

EXECUTIVE SUMMARY

HEALTH, ENVIRONMENT AND SUSTAINABILITY COLLECTION

ENGLISH



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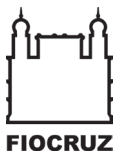
FIOCRUZ SERIES – INSTITUTIONAL DOCUMENTS

Health, Environment, and Sustainability Collection - Executive Summary

EXECUTIVE SUMMARY

HEALTH, ENVIRONMENT AND SUSTAINABILITY COLLECTION





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PRESENTATION

This document is an Executive Summary of the Health, Environment and Sustainability Collection, of the Fiocruz Series - Institutional Documents¹, prepared by the Vice Presidency of the Environment, Health Care, and Health Promotion (VPAAPS), which includes eight volumes and presents the historical background of the Oswaldo Cruz Foundation (Fiocruz) of producing and searching for integrated knowledge in health, environment, and sustainability (HES).

We propose to briefly describe some of the important processes of this trajectory that led to the formal delimitation of this field, the political-institutional restructuring of Fiocruz in the face of new paradigms that articulate health, environment and sustainability, and the development of institutional devices and strategic projects.

To this end, this publication aims to provide results for Fiocruz as a Pan American Health Organization / World Health Organization (PAHO / WHO) Collaborating Center for Public Health and the Environment.

The document is organized in three parts. The first recovers the content of volume 1 - History and Governance - of the Health, Environment, and Sustainability Collection that presents some of the historical milestones that contributed to determining health and the environment as pillars for a thorough review of scientific work and as a conceptual and methodological basis for new forms of production more integrated with the environment and sociocultural diversity. A new understanding of the relationship between the environment, health and sustainability and the crises of the hegemonic model of development, production and consumption that has been demanding both a political-institutional repositioning of Fiocruz, and guides its projects through integrated approaches in the most different dimensions and scales. Also, this process is based on the autonomy of the researcher in teaching, research, extension, and technical-scientific cooperation.

1 Available on <https://portal.fiocruz.br/vpaaps-ambiente>

The second part of the text emphasizes the themes of the Health, Environment, and Sustainability Collection presented in volumes 2 to 8. Considered strategically relevant, the collection produced has a broad participation of institutional representation, under the coordination of the Environment area of the Vice Presidency for the Environment, Health Care and, Health Promotion (VPAAPS). These documents aim to contribute to the production, dissemination and sharing of knowledge, training, and technologies, in order to consolidate the Institutional Health, Environment and Sustainability Program (FioProsas) of Fiocruz, especially those that aim to strengthen the Brazilian Unified Health System (SUS).

The collection is an important mechanism for the theoretical-conceptual organization and proposals for actions to confront the transformations in the HES field in Brazil and in the world. Result of debates and internal reflections of the Institution, the published volumes specify the essential topics for the formulation and implementation of a broad research agenda in HES, as follows: Pesticides and Health; Biodiversity and Health; Climate, Health and Citizenship; Large Companies and Health Impacts; Sanitation and Health; Health of rural, forest and aquatic people and populations; and occupational health. Each of these topics is briefly described in this Executive Summary, valuing the effort of the Fiocruz work and research groups with intense mobilization in the preparation. The proposal of having an Executive Summary of the collection is to promote interdisciplinary dialogue with the regional and international scientific community, contributing to the work of public managers, health professionals, academia, and social movements, while indicating ways to face new challenges proposed by the HES field.

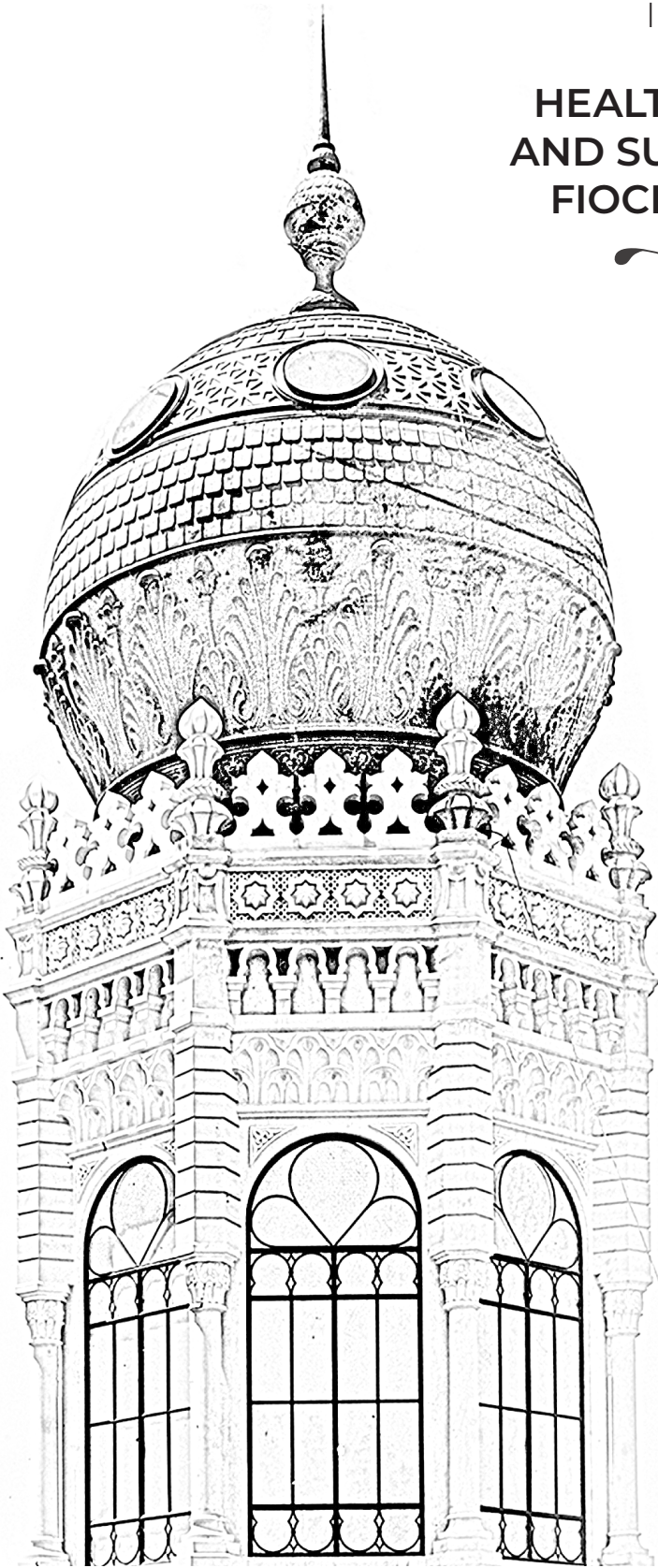
The third part of the document proposes to give visibility to the activities carried out by Fiocruz as a PAHO/WHO Collaborating Center (CC) in Public Health and the Environment, mainly in terms of actions and programs that are articulated and aligned with the 2030 Agenda of the United Nations (UN) and the Sustainable Development Goals (SDG).

A series of works, instruments, and programs are listed and some actions that have the collaboration and cooperation of other scientific institutions, government and social movements are discussed. We aim to point out health, environment, and sustainability issues that challenge society and require efforts and permanent mobilization.

