-nature relationship can thus be demonstrated, bearing in mind that the exchange relationship between human beings on the surrounding environment, in general, transmits a high degree of external energy input into natural systems, thus causing a local imbalance and discontinuous and often unpredictable feedbacks.

The asymmetric arrows of space-time as a tool of analysis Verifying the discontinuity of planetary systems, different scientists seek a stewardship of the Earth System, compatible with the desired habitable stability. However, perhaps, because they still "drink" too much of the classical influence, the models have difficulty understanding the society-nature coevolution, issues such as uncertainty, so common in our days, for example, do not have mechanisms for their scope (VEIGA, 2019).

Seeking a reading of the planetary evolutionary process, from a systemic-quantum epistemological view, Camargo (2021), effectuates the term arrow of space time to redefine the meaning, linear and fragmented, that was associated with the arrow of time.

Essentially, the arrow of time did not verify the discontinuity and achronic disharmony that surrounds all systems on the planet. For her, past, present and future are sequences, but tomorrow is the fruit of the complexity of today, so it cannot be repetitive and monotonous. However, when we list space as a fundamental element for the understanding of time, we find that the flow of time cannot be linear and predictable, considering the variables that differentiate and singularize space.

In seeking to prove the existence of the arrow of space-time, Camargo (2021) verifying that agriculture, being the art of disturbing the balance of nature in a safer way for human benefit (Wigglesworth) (DREW, 2002), presents how the human being directly interferes in the planetary balance, deliberately causing thermodynamic imbalances.

Thus, it proposes a comparison between an agricultural area, which uses a high degree of the use of pesticides, tractors, artificial irrigation, among other elements, in contrast to ecological agriculture. Camargo (2021), demonstrates that due to the high degree of external energy input in the areas of non-ecological agriculture, it ends up generating systemic imbalance in the spheres that surround it, and in some cases, these mechanisms provoke unpredictable responses, which arise at random, and may create new irreversible patterns.

That is, soils that have non-ecological management, in contrast to ecological soils, due to their technical and spatial organizational apparatus, measure greater energy exchanges with natural spheres, thus bringing greater instabilities, and often causing irreversible processes to the systemic set. In turn, ecological agricultural systems size structures closer to natural systems, causing little change in the dynamics that involve natural spheres in their processes.

According to Drew (2002, p. 146):

> The effects of agriculture on the environment relate directly to the scale at which it is undertaken. There are two aspects to consider: the intensity and degree of alteration caused in the soil and in the pre-existing vegetation; and the area where the change took place.

Therefore, it is a spatio-temporal question of easy understanding. The natural cycles of energy and mass function to some extent as closed systems, as nutrients are retained within the soil-vegetation system. Here the equilibrium is maintained unchanged, however, as agriculture deliberately transforms this dynamic, with the intention of manipulating certain aspects to obtain the maximum yield and foodstuffs, a large external energy input is then generated in the system, creating a lot of entropy in the agricultural processes.

Therefore, Drew (2002) states that one of the traits of modern and intensive agriculture is the very high deformation of natural energy currents and the application of external energy to the earth.

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The essence of this mechanism is in, when they import and export energy, linked to the process of agricultural production, energy development is achieved and, often, change in its cyclical characteristic that caused the energy that was sent to a subsystem, to return without high entropy rates (LORENTZ, 1996).

Therefore, when we compare both agricultural models, we will find different arrows of space-time, and in the form-content, linked to the agricultural areas of high yield, the arrow ends up presenting constant asymmetries.

According to Prigogine (2008), close to equilibrium, linear dynamics is possible, is the case of ecological agriculture, in which the cycles occur closer to that of semi-closed systems, with low loss rates, or low entropy, therefore, remaining relatively permanent. However, when the system receives a high degree of external energy, a non-linearity occurs, where new patterns emerge, new behaviors that would be impossible near equilibrium. Nonlinearity can thus describe new irreversible realities, generating within the system a differentiation from its outer universe. Far from equilibrium, matter acquires new properties, that is, from different probabilities of responses, caused by an energetic stress, the system can acquire a new irreversible pattern (PRIGOGINE, 2008).

The rule is: If an isolated system in equilibrium is disturbed, in the negative feedback, it returns successively to equilibrium and can control future operations in the system; however, in dynamical systems perturbations, linked to positive feedback, lead to the emergence of new possibilities, and, new levels of organization can be created, which give rise to new irreversible structures. An example, on a given scale, is the development of a ravine (PRIGOGINE and STENGERLS, 1984; Christofoletti, 1999).

Thus, due to its spatial productive process, an open system can actively tend towards a state of higher organization. A feedback mechanism can reactively reach a state of higher organization, due to learning (positive feedback), that is, the information introduced into the system, coming from another subsystem, leading it to modify and evolve together with the new pattern that has been formed.

The arrow of space-time is thus associated with how the content forms develop, because depending on it, its asymmetry will be something common, and often exponential, collaborating to the constant imbalances that mark the Anthropocene.

V. Anthropocene: An Evolutionary Nonlinear Response

In this section, we seek to demonstrate that the Anthropocene is linked to the emergence of chance by self-organization and increased complexity. Thus, we verified the proximity of our hypotheses with the studies developed linked to Earth Systems Science (ESS).

Defining the Anthropocene is still something very controversial, some consider it from the second world war, others from the Industrial Revolution, others from when man began to cultivate, and therefore ceased to be sedentary.

Thus, in this phase of our research, we will try to demonstrate that the Anthropocene is the result of the movement of exchanges of energy and matter with its means, this being a process and not an end, bearing in mind that the same has been forming over time, where new space-time dimensions, relative to the technical-technological environment of humanity, has been constantly intensifying planetary thermodynamic exchanges.

Therefore, and still seeking to understand the Anthropocene, we verified that this movement, if seen from the process of totalization of each form-content, due to its uniqueness, also demonstrates that it has its flows of exchanges between energy and matter relative to the very specificity of each place and, Therefore, each form-content will have its own thermodynamic characteristic, thus contributing, in a unique way, to the generation of the evolutionary totalization of society-planetary nature.