Guilherme Franco Netto

INTRODUCTION

**HEALTH, ENVIRONMENT
AND SUSTAINABILITY AND
FIOCRUZ TRAJECTORY**



The field of Health, Environment and Sustainability is closely related to the social and environmental changes that society has experienced, especially throughout the 20th century. However, it acted mainly as a response and an attempt to understand the ongoing economic and social crises of capitalism, which began to produce effects at different spatial scales, and which demand a new way of approaching production processes, with the consumption of natural resources and the perverse effects of globalization on populations, territories, and ecosystems.

In the 1970s, a wide discussion began in the world between the nation states, the scientific community and civil society about the challenges imposed by the global economic system and its externalities. People recognized that the development model in vogue until then had been producing significant negative impacts on the environment and the health of peoples and territories, compromising development and future generations. However, the international political agenda advanced incorporating new trends and phenomena on a global scale, such as the accelerated pace of urbanization; rapid demographic growth and transitions; increasing inequalities, poverty and malnutrition; the depletion of non-renewable natural resources; and the deterioration of the environment (NETTO; VILLARDI; ALMEIDA, 2018).

In 1972, the First United Nations Conference on Environment and Development was held in Stockholm, Sweden (UNCED, 1972) in which man and the environment were also discussed to build an international pact. This meeting became the first worldwide effort to try to organize new relationships between man and the environment. In turn, the Declaration of Alma-Ata, in 1978, and the International Conference on Health Promotion (Ottawa Charter), in 1986, established primary care and health promotion as fundamental factors to improve the quality of people's lives, responsibilities which are no longer limited to the health sector.

In Brazil, the VIII National Health Conference (1986) incorporated a series of elements related to the living conditions and environment of the populations in Public Health. The Health Reform Movement (MRS) gained strength in this struggle for paradigm change, bringing as a central proposal the reorganization of the Brazilian health sector, a process that supported the inclusion and

approval of what would be the bases of the Unified Health System (SUS) in the 1988 Federal Constitution.

The SUS legal framework regulated in 1990¹ (BRASIL, 1990) incorporated the importance of the social and environmental determination of people's health, with universal access, equality, comprehensiveness, social participation, decentralization, regionalization and hierarchical organization in the structure of the system as central principles and guidelines.

The Second United Nations Conference on Environment and Development (UNCED), known as Rio-92 or ECO-92, besides consolidating the global movement in defense of biodiversity, with the signing of the Convention on Biological Diversity (CBD), broadened the understanding of the needs for sustainability encompassing other mechanisms, such as the Climate Convention and the Cartagena Protocol. It also articulated other areas of life, such as education and economic development, it established links between technical production and legal references in HES. Health was thus recognized as a precondition for sustainable development at the Third United Nations Conference, known as RIO+20, with a commitment agreed in 2015, when the Sustainable Development Goals (SDG) Agenda, called Agenda 2030, was established and in which health is the third goal among the 17 SDGs.

At FIOCRUZ, these guidelines contributed to scientific production in health and an environment of international repercussion, fostering an important collaborative network in the country and, as a guiding line, the strengthening of the public health policy, consolidated in the SUS. The Institution's trajectory is intertwined throughout this historical process, acting in the strengthening through research, teaching, and knowledge production programs, creating bridges between health the environment.

This framework reaffirms FIOCRUZ as a strategic public institution of the State, which seeks to overcome the biomedical model and the traditional way of thinking and acting of classical epidemiology that restricts the social dimension

1 Laws nº 8.080 and nº 8.142/1990.

in determining the health-disease process. In other words, it is insufficient to prioritize and articulate improvements in living conditions, work and social structures (FIOCRUZ, 2018a).

Because of this international HES experience, FIOCRUZ was designated as a Collaborating Center for Public Health and the Environment of the Pan

American Health Organization / World Health Organization (PAHO/WHO) in 2010. The Collaborating Center (CC) operates as a disseminator of knowledge on a regional and global scale; mobilizes practices and technologies of different aspects; promotes the exchange of information and actions and regional and international technical cooperation; and supports the strengthening of HES networks.

This framework reaffirms FIOCRUZ as a strategic public institution of the State, which seeks to overcome the biomedical model and the traditional way of thinking and acting of classical epidemiology that restricts the social dimension in determining the health-disease process. In other words, it is insufficient to prioritize and articulate improvements in living conditions, work and social structures

(FIOCRUZ, 2018a).

In 2018, this role as CC was renewed for a new cycle (2018-2022), with FIOCRUZ now coordinating the scientific production that aligns the processes of socio-environmental determination of health with the 2030 Agenda of the SDGs. The following attributions established for the Collaborating Centers in this new period stand out: collaborating in the expansion of the network of Collaborating Centers in the Americas and the Global South axis; advise PAHO/WHO on the development of social technologies, diagnoses, and specific methodologies; offer technical assistance in Geographic Information Systems and

other informational tools for monitoring data related to environmental, climate, and health surveillance.

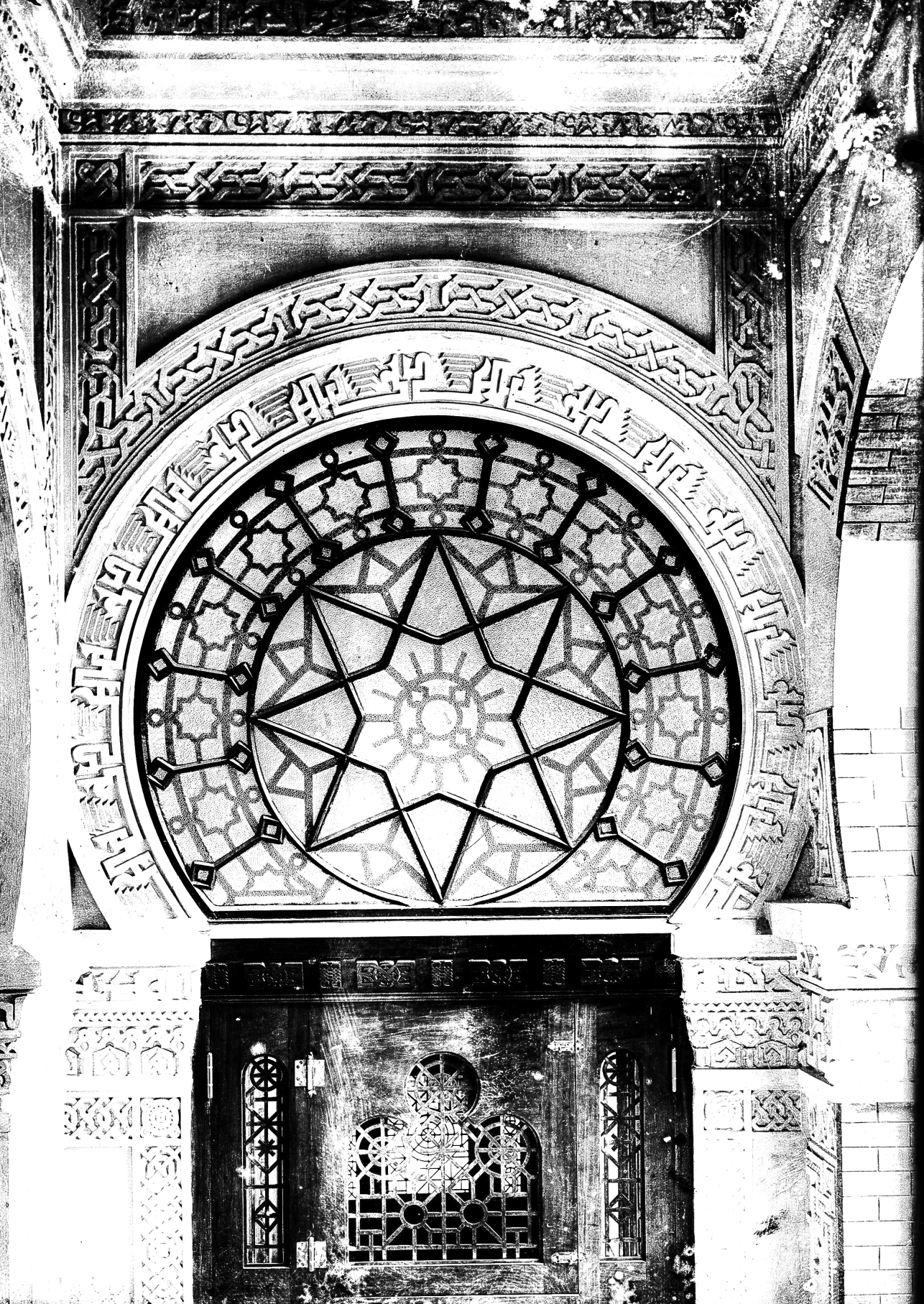
Another key point was the prerogatives and deliberations of the VI Internal Congress of FIOCRUZ², held in 2011, ratified by the VII Internal Congress (2014), which established that the HES are pillars in the institution's performance. This decision began to support the consolidation of the Institutional Health and Environment Program and the holding of several meetings and seminars on the subject of HES.

Finally, at the VIII Internal Congress of FIOCRUZ, held in 2017, the 2030 Agenda was recognized as the most comprehensive international benchmark, with the ability to mobilize values, guide sustainable development models, build technical cooperation, becoming an important benchmark for the medium and long-term research agenda of the Institution.

As mentioned in the PRESENTATION to this text, the different workshops, with the presence of several experts, researchers and managers, produced and validated important institutional documents. In the case of the in Health, Environment, and Sustainability Collection, its themes represent the accumulation of knowledge in these fields of action, which allows us to locate the "institutional state-of-the-art as of 2018", combining content and accumulated reflections on each topic addressed. Also, they cover a wide range of HES structural elements and open a dialogue with the SDGs. The prerogatives of each topic guide the fundamental guidelines for the production of knowledge, joint efforts, and political mobilization around the 2030 Agenda.

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2 The Internal Congress is the highest representative body of the Oswaldo Cruz Foundation community. It deliberates on strategic matters related to the institutional macro-project, on internal regulations, proposals for modifying the statute, and on matters of strategic importance for the Institution's management. The powers of this collegiate body are explained in the Statute of FIOCRUZ (FIOCRUZ, 2021).



HES THEMATIC AGENDA



Among the HES devices, the Health, Environment and Sustainability Collection has become an important contribution to the interdisciplinary debate on the future and challenges of this field. The series organized around the seven strategic themes mentioned above addressed and described the main concepts, legal frameworks, programs, and benchmark research for each theme.

Besides Volume 1, History and Governance (NETO; VILLARDI; ALMEIDA, 2018), the publication gathers several technical efforts, historical initiatives and the entire scientific production of Fiocruz, which allows us to present a broad idea of HES complexity. In this part of the text, we establish some excerpts regarding the entire collection. We will shed light on two main dimensions, namely: i) the conceptual bases; ii) and the specific structural challenges of each. It is proposed to create links between concepts, deadlines and public policies to contribute to the debate. At the same time, the reader is invited to search for new content and details in the original documents¹.

¹ Available on <https://portal.fiocruz.br/vpaaps-ambiente>

1. PESTICIDES AND HEALTH

1.1 Conceptual bases and historical milestones

The topic “pesticides and health” is directly associated with the monoculture-based export production model. This hegemonic characteristic is centuries old in Brazil, but it has been acquiring new contours in recent decades. The boom in agricultural commodities accentuated the structural problems generated by Brazilian agribusiness, based on the overexploitation of natural resources and technological processes that have been unsustainable over the decades.

This model is marked by deep social and environmental injustice, driven by the so-called Green Revolution, responsible for the concentration of land in the hands of few owners and the advance of the modernization of agriculture that feeds on the intensive use of agricultural inputs. Also, the widespread use of pesticides has become one of the main causes of illness and death among rural workers (GURGEL *et al.*, 2018).

The authors warn about the fact that the expansion of pesticide consumption in the country was supported and financed by the Brazilian State (PORTO; SOUZA, 2011; PAULO NETTO, 2012), besides tax subsidies and a wide offer of bank credit, the relaxation of the rules of production and labor relationships, the introduction of new chemical and transgenic inputs into agriculture, and rural mechanization, which socialized the effects of this transformation. In this context, the populations with the greatest socio-environmental vulnerability are the most affected due to their class, gender, ethnicity, or particular territories.

As an example, in 2015 alone, 887.6 thousand tons of chemical inputs were sold in Brazil (SINDIVEG, 2016), a direct result of the advancement of this model, which increasingly seeks favorable conditions for its expansion in the countries of the southern hemisphere. Actually, what has been seen in recent years has been the expansion of its borders on ecosystems and environments, including those protected by specific legislation, such as the Legal Amazon areas.

One path that has been taken as a confrontation by social movements and researchers on this issue is the review of the process of knowledge production and who it serves (CARNEIRO *et al.*, 2015). In other words, science itself must be challenged in the sense that it has been playing a central role in legitimizing the interests of large economic agents and corporations linked to agribusiness, mainly due to several changes in the environmental legislation, the weakened surveillance protocols, and research aimed at promoting and approving the use of pesticides and transgenic plants.

In other words, science itself must be challenged in the sense that it has been playing a central role in legitimizing the interests of large economic agents and corporations linked to agribusiness

1.2 Main challenges and problems

We have two challenges to face the advance of financial capital over the inland and forest regions: 1) the influence of industry and agribusiness in the legal regulation of the production and consumption of transgenic products and chemical inputs; and 2) the conniving action of the academic community around the production of information and data that seek to legitimize the increasingly extensive use of pesticides and genetically modified organisms.

There is a conflict of interest that traverses the decision-making spaces and, at the same time, blocks the political participation of social movements, rural workers, and traditional peoples in the spheres of power and the legislative bodies that generate the regulatory mechanisms of agricultural, livestock, and land production. The clash between the main polluters and the institutions and groups that advocate for social and environmental justice is inevitable and has revealed the condescending role of regulatory agencies with the interests of capital (GURGEL *et al.*, 2018).