This means that there is a spatio-temporal evolutionary contribution proper to each form-content. There is the contribution of the areas of agribusiness, in a high degree of energy stress, and also of the areas of low spatio-temporal content of exchanges, where natural systems suffer little or almost no external energy input, such as ecological agriculture. Each one thus possesses a totalization relative to its space (its space-time).

This totalization, whether of the place or the planetary, can be understood from the application of the General Theory of Systems (BERTALANFFY, 1968), and can be visualized, for example, in a similar way to that explained by the Copenhagen experience, because each place collaborates in a unique spatio-temporal way with the totality in its totalization process.

Thus, the totality is here constituted of the society-nature integration, from the syntropy of the natural spheres (hydrosphere, lithosphere, atmosphere, biosphere and cryosphere) with the technological sphere (technosphere), which generates its totalization process. This process, interpreted by the principles of Prigoginian thermodynamics, believes that, depending on the degree of energetic stress that is involved in events that become dynamic, old patterns of natural organization (in any of the spheres) can be broken, generating the appearance of a new level of complexity at random, unexpectedly, reproducing the experience of Schroedinger's cat, explaining, too, the great state of disorder that "populates" the Anthropocene.

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VI. The Anthropocene

The beginning of the debate about the emergence of the Anthropocene occurred in the year 2000, when the Nobel Prize in chemistry Paul Crutzen, popularized the term Anthropocene that had been believed by Eugene Stoemer in 1980. For Crutzen, this new era had emerged from the analysis of air trapped in polar ice, which had a large concentration of CO2 and NH4. These analyses portray the accumulation of these gases, which coincided with the emergence of the steam engine created by James Watt in 1784, and which started the industrial revolution (MENDES, 2020). Therefore, many authors such as Pellogia (2015), relate this time to the beginning of this new geological-ecological era.

In defense of the emergence of the Anthropocene, from the industrial revolution, for Crutzen the pre-industrial societies did not alter in great magnitude the ecosystems nor did their economic and social productive forces alter nature so much (PAULA and MELLO, 2019).

In relation to the Industrial Revolution, we can warn that in the following three centuries the global population increased tenfold reaching six billion. The cattle population has risen to 1.4 million, producing methane gas and about 30 to 50 percent of the planet's surface today is exploited. As well as also, energy use has grown 10 times in the last century, causing 160 million tons of CO2 emission (MENDES, 2020).

To what was put in the previous paragraph, different issues could be raised, therefore, taking into account the constant network exchanges that exist on the planet, when we apply to these data the syntropic logic of the society-nature relationship, we will verify that new and greater energetic exchanges have arisen throughout the planet.

If we empirically verify climate change, and part of the processes that have been resizing old environmental realities, we will observe patterns that are part of a new set of properties, which represent the Anthropocene.

For this reason, and escaping from Cartesian fragmentation, the Anthropocene is energized in a non-structuralist way, but in an evolutionary way involving all spheres of the Earth, including, as Capra and Standl-Rast (1991, p. 11) teach, because there are no parts at all, only "patterns in an inseparable web of relations".

Another characteristic of the new geological-ecological era, and that goes beyond greenhouse gas emissions, is associated with some authors who, to define the Anthropocene, bring the idea of technofossils, resulting from the unprecedented combination of plastics, fibers, metals, concrete and pesticides, among other elements that are presented in the stratigraphy of the planet. For these authors, this characteristic is a direct result of the rapid growth of humanity in number and exploitation of natural resources and that has over the last three centuries grown exponentially (NASCIMENTO, 2020).

As an example, Cerreata et.al. (2019) state that the Anthropocene differs from other epochs because it is a chronostratigraphic unit, and that it is contained completely within human history. The elements generated by humanity have the potential to persist in the long term in the stratigraphic layers, resulting in a robust range of evidence from this geological-ecological period, delimited from the eighteenth century.

In its less structuralist reading, and corroborating our hypotheses, according to Vianna (2019), the new geomorphological landscapes would also be a characteristic of the Anthropocene, because human interference has expanded the surface processes of the relief, greatly increasing the rates of sediment transport, also unbalancing the flow of matter and energy between the continents and altering the surface water resources.

For Vianna (2019, p. 358), different anthropogenic evidences about the relief and stratigraphic layer are also related to various human activities. "Parameters include lake sediments, greenhouse gas concentrations, artificial isotopes produced by nuclear weapon detonations," among others.

For this author (2019, p.356), who relates the expansion of greenhouse gases on the planet with the new geological-ecological epoch, the main characteristics of the Anthropocene would be: "1) appearance and increase of anthropogenic deposits; 2) change in biota volume; 3) geochemical change in sediments; 4) climate change; and 5) catastrophic events."

Human influence on the environment has caused dramatic transformations due to the acceleration of our actions. This generated a series of spatio-temporal discontinuities, which led to the suggestion of the arrival of a new geological-ecological era. In this sense, corroborating our hypothesis, humanity would represent a driving force responsible for the exit of the Holocene and its arrival at the Anthropocene (FIGUEIREDO, et.al., 2020).

It is true that exponential economic growth, which links the development of modern science to Baconian logic and humus economicus, has increasingly made nature a hostage object of its valuation and exploitation. The dynamics of systemic exchanges, which involve the entire planet, ends up raising increasingly intense and achronic reformulations in space-time. They are always linked to much broader biogeophysicochemical processes than the dominant economic system can explain. Syntropy, born of the society-nature relationship, generated a new "natural" evolutionary systemic dynamic, filled with the artificial that became naturalized and that is the question.

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The transition from the Holocene to the Anthropocene represents a radical discontinuity in natural flows, and demonstrates the planet's departure from expected behavior. Cearreta et.al. (2019), also believe that, from the Anthropocene, human action generated irreversible changes on the planet, changing the dynamics of the environment, where its consequences will be perceived for many centuries ahead (MENDES, 2020a).

The new era has, as well as a characteristic, the mark left by humanity on the earth's surface, making it humanized. Therefore, the transformations generated in natural systems, by creating non-existent patterns, also bring new species, structures, processes and natural forms that are installed and evolve, establishing new dynamics of varying proportions and scales (PONTE & SZLAFSZTEIN, 2019).