The State must prevent the risks and harm of new products, technologies, and companies. However, oversight bodies are often pressured by large corporations

who use a false neutrality of science to develop standards and methodologies to be used in the registration and monitoring of dangerous products.

Studies show that the market for transgenic pesticides and seeds in Brazil (PELAEZ, 2012) and globally (MEGA, 2015) is increasingly concentrated and mostly controlled by six multinationals: Bayer, Syngenta, BASF, Monsanto, Dow AgroSciences, and Dupont. In the case of transgenic plants, they represent a commercial strategy for the combined sale of two products from the same company: Genetically Modified Organisms (GMOs) and chemical inputs.

The addition of GMOs in a plant community, for example, can produce undesirable effects, such as the displacement or elimination of non-domesticated species; the exposure of species to new pathogens or toxic agents; genetic contamination; the erosion of genetic diversity; and the interruption of the recycling of nutrients and energy (NODARI; GUERRA, 2003).

Currently, the United States, Brazil, Argentina, India and Canada concentrate 95% of all the transgenic cultivated area on the planet, and 98% of the plants have been modified to tolerate and resist the lethal action of toxins and certain herbicides (FERMENT *et al.*, 2015). Furthermore, growth in the area planted with soybeans and corn has replaced other crops, which may be related to the decrease in food production crops, such as beans and rice, compromising food and nutritional security. Agricultural workers and consumers are more exposed to pesticide residues, as is society as a whole to the effects of environmental pollution, especially water resources.

Populations exposed to pesticides have been developing acute and chronic diseases, as shown by studies in several countries (BASSIL; VAKIL; SANBORN, 2007; CARNEIRO *et al.*, 2015), the result of regulatory decisions based on this reductionist paradigm of risk assessment, the rupture of the inspection and control agencies and economic power, and the asymmetry of power in decision-making levels between large corporations and popular movements.

Conducting research and scientific events sponsored by the private sector configures situations in which those involved have conflicts of interest, especially for the dissemination of results that may put the safety of these products into question. These facts illustrate how research results and scientists' opinions on the health and environmental impacts of pesticides can be distorted when there is private sector funding, which the ethics of science call into question.

In general, studies that seek to show the safety of transgenic plants, for example, are often carried out using methodologies inappropriate to the reality of use and exposure of ecosystems and are almost always advocated by researchers funded by industries producing transgenic technology (GURGEL *et al.*, 2018).

The dimension of this problem transcends academic bodies, since it is reflected in the calculation of the limits of pesticide residues that may be present in water for human consumption and other species or in food, or in the definition of “acceptable” diseases for exposed populations. Moreover, the pressure on researchers and institutions that publish studies and contrary scientific positions and that reveal the dangers of pesticides negatively affects all academic production and society itself.

Scientific production and the autonomy of the health field become central to the development and advancement of Brazilian and global agroecology.

In Brazil, researchers and social movements coexist with pressures of several kinds when revealing the risks related to the use and consumption of pesticides and transgenic organisms (GURGEL *et al.*, 2018), and even further when pointing out the relationship between the performance of companies in the sector and the occurrence of diseases and impacts on the health of vulnerable populations and territories.

This reality serves as a warning to universities and other research institutions such as Fiocruz, since these pressures are not always clear and can occur due to the dismissal of researchers from their work benches or their positions, the non-recognition of the work carried out, or even hinder the dissemination of research results. Thus, the democratic control mechanisms must be defended and permanently improved to ensure freedom of investigation.

Scientific production and the autonomy of the health field become central to the development and advancement of Brazilian and global agroecology. It is a necessary effort to overcome the pesticide-dependent agriculture model, and at the same time, institutional strengthening of the set of intersectoral public policies that articulate the promotion of health and environmental justice in our country.

2. BIODIVERSITY AND HEALTH

2.1 Conceptual bases and historical milestones

Human action and its production processes historically represent situations of aggression to the environment, especially from the moment when man started agricultural activities. Fundamentally from the 19th century and, especially, from the 20th century to this day, these productive processes and technological uses were increasingly structured around the consumption of natural resources and soil, bringing environmental changes whose intensity and scale acquired an extraordinary dimension. (CHAME; BRANDÃO, 2018).

As we have seen in the previous item, it is a system that promotes the disconnection between agriculture, urbanization, and other activities that replace or suppress natural ecosystems, changing an important part of the services that nature performs in the regeneration of the fertility of the ecosystems in their capacity for resistance and resilience, with serious consequences for health and even productivity.

The tropical ecosystems have high biodiversity because of the climatic stability and the abundant energy and water resources, which create the right conditions for high biodiversity. However, in the long run, this will increasingly depend on the conservation of environmental conditions, the balance of which is related to the connections of the physical elements of the environment with complex biological communities.

The Convention on Biological Diversity (CBD) aimed to establish mechanisms to ensure biodiversity, inaugurating one of the most important international instruments related to environmental policy. The CBD has 168 signatories, including Brazil, and is structured around three main pillars: preservation of biological diversity; its sustainable use; and the fair and equitable sharing of benefits derived from the use of genetic resources and associated traditional knowledge.

In this context, the Nagoya Protocol, signed in Japan in 2010 and ratified by the Brazilian Legislative Decree No. 136/2020 (August 12, 2020), began to regulate

the “Access to genetic resources and the fair and equitable distribution of the benefits derived from its use” (ABS – Access and Benefit Sharing). Its approval provides guidelines for the establishment of fair commercial relationships between the supplier country and the user country of environmental resources, ranging from the payment of royalties to the establishment of consortia between companies, in order to guarantee technology transfer and training.

In Brazil, the construction of a regulatory framework aimed at complying with the commitments assumed in the CBD has taken a somewhat recent course. The first legislation to protect the use of biodiversity in the country, Provisional Measure N° 2.186-16/2001, aimed to confront and prevent biopiracy and ensure the distribution of benefits derived from the use of Brazilian biodiversity fairly and between people holding traditional knowledge, where appropriate.

After reviews, criticisms, and political struggle for legislation with less bureaucratic rules, more appropriate to the Brazilian reality and capable of establishing legal certainty, the new Biodiversity Law¹, of 2015, begins to stimulate research and technological development, with guarantees clearer access to genetic heritage, protection of traditional knowledge and sharing of benefits for the conservation and sustainable use of biodiversity.

The new law covers all research carried out on Brazilian biodiversity, including studies related to taxonomy, description of new species, inventories, and ecological and epidemiological studies. It also defines the criteria for the distribution of benefits, a central element for the fair guarantee of the restoration of ecosystems and the traditional knowledge of rural, forest, and aquatic peoples.

However, several changes have modified and have been modifying the national legal setting for the protection of natural ecosystems and biodiversity in recent years, such as the substantial change in the Forestry Code (Law 12.651 of May 25, 2012). The diverse flexibility in the granting of environmental licenses has led to a reduction of the preservation units and scrapping by environmental agencies, which favors an increase in deforestation, fires, land grabbing, pollution, and overexploitation of species.

1 Law nº 13.123, of 17/11/2015.

Starting in 2000, the articulation between projects coordinated by the Ministry of the Environment (MMA) with resources from the Global Environmental Fund (GEF) to support developing countries in complying with the

In Brazil, through the guidelines of the Family Health Strategy and Health Surveillance, the SUS offers a unique opportunity to apply the concepts One Health, Global Health, and Planetary Health

commitments of the CBD, began to bring biodiversity closer to Health. In Brazil, through the guidelines of the Family Health Strategy and Health Surveillance, the SUS offers a unique opportunity to apply the concepts One Health, Global Health, and Planetary Health, initiatives created by groups of different origins, but which converge on many objectives that have been incorporated into WHO policies (CHAME; BRANDÃO, 2018).

In general, they address issues that impact human health and survival and propose the integration between the human, animal, and environmental health sectors, in order to face the challenges related to the prevention of epidemics and zoonoses and the maintenance of the integrity of ecosystems for human benefit. In this context, the construction of the Biodiversity and Human Health Program, an alliance between CBD and WHO, is recent (2015) and important.

Regarding the 2030 Agenda and the SDGs, the link between health and biodiversity is still under construction. However, the foundations of this integration have been laid, with the existence of guidelines, the increasing academic production on the subject, and with the performance of research and work groups that provide technical support to the executive and control bodies.

2.2 Main challenges and problems

Deforestation, fires, the replacement and simplification of ecosystems and pollution modify the natural balance and the regenerative capacity of natural

environments, limiting production in terrestrial, continental, and marine waters. The extensive use of chemical inputs in agriculture, mining tailings and domestic, and industrial activities generate impacts of different magnitude, from the genetic loss and erosion of species to the production of microbial resistance, local and regional effects such as desertification, droughts, floods, and the direct action of solar radiation that hinders the regeneration of the original ecosystem (CHAME; BRANDÃO, 2018).

In turn, the so-called modernization of Brazilian agriculture deepens the concentration of land and escalates the migration of thousands of workers from areas of expansion of the agricultural frontier to large urban centers. This paradigm has been producing other structural effects, such as occupational accidents, chemical contamination of water, air and soil along the agricultural production chain. They are fundamental issues to address when we think about formulating policies that seek socioenvironmental preservation and respect for our biodiversity and all the peoples that inhabit our territories.

Another challenging issue, which has been returning to the agenda within the Biodiversity and Health issue, are the significant changes in the dynamics of some diseases favored by behavioral, cultural, socioeconomic, political, technological and environmental aspects. These changes, of which man is the main actor, have a direct impact on the processes of determining health / disease relationships, causing, among others, changes in the patterns of appearance and spread of new and old diseases, transforming extremely complex socio-epidemiological profiles. Thus, these effects can be evidenced in the expanded distribution and transmission of infectious diseases such as Chagas disease in the Amazon, the urbanization of leishmaniasis throughout the country, new outbreaks of wild yellow fever and the appearance of areas of transmission of systemic mycoses, among others. The appearance of zoonoses is not a Brazilian challenge, but a global one, as evidenced by the higher incidence of these diseases in humans in recent decades (CDC, 1994).

Besides the direct impact on health by pathogens, the loss of species essential for the balance of the ecosystem, such as predators, trigger overpopulations of pests, especially in urban centers and rural areas, and the loss of genetic variability of species limits the possibilities in the future such as autochthonous

varieties, strategic for food sovereignty, medicinal ones, and others with biotechnological potential.

Urban centers and monoculture areas favor the colonization of exotic animals or the adaptation of native species with great genetic plasticity. Thus, many become pests, with an impact on health, the economy, and local biodiversity (GAERTNER *et al.*, 2016).

Health surveillance and the implementation of effective prevention plans, besides vaccines, do not understand the cycles of emerging, communicable and noncommunicable diseases, and are mostly hampered by the lack of quality data and information with geographic limitations. The health sector faces accelerated

dynamics in health-disease processes, which require the development of complex analyses, but involve rapid diagnosis methods, real-time monitoring, response capacity, and structuring investments in basic sanitation and housing.

Despite the problems, several initiatives and scientific knowledge already show the effect of biodiversity preservation to improve living and health conditions, to contain mental health pandemics, and that must be disseminated and adapted to the different Brazilian realities.

Thinking about the relationship between biodiversity and health means, therefore, addressing both the preservation of ecosystems and the establishment of

bridges with the health of workers, the right to land and the recognition of the culture of traditional peoples. In other words, we must debate labor relationships, other ways of living in the world, and the right to biodiversity of future generations in the same struggle setting.

Thinking about the relationship between biodiversity and health means, therefore, addressing both the preservation of ecosystems and the establishment of bridges with the health of workers, the right to land and the recognition of the culture of traditional peoples.

3. CLIMATE, HEALTH, AND CITIZENSHIP

3.1 Conceptual bases and historical milestones

An approach that is strongly related to the previous debate on biodiversity and health refers to the discussion of climate change and its effects. Since the creation of the Intergovernmental Panel on Climate Change (IPCC), at the initiative of the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO), States, scientific societies, NGOs and a part of the global population familiarized with the issue, which was internalized by national and international governmental spheres in ECO-92.

At the same time, 175 countries signed the United Nations Framework Convention on Climate Change (UNFCCC). The signatory governments have recognized climate change as “a common concern of humanity” for present and future generations; and they became parties to the Convention, proposing the elaboration of a global strategy “to protect the climate system for present and future generations” (UNFCCC, 1992, p. 4).

Climate change as “a common concern of humanity”.

This strategic theme seeks to establish bridges between climate change, health and social and citizen rights of populations and territories, alerting about the correlation between climatic phenomena, health impacts and processes producing social inequality and socio-environmental vulnerabilities to the climate effects, including floods, droughts, poor sanitation infrastructure, food insecurity, emerging diseases, and migratory flows.

We can say that Brazil harbors three clear patterns of population health (XAVIER; GRACIE; BARCELLOS, 2018). The first of them is represented by cardiovascular and neoplastic diseases, whose increasing trend in the last ten years follows the aging of the population. The second pattern is made up of infectious and parasitic diseases, which are also clearly determined by the social and environmental

conditions of the social environment. And finally, the so-called external causes, which can range from accidents to cases of violence in general. These three scenarios are likely to be related to environmental issues in different orders, scales, and contexts (BRASIL, 2008).

In this sense, facing the problems derived from climate change requires the articulation of measures in the social, economic, and environmental spheres, given the vulnerability of societies and governments committed to

In this sense, facing the problems derived from climate change requires the articulation of measures in the social, economic, and environmental spheres, given the vulnerability of societies and governments committed to the search for more sustainable ways of life.

the search for more sustainable ways of life. This vulnerability may change due to different factors, such as population density, level of economic development, food availability, income and distribution level, local environmental conditions, situation of pre-existing diseases, and the quality and availability of health and sanitation services.

Variables such as age, health profile, physiological resilience, social conditions, and the quality of monitoring and control policies can also affect the capacity to respond to climate change. The impacts of global environmental and climatic changes on health arise from the escalating incidence of health problems, maintaining their socioepidemiological pattern; in the

spatial spread of some diseases to new vulnerable areas; and even in the appearance of new diseases, especially arboviruses such as Zika, Dengue and Chikungunya (XAVIER; GRACIE; BARCELLOS, 2018).