Affirming this perspective of innovation, generated from human action, Nascimento (2020), referring to the Anthropocene, presents the Covid-19 pandemic as a didactic element, which demonstrates the interdependence of humanity with nature; Drew (2002), states that deforestation is responsible for the emergence of new viruses; Letcher (2021), in turn, links the rise in global temperature to the emergence of Covid-19.

Therefore, our research approaches the planetary systemic view or Earth Systems Science (ESS). This vision involves the natural spheres, associated with the dynamics of the so-called technosphere (MENDES, 2020a).

We thus corroborate the concepts linked to the SSE. The ESS is based on the concept that the planet is a large system interconnected between physical, chemical and biological processes, maintaining complicated relationships that involve feedbacks, with transfer and transformations of matter and energy. Therefore, the transition from the Holocene to the Anthropocene represents a radical discontinuity in natural flows, going beyond linear causality. The technosphere today, for the SSE is hybrid, that is, it has syntropy dialectically integrating society and nature (MENDES, 2020a).

VII. Final Considerations

We live in an environmental panopticon, fed by classical science so intensely that it is already part of a dangerous common sense of reality. Dangerous, because it is necessary to develop research escaping, both from the static sense of space, and in planning from the reading of a linear time. To think of nature as a repetitive and easily controlled element in the twenty-first century is fearful in the face of the necessary dialectical analysis of reality.

Our research found that the Holocene presented a relative stability, linked to little productive energy demand, however, from the last century, probably as a result of the interconnectivity of humanity with nature, increasingly the natural environment presented unpredictable and achronic phenomena, where chance is made, every day, more present in our lives.

The Anthropocene is itself this new reality, which has its genesis, a web of interconnectedness, which goes far beyond global warming and climate change. Being part of the totality, the atmosphere participates dialectically in all mechanisms of exchange, where the energetic demands happen, involving all spheres.

Ayoade (1986) defines climate as the usual succession of weather types and, therefore, the type of weather, is directly associated with different geographical factors, either in macro scale (Latitude, altitude, continentality, maritimity) or in the local scale. Therefore, the climate, being a component of the atmosphere, participates dialectically, along with the other spheres, in the mechanisms brought by the local influence of the technosphere. Where each place, through its arrow of space-time, effectively participates in the general processes of the planet.

Global changes are the result of a dynamic of complex human actions, involving all natural spheres, where the technosphere is a driving and dissipating element, thus generating flows of energy and matter, which have become naturalized, and which are part of our spatio-temporal evolutionary mechanism. Therefore, change is not only climatic, it is dialectically of totality.

In this sense, it is not only necessary to review the production process, adopting sustainable energies and technologies, but, however, to embrace a new scientific and conceptual perspective, which understands the planet as it really is, that is, a continuous spatio-temporal evolutionary mechanism, which self-organizes, determining its future often in an unpredictable way.

Recently, different patterns have been broken, not only climate changes, but ecosystems and water behaviors, have also undergone changes. These changes, even if hierarchical and fragmented, by the common sense of reality, demonstrate the joint evolution, and that has no end, where with each imbalance, a new order of (re)balance manifests itself spontaneously, evolving as a spiral of space-time, developing increasingly asymmetrical arrows.

This new planetary epoch, where disorder, and the generation of new patterns, is more present than in the Holocene, and which already presents empirical data of its existence, we call the Anthropocene.

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By Renata L. Gouveia, Vanice S. F. Selva & Múcio L. B. Fernandes

Federal University of Pernambuco

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Keywords: environmental governance. environment. electric mobility.

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I. Introduction

Climate change is on the agenda of several international debates, because the increase in temperature on the globe ends up intensifying extreme weather events such as floods, droughts, storms, rising of sea levels, among others. According to Vargas (2021), as of the 1930s, Brazil's environmental policy begins to be designed, mainly due to pressure of international and multilateral organizations, such as the United Nations (UN), the World Bank, and environmental movements.

According to Moreno and Ravache (2021) the UN, through the Intergovernmental Panel on Climate Change (IPCC), has been disseminating efforts to mitigate climate changes and its effects. The Archipelago of Fernando de Noronha, located in the state of Pernambuco, presents peculiar characteristics being a place of geographical isolation, therefore ecologically more fragile and vulnerable to climate change.

With paradisiacal landscapes, Fernando de Noronha, the only inhabited island of the archipelago of the same name, becomes a relevant place from the scenic point of view in relation to tourism. It presents significant importance for the conservation of coastal and marine biodiversity, whose necessity for conservation led to the creation of two Federal Conservation Units in this territory – Marine National Park of Fernando de Noronha (PARANAMAR) and Environmental Protection Area (APA) of Fernando de Noronha - Rocas - São Pedro e São Paulo. By presenting these characteristics, it was chosen by the government of Pernambuco to start actions to decrease carbon emissions.

The Noronha Zero Carbon Program, according to Cordeiro and Körössy (2018), was announced in 2013 presenting as perspectives of low carbon on the island, being a pioneer territory offsetting greenhouse gas (GHG). Besides the insertion of electric cars, the program also foresees the replacement of the island's main energy matrix, the diesel. The Tubarão Power Plant, owned by Neoenergia, is the thermoelectric plant that produces and distributes energy within the island, that is the most used energy matrix. Noronha, as the island is called, also has two solar power plants, Noronha I and Noronha II, which supply only 15% of the energy demand needed to supply the island.

Thus, in 2020, Law 16.810/2020 was sanctioned, prohibiting the entry, circulation, and permanence of combustion vehicles within the State District of Fernando de Noronha. Combustion-driven vehicles will be prohibited entering the island from August 10, 2022, and from August 10, 2030, this type of vehicle will be prohibited from remaining on the island. The law makes an exception when it comes to boats, tractors, aircraft, cranes, and vehicles for road paving or airport operations.