Furthermore, these climate change effects on health can take different forms and levels of complexity. Given this condition, it is essential to organize and produce information that allows understanding the health situation of the population, its socioenvironmental and socioeconomic vulnerabilities, analyze

climate risk and its impacts on different age groups, providing public managers with data, information, and tools that can contribute to public climate and health policies.

WHO estimates that 30% of health damage is currently related to environmental problems arising from inadequate basic sanitation (e.g., water, garbage, sewage, and drainage) and air pollution, exposure to chemical and physical substances, natural disasters, biological factors (e.g., vectors, hosts, and reservoirs) (WHO, 2008). The health sector has played an active role in the work of the IPCC and has benefited from the knowledge produced. However, action related to climate change has been slow to take.

3.2 Main challenges and problems

The concept of risk stems from the theory of probabilities, which assumes the possibility of predicting certain situations or events through knowledge of the parameters of distribution of cases and the mathematical calculation of expectations. It is associated with the potential for loss and damage and the magnitude of the consequences (XAVIER; GRACIE; BARCELLOS, 2018).

Risk assessment plays a strategic role in environmental health since it allows cross-referencing information on exposures with potential effects on exposed and vulnerable populations. However, carrying it out requires defining research priorities, which will only be possible with the existence of databases and good quality health and environment information systems, which allow establishing indicators and pointing out problems that must be evaluated in greater depth (CÂMARA; TAMBELLINI, 2003).

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In this context, the greatest challenge to make risk assessment an effective tool for environmental health surveillance is to contextualize it in our reality and base it on integrated and participatory approaches. These approaches can articulate the analysis of chemical, physical, and biological behavior combined with social, political, cultural, ethical and moral dynamics, contributing to the search for broader and more durable solutions (FREITAS *et al.*, 2002).

A central point is the need to advance in the monitoring of impacts whose timing is inconsistent and not immediate, such as the effects generated in the medium- and long-term by large industrial companies. These types of health problems should be the focus of a specific policy, as they are not part of the routine assessment of damage caused by disasters and can go unnoticed by health alert and surveillance systems.

Concerning public health, we can list some of the main problems related to climate change and that demand knowledge and information: the scarcity of water and the greater risk of incidence of diseases related to inadequate environmental sanitation (DRIES); air pollution, fires, and possible effects on respiratory and cardiovascular diseases; besides changing ecosystems and expanding the areas of transmission of vector-borne diseases; and extreme weather and climate events such as heat waves, tropical and extratropical cyclones, floods, landslides, and droughts (XAVIER; GRACIE; BARCELLOS, 2018).

According to data from the latest Diagnosis of Water and Sewerage Services of the National Sanitation Information System (SNIS), 83.3% of Brazilian municipalities have a drinking water network, with 97.4% of these services concentrated in urban areas, while only 50.3% have a sewerage network, with 58% in urban areas. It should be noted that only 74% of the total volume of wastewater collected undergoes treatment before being discharged into water bodies; in other words, it is estimated that only 42.7% of all the wastewater generated undergoes some treatment before being released into the environment (XAVIER; GRACIE; BARCELLOS, 2018).

This exposure to DRIES can be further materialized with Brazilian households' data. According to the 2010 Census, 19 million people living in urban areas lacked clean drinking water. Another 21 million people residing in rural areas also lacked access to treated water (BRASIL, 2010).

We will see in the item “Sanitation and Health” that the scarcity and intermittent distribution of water, for example, force vulnerable populations to adopt alternative storage practices, especially in urban suburbs. Due to these inadequate forms of reservoir and management of water resources, there is an increase in the breeding grounds of vector-borne diseases such as Dengue.

Several diseases are transmitted by these vectors. Some are widely distributed throughout the country and others are restricted to specific regions of the country. The life cycle of vectors and the reservoirs and hosts that participate in the chain of disease transmission are strongly related to the environmental dynamics of the ecosystems where they live, limited by environmental variables such as temperature, precipitation, humidity, use patterns, and land cover.

The study of climate change implies understanding these different phenomena and scales, which requires a plurality of investigations, transversality between fields of knowledge and integrated actions at different spatial scales. After all, health impacts follow different orders and characteristics, from major environmental disasters to diseases caused by urban animal species or in specific places and regions on the planet.

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4. MAIN UNDERTAKINGS AND IMPACTS ON HEALTH

4.1 Conceptual bases and historical milestones

Industrialization, urbanization, and health are processes that intersect in the history of Brazilian economic development. Since the first decades of the 20th century, the health sector has played a fundamental role in the execution and implementation of large undertakings of national interest. This fact is plagued with contradictions and conflicts, considering that this same movement that induces national capitalism has been responsible for producing strong impacts on the health and environment of the country's populations and territories.

The very creation of Fiocruz is part of this historical transition between economic and development models, when Brazil assumes occupying a vast area of the national territory, either by urbanizing or implementing large industrial plants and road logistics networks, as a modernization project. From the health missions to the Amazon led by Oswaldo Cruz and Carlos Chagas, in 1910 and 1913, to the fight against endemic diseases in large urban centers (ANGELO; TOLEDO; SABROZA, 2018), the institution was present at the great historical milestones of the country's transformation.

Starting in the second half of the 20th century, Brazilian industrialization is characterized by the implementation of large industries of basic supplies, capital goods, and durable consumer goods. Between the 1970s and 1980s, during Brazil's military dictatorship, the so-called "Brazilian economic miracle" maintained an average GDP of around 10% until 1973. The period was characterized by investments in ventures with high socioeconomic and environmental impact, with high polluting potential, such as the construction of refineries, works, and transportation logistics, besides hydroelectric plants.

Parallel to these undertakings, social struggles for reforms in public health and education policies were gaining ground as alternatives to the exclusionary and polluting Brazilian industrial model (ANGELO; TOLEDO; SABROZA, 2018). As already mentioned, the Brazilian Health Reform and the several protocols signed

through international cooperation sought to find alternatives to the hegemonic development model and build legal instruments to confront it.

Regarding the social and environmental impacts involving large projects, in Brazil, the National Environmental Policy (PNMA)¹ was created and aimed to “preserve, improve and restore environmental quality” to ensure adequate conditions for the sustainable development and the protection of human life dignity (BRAZIL, 1981).

PNMA was also responsible for the creation of the National Environmental System (SISNAMA), an organism made up of Federal bodies and entities, the states, the Federal District, municipalities, and the National Environmental Council (CONAMA), a consultative and deliberative body of SISNAMA empowered to propose guidelines for government environmental policies.

As a result of this process, CONAMA Resolution N° 1 of January 23, 1986 stands out, which introduced into the Brazilian regulatory framework the mandatory nature of environmental impact studies and reports (EIAS/RIMAS) in certain works. Another important advance is the inclusion of Article 225 in the 1988 Brazilian Constitution, which refers to the environment and defined an ecologically balanced environment as a fundamental right of the population.

However, in the general framework of licensing, health-related aspects are still non-existent or hardly incorporated in technical studies of environmental impacts. Generally, when health is approached, it is portrayed from a retrospective dimension and refers to activities with potential chemical contamination, renewal of the licensing process, accidents and disasters with chemical products or disposal of hazardous waste; that is, technical readings that would be applied only after environmental damage (ANGELO; TOLEDO; SABROZA, 2018).