This paper analyzed how governance is being conducted in the implementation of the law that provides the insertion of the use of electric mobility within this environment, environmental public policies

Corresponding Author α: Federal University of Pernambuco, Graduate Program in Development and Environment, Avenue Professor Moraes Rego, 1235, Recife, PE, 50670-901, Brazil.
e-mail: renatalaranjeiras@gmail.com
Author σ: University of Pernambuco, Department of Biological Sciences, Road Amaro Maltês de Farias, Nazaré da Mata, PE, 55800-000, Brazil.
Author ρ: Advanced Institute of Technology and Innovation, Road Potyra 31, Recife, PE, 50751-310 Brazil. e-mail: mucio.banja@upe.br

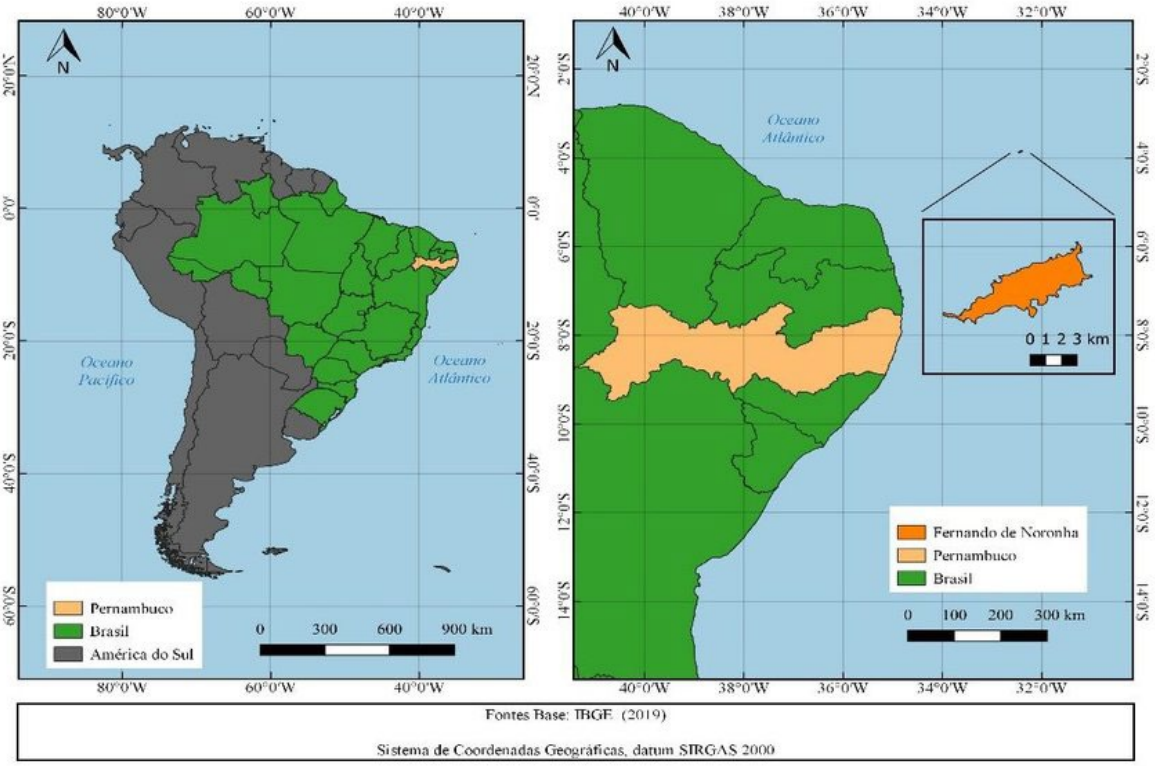
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related to electric mobility within the Fernando de Noronha Archipelago, seeking to understand what environmental and economic impacts this entails. Since the cost of an electric car is high, and importing it to the island places an additional burden on the owners. In light of this, it will be analyzed whether environmental governance, in terms of the attributes of good governance of Bursztyn and Bursztyn (2012), can be met, or at least have the tendency to occur in this place with very peculiar environmental, geographical, territorial, and economic characteristics.

II. Materials and Methods

a) Study area

The research took place on the island of Fernando de Noronha, which according to Cordeiro and Körössy (2018), is a state district with protected areas through two conservation units: the Marine National Park (PARANAMAR), which is of full protection and the Environmental Protection Area (APA) of Fernando de Noronha - Rocas - São Pedro e São Paulo, which presents sustainable use (Figure 1).



Source: https://www.researchgate.net/figure/Figura-1-Mapa-de-Localizacao-de-Fernando-de-Noronha-PE-Brasil_fig1_346854559

Fig. 1: Geographic map of the island of Fernando de Noronha (PE), 2022.

b) Data collection and analysis

In order to analyze the insertion model of a new mobility modal in Fernando de Noronha, this research used the qualitative approach, which according to Gonçalves, Gonçalves and Marques (2021) acts when a problem or question needs to be explored, it is necessary to understand the contexts and scenarios in which the study participants live, listen to their voices and share their stories. For Gonçalves, Gonçalves and Marques (2021), qualitative data collection is part of three main strategies for conducting studies: document analysis, interviews and observation.

The bibliographic and documentary research was one of the research steps in collecting information about electric mobility, solar energy, environmental impact, and social impact. Articles relevant to the theme were surveyed. Were also used the normative documents intended for Fernando de Noronha regarding electric mobility from Federal, State and Municipal (District Council).

The structured interview was another data collection instrument, aimed at understanding the attributes of good governance. The interviews took place in person on the island of Fernando de Noronha, and were conducted by the main author of this article. The interviews were conducted particularly with each selected actor and lasted approximately 40 minutes. All interviewees are residents of the island and were connected to some activity relevant to electric mobility. The interview script followed is available in Table 01.

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Table 01: Principles of good governance by Bursztyn and Bursztyn (2012) related to the interview script used with the social actors involved with electric mobility in Fernando de Noronha (PE).

Principles of good governance		
1. Decentralization	Entry of other actors into the decision-making process, the State no longer being the sole decision-maker	Which sector coordinates the insertion of the Noronha Zero Carbon Law (16.810/2020) in Fernando de Noronha? What other sectors or institutions participate in the management? If yes, how do they participate? Does organized civil society participate in decisions about this mobility change on the island? If yes, how do they participate?
2. Subsidiarity	The State must transfer responsibilities that are in its power as much as possible	What responsibilities does the institution/ association/organization have regarding electric mobility in Fernando de Noronha? Are the responsibilities transferred to other institutions or sectors of this institution? Do you transfer some responsibilities to councils, civil society? If yes, to whom? How do you do it? Does the institution that manages electric mobility indicate any responsibility of this association/ organization in the management?
3. Flexibility	Action instruments taking into account the specifics contexts	How do negotiations occur between the actors involved (institutions, organizations) in the insertion of this new modal on the island? Can everyone give their opinion? Is there room for debate or is everything left to a higher instance?
4. Bottom-up Decisions	Decision-making process occurring from the bottom up	Where do debates and ideas on issues related to electric mobility in Fernando de Noronha come from? Are suggestions from other institutions/ organizations accepted by the managing institution?
5. Participation/empowerment	It is ensured through mechanisms that facilitate access by different actors	How does civil society participate? Are problems identified by the Noronha population with the insertion of this new modal? How does the search for solutions occur? Is there any kind of incentive for the participation of actors in decision-making? How does the association/organization seek solutions to the problems identified in the insertion of this new modal on the island?
6. Belonging	Actors need to take decisions as their own.	Are the interests and issues that civil society considers relevant included in the discussions? Do other institutions and neighborhood associations seek the institution to request actions or contribute to the process of inserting electric mobility? Are they willing to collaborate? Which institutions and/or organizations are involved in the discussions or decisions? Have any of your ideas been put into practice by the government?

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7. Accountability	Provide clarification, provide information, reformulate systems and practices, and ensure the establishment and enforcement of sanctions	Are there resources intended to facilitate the purchase and transport of electric vehicles for residents of the island? How does the association/organization receive or seek information about the insertion of electric mobility in Noronha? Are there participatory ways of social control over these resources?
8. Transparency	Clear information and decisions with communication channels between actors and operators	How are the decisions taken here passed to other institutions (if they do not actively participate in the decision-making process)? And to civil society? What are the existing communication channels on electric mobility? How often does this occur? How does this institution have access to the information and decisions that were taken for electric mobility in Noronha? When does it happens?
9. Security	People are free from any kind of threat	Can you report any occasion where there was any kind of discomfort with the actors involved in the change of modal on the island? Do residents feel comfortable with this change within the island?

Source: Adapted from Bursztyn and Bursztyn (2012)

Were defined 10 social actors with relevant connection to the object of study of various segments for the application of the interviews: public authorities (administration, NGOs, district council, school), association of buggy drivers, association of taxi drivers, inns owners, artisans' association, dive operators and tourist receptive. All interviews were audio recorded with the consent of the interviewee, respecting their anonymity in the face of the speeches.

Aiming at interpreting the interviewees' statements, the methodology proposed by Bardin (2016) of content analysis was used, which takes place through three processes: (1) pre-analysis (systematizing the initial ideas, organization); (2) exploration of the material (coding, decomposition or enumeration operations); (3) treatment of results, inference and interpretation. To maintain the anonymity of respondents, they will be represented throughout the results with the codes contained in Table 02.

Table 02: Code of respondents on the island of Fernando de Noronha (PE).

Respondent code	Respondent's gender	Representation sector
EPP01	Female	Public Authorities
EPP02	Female	Public Authorities
EPP03	Male	Public Authorities
EPP04	Female	Public Authorities
ESC01	Female	Civil society
ESC02	Female	Civil society
EEP01	Female	Private company
EEP02	Male	Private company
EEP03	Male	Private company
EEP04	Male	Private company

III. Results and Discussion

When it comes to environmental governance, according to Bursztyn and Bursztyn (2012, p.166) it can be considered as "the set of practices involving institutions and interfaces of actors and interests, aimed at conserving the quality of the natural and built environment, in line with the principles of sustainability". For Silva et al. (2022, p.15) environmental governance relates to "interventions aimed at modifying incentives related to the environment, knowledge, institutions, decision-making and behavior".

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When thinking about electric mobility, environmental governance, characterized by Jacobi and Sinisgalli (2012), aims to encompass each and every one about the decisions involving the environment in order to obtain broad and unrestricted adherence to a given project that comes to contribute with the maintenance of the planet's integrity. For Fonseca and Bursztyn (2009, s/p), "governance is a key term in the implementation of environmental and development policies".

This multiscale nature brings the challenges that need to be overcome through coordinated actions between society and the State, in the pursuit of sustainable development (ADMS et al., 2020). Thinking about the definitions cited by the authors above, each of the principles of good governance related to the insertion of electric mobility in Fernando de Noronha will be discussed.

The *principle of decentralization* acts in the insertion of new actors in the decision-making process, so that decisions can be taken by more people. Thus, the State would no longer be the sole decision-maker. When questioned about this principle (the guiding questions can be seen in Table 01), the answers were not unanimous among the interviewees. Some feel that their sectors are included in the discussions, being part of the process, while others are unable to assert their opinion, as can be seen from the interviewees' statements:

"Yes, usually as a consultant. Ask what we think, we try to express ourselves. Our opinion is not always accepted (EEP02)".

"It is directly linked to the administrator, it goes through some things through the Environment sector (EPP02)".

"As far as I know, from these meetings that they are having, but previously what happened was within that initial policy of insertion of some vehicles, the companies entered as participants in relation to the adhesion and inclusion of these vehicles in the routine (EEP01)".

"No (EEP04)".

"Yes, both from the law and from the decree. The decree is ours, from district, and then we made it, the law is almost a mirror image of it. In the discussions in the district government itself, we said to the government staff, the government deputies, you have to leave a provision there that if it arrives in 2022 and the thing is not in conditions, we try to extend it. And that was it, this mechanism remained because the people of the island have to do their duty, but the government also has to do its own (EPP03)".

"But our association, for example, is not being asked for an isolated opinion, but rather collectively, together with the population (EEP03)".

"In no way, nor was it consulted, nor was it informed about any activity (ESC01)".