The Brazilian Health Reform and the several protocols signed through international cooperation sought to find alternatives to the hegemonic development model and build legal instruments to confront it.

1 Law n° 6.938, of August 31, 1981.

In many cases, the instruments that grant environmental licenses rely on limited methodologies, with greater emphasis on physical, chemical and biological aspects, leaving aside the social and cultural dimensions. Likewise, the scales

The identification of potential or produced health problems requires analyzing the health situation at different scales and time perspectives.

of impacts can be at the local, national or even global level, which would require a reformulation of the health and socio-environmental surveillance and monitoring systems (PAIM; ALMEIDA-FILHO, 2014).

In practice, large industrial companies, whose production requires a high consumption of natural resources, essentially have aspects that generate territorial vulnerabilities. The identification of potential or produced health problems

requires analyzing the health situation at different scales and time perspectives. One of the structural problems of the environmental licensing process is that the direct and indirect health impacts are not yet clearly measured.

4.2 Main challenges and problems

As we have seen, large industrial works and projects change and affect the environment and the lives of the local population in multiple ways, especially regarding the emergence of health complications. Therefore, it is crucial to conduct environmental research and studies, mainly to support political action and the legal and technical organization of the environmental licensing sector at different levels of public administration.

These problems were even more evident with the disasters generated by the collapse of the Fundão dam, owned by Samarco, in Mariana, 2015; and the Vale S.A dam in Brumadinho, 2019, both in Minas Gerais. These critical events revealed the fragility of the authorities in the application of existing regulations in Brazil, although the Environmental Crimes Law (Law N° 9605/1998) provides for the sanction for environmental problems with consequences for public health (BRAZIL, 1998).

The environmental inspection system and Judiciary's failure to impose sanctions is observed at all levels of government. When there is a multiscale disaster such as Mariana or Brumadinho, this fragility becomes clearer. Furthermore, the political and economic burden of large international corporations and their influence on the national scene end up undermining any possibility of punishing those responsible, mitigating damages, and compensating the victims.

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A central challenge is the need to expand, in the first place, the set of typologies related to the projects with the greatest potential impact. Moreover, new instruments and information systems with greater sensitivity in terms of impact indicators should be incorporated into environmental planning. Greater popular participation in the different stages of construction and issuance of licenses (previous, installation and operation) should be more than an incentive. It is necessary to incorporate it into the inspection and control processes, now reduced to public hearings that rarely allow analyzing and measuring possible and future impacts.

Unfortunately, a set of bills that can change the licensing system in the country are being processed in the National Congress, which can generate a risk of declining environmental guarantees and rights, because they are measures that They propose to weaken or dismantle the main instruments of inspection and prevention of impacts on health and the environment.

According to one of the constitutional reform proposals, PEC 65/2012, the presentation of a previous environmental impact study would be enough to authorize the works and avoid their suspension or cancellation during the debates on their content (ARAÚJO; HOFMANN, 2016).

These proposals have been raising questions from several institutions of civil society and social movements, which warn about the violation of fundamental rights provided for in the Constitution. We currently observe attempts to weaken

the already limited instruments of environmental licensing, which, while in need of further reviews and contributions, are important mechanisms for preserving and caring for the environment and health.

The start-up of a large company actually requires the recognition of the multiple vulnerabilities of the territory, seen as a dynamic space, marked

by power relations and conflict, in which emerging crisis situations and health problems demand broad performance of the health system. Better identifying the impacts and risks to human health is one of the main reasons for incorporating health issues into licensing instruments and greater integration with SUS and other health policies.

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We should understand that the productivist science model is closely related to the industrial development supported by the intense consumption of natural resources for the production of commodities. Therefore, there is an

urgent need to advance in the production of new monitoring mechanisms, in the prevention of risk and exposure factors, and in the protection of social and fundamental rights governed by the Brazilian Constitution.

5. SANITATION AND HEALTH

5.1 Conceptual bases and historical milestones

The expanded concept of health, which includes social determination as fundamental to understand the health-disease process, established new conceptual possibilities for the relationship between sanitation and health. Key concepts such as human rights, environmental justice, and health promotion have become important theoretical references incorporated in the analysis of this relationship, which broadens the vision of sanitation, historically rooted in engineering and as a vector of economic development. It is also worth remembering that access to water and sanitation are also recognized as human rights and part of the International Covenant on Economic, Social and Cultural Rights (HELLER *et al.*, 2018).

After the United Nations Conference on Water, in 1977, in Mar del Plata, Argentina, some sectors of civil society began to demand the recognition of these rights. From this new perspective, all people, regardless of their economic and social situation, must have access to drinking water in sufficient quantity and quality to guarantee the satisfaction of their basic needs. According to WHO data, in 2012, 842,000 people died on the planet due to diseases related to access to water, sanitation, and hygiene (WHO, 2016). Besides the individual issue, Heller (2015) argues that adequate access to sewerage services has an important dimension in public health, since it can prevent environmental pollution and the incidence of diseases.

Indeed, current emerging and re-emerging diseases are closely related to sanitation (HELLER *et al.*, 2018). We saw in the section “Biodiversity and Health” that the deficient and insufficient supply of sanitation services are crucial for the occurrence and maintenance of these diseases, diarrheal diseases and other sanitation-linked conditions.

Although access to water and sanitation is a fundamental human right, some persistent and significant obstacles hamper its assurance, mainly from the perspective of availability, quality, acceptability and affordability. According

to Castro (2013), political interests, the fragility of institutional structures and the financial restrictions of the States would be the main responsible for these existing gaps.

Important debates as early as in the 1970s began to include new perceptions in terms of the connection between health, sanitation and human rights, broadening

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the perception about the production of social and regional inequalities. In response, new analytical categories started to be built, seeking to bring scientific perspectives closer to the social reality of different populations and territories throughout the planet.

Inspired by the struggle of social movements in the United States, unleashed by the living conditions of the black and Hispanic-American population – who were exposed to serious environmental risks attributed to polluting industry facilities and suffered from poor sanitation

(MARTINES-ALIER, 2001) –, new concepts such as environmental justice began to be related to the fight for access to quality water.

Even today, situations of environmental injustice are part of the reality of many social groups and places in Brazil. Such practices favor the unequal distribution of risks, segregating the populations that live in areas of greater degradation and environmental risk and predisposing specific social groups to health problems. Furthermore, a wide range of sanitation policies cannot provide adequate water and sanitation services in the regions inhabited by these vulnerable populations.

Due to this framework, the SDGs focus on eradicating poverty in all its dimensions. The SDGs must be seen and addressed as integrated, articulating the economic, social and environmental dimensions of development. SDG 6 was agreed regarding the human rights to water and sanitation (HRWS) and

aims to “Guarantee the availability and sustainable management of water and sanitation for all by 2030”.