According to Gouveia (2019, p.22), governance "has as its main point the decentralization of power, the State no longer governs alone and relies on other actors (private companies, NGOs, Universities, organized civil society) that will collaborate in the decision-making process. It is important in this process that users of electric mobility can understand the positive impacts of its implementation and also be decision makers. Fernando de Noronha, being an island, a closed and complex system, becomes a very interesting case for the applicability of a new mobility modal.

For Bursztyn and Bursztyn (2012, p.169) some aspects can be credited to the local institutional capacity that facilitate the principle of decentralization: "qualified government personnel; clear, legitimate and effective rules; social control mechanisms (accountability); and instances of sovereign participation of society in government decisions".

Regarding the *principle of subsidiarity,* it was noted that the principle is not visible within the management of electric mobility on the island. The only agency that claimed to have some responsibility from the administration was the Department of Environment. This principle acts in the transfer of responsibilities that were in the hands of the State to society or companies. This department has the task of enforcing the electric mobility decree, through actions that make it possible through The Noronha Zero Carbon Program, which aims to zero carbon emissions on the island by the year 2030.

The principle of *flexibility,* for Bursztyn and Bursztyn (2012) takes away the rigid and bureaucratic structures, replacing it for more flexible instruments of action adapted to the context in which it is inserted. The place for the biggest debates on the island is in the District Council, which according to Pernambuco (1995, art. 42) may constitute, through resolution, permanent or temporary commissions for the analysis and appreciation of specific matters of interest to the State District of Fernando de Noronha and the island population, as provided in the Internal Regulations".

In the interviews, it was noted that a large portion of the population, even with this instrument, did not feel heard by the Public Authorities, especially in the sense that the deadlines and subsidies for the purchase of electric vehicles were not negotiated, taking into consideration mainly the time when the entire fleet should become electric.

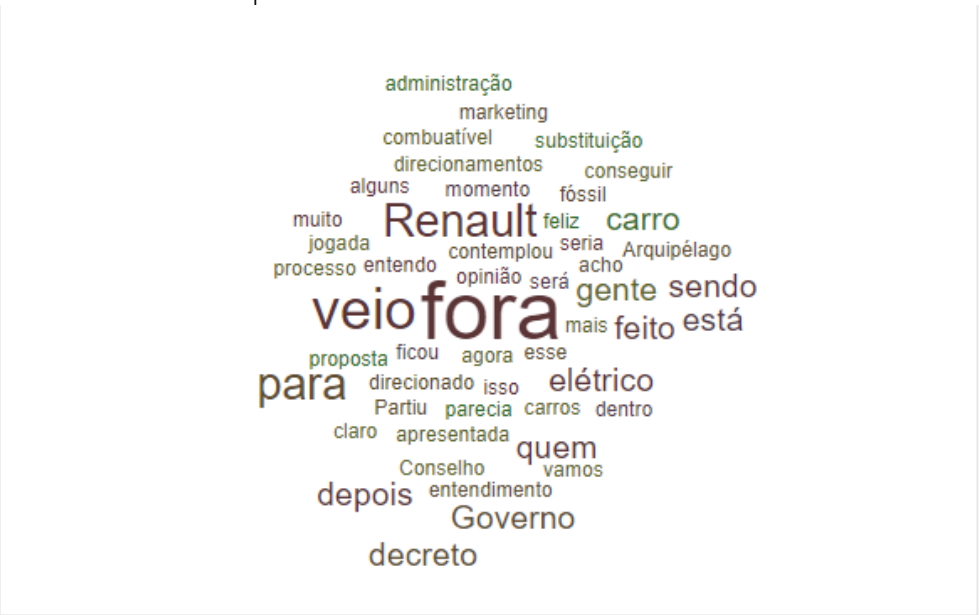
As Calame (2004) affirms, states usually tend to be above society, even though they are expressions of it. The idea of an egalitarian dialogue is still a reality far removed from the community, the institutional mechanisms often seem incomprehensible to the community and their aspirations lose their validity for governments.

The *bottom-up decision-making principle* works so that the decision-making process can occur from the bottom up, coming from the community, with its desires and points of view. According to Ildi, Silva and Brasil (2022), in Brazil, public hearings and consultations are the main mechanisms for the operationalization of

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popular participation, but these are still top-down models, as information comes from experts to the public. It is necessary that the dissemination and public contributions are carried out within the process.

It can be seen through the word cloud (Figure 2), how this principle was detected in the research *locus* when it comes to electric mobility.



Source: Elaborated by the authors based on: https://worditout.com/word-cloud/create . Most relevant words from the interviews: outside (fora); come (veio); Renault; electric (elétrico); government (Governo); decree (decreto)

Fig. 2: Word cloud from the speech of respondents representing the bottow-up principle, 2022.

There is a higher incidence of the word "outside" (in Portuguese: "Fora"). The residents of the island refer to the mainland as "outside" because the decisions are not being made on the island; therefore, it can be understood that decisions tend to come from the mainland to the island and do not meet the wishes of the community.

Residents were not consulted about the insertion of this modal on the island; therefore, it is necessary to pay attention, as stated by Edgar, Marshal and Basset (2006), the decisions taken by institutions need to seek to serve all interested parties, besides producing results that meet the needs of the collectivity.

The principle of *participation/empowerment* of civil society is quite interesting, because according to Gouveia (2019), public policies related to the environment, being created from governance structures, will allow to serve local communities, as they can be part of part of the decision-making process, through their representatives. This can occur through the adoption of good governance practices, where policies can be created stronger and effective to face the problems.

> *"Generally speaking, the population is heard when it is encouraged to be heard. It is in the District Council Chamber, which is like our City Council, they are the voice of the people. So, when we really need the population to be heard, we go to them and ask for a hearing, then we have the plenary, and we give the information we are looking for, so to speak (EEP03)".*

> *"It doesn't happen, it doesn't. Not even the District Council does this function of intermediating, although there were some meetings there that they called, I didn't participate, I couldn't say, but I think the council called to ask something (ESC01)".*

According to Indi, Silva and Brasil (2022), popular participation requires operationalization, which is formed through participation methods, procedural instruments, mechanisms or tools to promote public engagement. This is not just about planning for urban mobility, but about planning in general. According to Alves (2021, p.5) "Social participation in issues that may significantly impact their lives is a corollary of the Democratic Rule of Law".

In the principle of *belonging,* actors need to assume decisions as their own, but for that they must be heard and put into practice what is expected of the popular voice. When asked if the segments feel heard by the government, the following responses can be analyzed:

> *"No. There was a meeting recently and this board now went to get some information to find out how it was going to be. Things here went downhill this year, there were some meetings, but the issue of electric cars was treated as if it was nothing, this is not going to happen now, and suddenly it happened, it arrived and now everyone is a little upset (EEP02)".*

> *"Yes. From the moment the subject is raised, they listen to what is being brought (EEP01)".*

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"No. What was done was a meeting with the entire population and not with the segments and a verdict was reached. But not even in this verdict that we reached, everyone is in a consensus, not even that was heard properly. When the decree came out, nothing contemplated the wishes of the population (EEP04)".

"She is heard, in quotes like that... he doesn't stop communicating, because if he doesn't announce something, it hangs on them too later, you know? (ESC02)".

"I'm sure that the wishes reached them, so far as it's still on the deadline, let's say, nothing has been done. So, until then, the fight is: extend this, extend this norm, extend this law because it really isn't possible now and we also want a counterpart in the improvement deadlines, not only on our side, but a counterpart deadline for those who are trying to change the island too (EEP03)".

The sense of belonging is fundamental for the effectiveness of the activities, since "the triggering point of citizen autonomy must be permeated by the promotion of values and critical educational processes oriented towards sustainability and the appreciation of local environmental characteristics and potential" (SANTOS and FREITAS, 2017, p.1633). Thus, when asked if what was requested and discussed with the civil community went from the discourse to practice, the following answers were obtained:

"Let's put it in this way: part of it yes, some part no. Because I also imagine that what we bring is a desire, a look, but it's not always what's there in their reality as a government, right? So, when they are provoked, they listen in some way and part is answered and part is not (EEP01)".

"No. None. In this universe that we live here in Noronha, there are many well-meaning people. But this issue has been politicized, and then interests are moving slowly, attitudes are very timid. I think it should be more aggressive about it. Starting from the Government, from an Autarchy, which would be the Secretariat of Technology and the Environment and using Noronha as a pilot, a model for us to test how far it will work, to be able to replicate this model in the entire state. Noronha should be a barn for this (EEP04)".

The deadline for the changes is a point much questioned by island residents. In Europe, the insertion plan for electric mobility implemented by the European Institute Smart Cities – SETIS, was 10 years, taking into consideration that European countries are developed, in addition to incentives for purchase such as subsidies, tax deductions, among others (SOARES, 2012). According to Reia (2018) in a survey carried out on the island of Corvo (Azores, Portugal) it is essential to have government incentives for the acquisition of electric vehicles, at least while it is still a more expensive technology than the conventional ones.

In the principle of *accountability,* it is emphasized that "can be used traditional mechanisms, such as audit courts, ombudsmen, controllers and employee codes of conduct, but also participatory forms of social control (BURSZTYN and BURSZTYN, 2012, p. 172).

It was not observed in the interviews by the respondents, any form of social control over the resources destinated to the insertion of electric mobility on the island. Therefore, they were asked if there was any kind of incentive for the acquisition of vehicles.

Respondents report that the incentives were in relation to the authorization letter for the entry of the car (see the following reports). On the island, only a few residents have the right to own a car, due to local weaknesses. These people, in addition to buying the car on the mainland and paying for the freight on the ships, need to "have" (buy) the license.

"I know that the administration authorized, if I'm not mistaken, 100 authorizations for the acquisition of electric vehicles, but then I don't know who were these people (EPP01)".

"Until now, the only incentive we've had was through authorization. The car only enters the island through an authorization, it opened 150 [authorizations], and then obviously the one with the longest time living on the island was contemplated. They did not set a criterion, anyone who had a permanent card could sign up (EPP04)".

"I don't think there is, that's why I even proposed it there today, because there has to be some subsidy and counterparts through companies, right?! Which vehicle manufacturing companies are going to sell the cars here? Is it one? Are several? Who defined it? Who chose which company? How is this process? We don't know either (ESC01)".

An electric car has a higher purchase price than a conventional one (internal combustion) and residents ask about an incentive, financing, help from the State to acquire a good that can often reach the value of an apartment on the mainland.

"[...] doing its best to get a car, but let's say, the car she's looking for is at least 180.000 BRL, 180.000 BRL is very expensive, it's a tiny SUV that even looks like a popular car, it really is a very big individual effort, it is a financial sacrifice (EEP03)".

"You have to have an incentive from the government. I'm not just talking about social freight, there has to be some kind of financing, special credit for that person to be able to invest that amount. The social freight is you don't pay to bring the car by ships, but close to what could be done, it's very little. We see that other places are much more advanced than us in this discussion, the local government, for example in London, we see those taxis that are famous. The government has financed, it has given a portion of approximately 40% of the value of the vehicle for the driver to switch from fossil combustion to electric (EEP04)".

This fact raises another debate: island's infrastructure. The island has the smallest Federal Highway in Brazil, the BR-363 with 7.9 km in length and the other accesses to the beaches and other areas of the island are made by dirt roads. These roads are in poor condition on dry days. On rainy days, it is even dangerous for certain types of vehicles to reach the beaches, such as Praia do Cachorro located in Vila dos Remédios, the busiest area of the island. Residents

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claim that the electric car is more fragile, as its battery is located underneath the car, making it an easy target for potholes on the roads.

There are great environmental benefits that the implementation of electric mobility will bring to the environment. According to Dourado (2016), electric vehicles differ from vehicles powered by gasoline or diesel, as they use an electric motor instead of an internal combustion engine that runs on fossil fuels, which emit GHGs into the atmosphere, contributing to global warming.

Besides being non-renewable natural resources, fossil fuels also release into the environment high rates of carbon dioxide (CO_2), a gas that contributes to the increase of the greenhouse effect. For Novais (2016) the transportation area is responsible for 23% of CO_2 emissions on the planet, showing a tendency to reach in 2050 emitting 50% of this total if nothing is done about it. To meet the target, drastic actions will be necessary, especially in the transportation area.

The population understands and supports this need, however, what has been generating greater discomfort is the timeframe for this to occur and the island's infrastructure, which needs to be quickly improved.

In the principle of *transparency,* information needs to be clear and there must be efficient communication channels. This is a principle that works within the island, taking into account mainly the "WhatsApp" channel. But in addition to this, the radio on the island is also a mean that is widely used by everyone when it needs to be publicized, as can be seen:

> *"The government releases. Put it on their social media, in the Federal Register and so on... (EEP03)".*
>
> *"There is the Golfinho Comunication System, which has the programs, they do the reports we end up knowing, then the moment comes when it is formalized and we know that it was formalized, but... when they put it on the communication system they say: such a thing happened, such a thing will happen, but they don't ask: what do you think about such a thing? (ESC01)".*
>
> *"They have TV Golfinho and the radio, which are channels that they use and that we watch, but in general also through WhatsApp, through the existing communication groups that they also participate with the community (EEP01)".*
>
> *"They use social media, Instagram messages, messages that are shared on WhatsApp and we find out (EEP04)".*

It can also be observed that normally these channels are used when the "fact" has already happened and not to call people to moments of debate. The island also has an official website (https://www.noronha.pe.gov.br/), where news is formalized by the Administration.

Luna et al. (2019, p.2) points out that "the change to electric cars is not simple and requires profound changes in society, such as the creation of new supply chains, charging infrastructure, technological improvements in batteries, changes in people's behavior, among others".

Another factor that also demands debate in mobility is the use of charging stations that are directly connected to the grid, without an interconnected photovoltaic system. Well, there is no point in using electric vehicles if the source of energy generation is diesel, a non-renewable fossil fuel that releases gases that intensify the greenhouse effect. According to Dourado (2016), energy is the basis of the economic development of any country and therefore has a vital importance in world economies.

The use of energy considered clean, reduces the environmental impact compared to other forms of generation. Speaking of electric mobility, solar energy is the most popular for vehicle supply systems. There is no point in using electric cars if they are supplied through an energy matrix that is not clean.

According to Nascimento (2020), the generation of photovoltaic solar energy occurs through the conversion of solar radiation, so the solar panel is formed from a photovoltaic cell with semiconductor materials. It is inside the cell that the conversion of solar radiation into electrical energy takes place. This type of production has been growing and is a promising clean and renewable technology for generating electricity.

It is necessary to strengthen the generation of energy from renewable sources, just like Noronha, the Galápagos Island only has 15% of its generation coming from clean sources of energy generation (PIZARRO, 2021). A study carried out by the WWF (2021) in Fernando Noronha, pointed out that electric vehicles will emit more CO_2 than internal combustion models with ethanol on the island, if the energy matrix is not changed to a clean matrix.

In a country marked by great social differences, it is essential to guarantee the *principle of security.* It could be public, social or food security. As it is an island, cases of violence, robberies are not common, but even so, social inequality is evident. When asked if there has been any discomfort in relation to electric mobility, the following reports can be seen:

> *"Not yet. There was a delay due to the pandemic, many people were unable to put into practice what was planned, but no one has been harmed so far (EEP04)".*
>
> *"No, it didn't. There was, like, general dissatisfaction like all things that come like this... they complained... ah this was imposed, no one asked us, it comes from the top down, so there is always this same complaint. And in the case of electric cars too, mainly a very big reaction is that there are dates to carry out the acquisition of a good that is very expensive and that people don't have money and to make things worse, there was the pandemic, so it is difficult, right?! so much so that now they will try to make these deadlines longer (ESC01)".*

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"Yes, they comment that on certain roads that we have here, many of them are muddy, and they say that in the mud, when it rains, it doesn't perform well. And since the battery of these cars is underneath it, and the most popular ones are low, they fear that it will be hit. In the meetings things were difficult too. They protested inside the Council (EPP03)".

According to the Intergovernmental Panel on Climate Change (IPCC, 2022) global warming in the short term will continue to cause damage to plants and animals, may move their geographic ranges. Without urgent and deep emissions reductions, some ecosystems will face in the coming decades temperatures beyond their historical levels, as for example in the polar regions. These temperature rises leads to mass death of trees, corals, reef bleaching and large declines in species. Thus, as corroborated by Artaxo (2020), ecosystems are greatly affected by climate change in all spheres (global, regional and local).

Thus, it is important to consider that the use of electric mobility will bring several environmental benefits to the region, mainly because Fernando de Noronha is an island with a highly regarded environmental attraction that needs preservation. However, this modal change needs to be accompanied by planning so that the energy generating on the island is also modified and can achieve effective sustainability on the island.

IV. Conclusions

The research indicates that there is evidence of the use of the following principles of good governance: decentralization, transparency and security.

The principles subsidiarity, flexibility, bottom-up decisions, participation, belonging, and accountability tended to distance themselves from electric mobility according to the survey participants.

It is reflected that the residents are aware of the benefits of the island's transformation to electric mobility, but point out some difficulties such as: the cost of obtaining the car, the short time to acquire the vehicle, the precarious infrastructure of the island, and the use of a thermoelectric plant powered by diesel as the energy generator in that area.

In order for the island to become truly sustainable, it is necessary to increase photovoltaic generation, both for supplying cars and for homes and commercial establishments, and for this to occur, planning should have taken place before the purchase of electric vehicles by the population in detriment of internal combustion vehicles.

Thinking about sustainability is also thinking about the population that experiences this reality: it is necessary to identify and try to remedy existing local difficulties presented by residents in search of balance with environmental, social and economic aspects.

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Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.

Figures

Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

Preparation of Eletronic Figures for Publication

Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

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Tips for writing a good quality Social Science Research Paper

Techniques for writing a good quality homan social science research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of homan social science then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.



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7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

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11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

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14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.
Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

19. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

20. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

21. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

22. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.



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Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.



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Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."



Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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