In these prerogatives, HRWS now has a direct relationship with the concept of health promotion. The lack or deficiency in access to such rights affect infectious and parasitic diseases and promote the loss of the quality of life of the entire population, especially women. For example, in rural regions and urban peripheries, women are responsible for bringing water for the whole family. In some cases, they even travel long distances between the house and the water source. Such a social condition is an extreme condition of inequality and injustice, which deprives women of the possibility of carrying out other activities, such as working, studying, living with their children, and leisure.

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Then, thinking about sanitation from the perspective of health promotion is recognizing its technical dimension and importance in disease prevention and the existence of these unequal and unjust social structures. The social, cultural, political, and economic dimensions must be incorporated into sanitation policies within an expanded concept of health. Sanitation programs should include actions aimed at the citizenship of the people and the community, the inclusion of local social technologies, the expansion of autonomy and political awareness and, consequently, participation and social control.

5.2 Main challenges and problems

Even after this theoretical and technical alignment between sanitation and health, a political and institutional distance still prevails between these fields, with significant obstacles to the effective universalization of sanitation services for the entire population. The lack of coordinated actions, the

economic, political and social differences, and the capitalist logic that favored investment in regions of greater economic interest generate inequalities that persist today (HELLER *et al.*, 2018).

The need to establish a new theoretical and legal framework capable of articulating sanitation, health and human rights seems clear. This association can contribute to democracy in the management of sanitation services, seeking access without discrimination and socio-environmental justice. It

is essential to establish paths to really bring sanitation and public health closer, emphasizing actions that are strategic for this consolidation.

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According to Heller (2015), the field of sanitation has been guided by four general principles that must be overcome: technocentrism, focused on techniques and engineering; elitism, which prevents user participation; encapsulation, with insufficient interdisciplinary practices and

sectoral articulation; and immediacy, due to the lack of a planning culture. As a result, the basic sanitation sector must rebuild a way of thinking that allows it to reflect on structural changes in society, their impacts and preparation to face uncertainties and social and environmental changes at different scales (e.g., climate change, impact of large projects, floods, droughts, and inundations).

In Brazil, the sanitation sector has always been linked to economic development policies throughout the 20th century, treated as a segment destined to leverage economies through urbanization of cities and the supply of logistics for productive sectors. The National Sanitation Plan (PLANASA) was launched in 1971 and is an example of a historical milestone that promoted the advancement of the coverage of water and sanitary sewerage services in the country. However, PLANASA has been conceptually based on a business vision of the economic feasibility of services, which ended up generating a higher inequality concerning coverage, blocking the access of population

groups deprived of economic and political power in urban and rural areas (HELLER *et al.*, 2018).

The consequences of this historical process were the reproduction of regional inequalities, with repetitions of solutions and technologies unable to dialogue with vulnerable populations and territories, ignoring local social, cultural, environmental and political conditions. Moreover, another structural problem is that the actual health situation of social groups is hardly considered in the construction and decision-making on the priorities for intervention in sanitation policies.

In Brazil, public investments in infrastructure resumed between 1980 and 2000 after a long period of global neoliberal policies. The National Basic Sanitation Law (No. 11.445 / 2007), regulated by Decree No. 7217, of 2010, became the legal framework. Its fundamental principles are universalization, comprehensiveness, health promotion, and social control. In 2009, the National Basic Sanitation Plan (PLANSAB) began to be drawn up, approved in 2013, which must cover a 20-year period (2014/2033).

This legislative bundle should offer solid bases for the incorporation of participation and social control as pillars of sanitation in the country (HELLER *et al.*, 2018). However, on the contrary, the privatization of state sanitation companies has dominated the public agenda, even serving as a counterpart imposed by the Federal Government to renegotiate public debts with the states in a context of fiscal crisis. Due to its monopolistic nature, the sanitation sector emerges as a new business opportunity for the generation of profits from private capital, attracting both Brazilian companies and foreign and multinational investment groups.

Some authors argue that it is necessary to value cultural diversities, support easy-to-apply technological solutions and promote participatory management to escape from the technocratic and privatist vision of the sector (SOUZA et al., 2015).

Some authors argue that it is necessary to value cultural diversities, support easy-to-apply technological solutions and promote participatory management to escape from the technocratic and privatist vision of the sector (SOUZA *et al.*, 2015). For this line of thought, policies that only value technical knowledge and do not take ownership of popular knowledge prevent the population from using locally developed technologies (CASTRO, 2013).

Based on the cultural and social conditions of the territory, these local initiatives could help shape water consumption practices, organizing services appropriately for each territory or region. Only this cross-cutting vision will be able to configure a wide political field. A field capable of blocking the new privatization impulses that began to control the sanitation and water resources agenda in the country (HELLER *et al.*, 2018).

6. HEALTH OF RURAL, FOREST AND AQUATIC PEOPLES AND POPULATIONS

6.1 Conceptual bases and historical milestones

The historical references for the consolidation of the theme “health of rural, forest and aquatic peoples and populations” begin with the first health expeditions to the country’s inland region by Oswaldo Cruz in the early 20th century. In this trajectory, the social struggles of rural workers and farmers for the right to health arise, reaching public policies and government measures directed at these populations, emphasizing the creation of the Brazilian Unified Health System (SUS).

However, in the process of building citizenship in Brazil, the category of rural worker had not been included in the country’s social protection system until the early 1970s. In other words, the Brazilian economic development model did not recognize rural men and women as exponents of the transformation of the country’s social reality (FENNER *et al.*, 2018). In rural areas, access to income and work was determined by local rulers and landowners. In the absence of social security, owners and employers were responsible for providing social assistance, including medical and hospital care, to rural workers.

Furthermore, until 1988, the right to health in Brazil was associated with the inclusion of workers in the formal labor market. This worker could benefit from social security only by contributing a percentage of their remuneration. In 1988, the Federal Constitution extended the right to health as a value of universal citizenship to rural workers and farmers with and without a formal employment relationship.

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The concept of “rural, forest and aquatic peoples and populations” entered the agenda of the Ministry of Health (MS) through social movements that were articulated with public managers of the health sector, health professionals, and members of the Coordination of the Executive Secretariat of the MS. The Land Group¹, as this political-institutional alignment became known, now had the National Comprehensive Health Policy for Rural, Forest and Aquatic Populations (PNSIPCFA), created in 2011.

In 1988, the Federal Constitution extended the right to health as a value of universal citizenship to rural workers and farmers with and without a formal employment relationship.

The PNSIPCFA was built to promote health and equity, related to human development and the quality of life of these populations. This process was based on clear evidence of the inequalities and health needs of these populations. Furthermore, the concept of social determination is incorporated as a guiding principle of the PNSIPCFA, constituting an important innovation in the legal and institutional framework of Brazilian public health.

Another important concept introduced into politics was territorialization, which according to Gondim and Monken (2017) allows us to recognize social reality’s concrete totality. The authors argue that territorializing is a social phenomenon, “an act of being, doing or fixing in a geographical space, delimiting a territory” (FENNER *et al.*, 2018, p.35). In other words, it represents the capacity of different social actors to exercise some type of power or action to protect their identity, rules, ties, norms, and regulations of their territory and intervene and guide the implementation of the PNSIPCFA.

1 The Earth Group established by the Coordination of the Executive Secretariat of the MS was coordinated by the Strategic and Participative Management Secretariat (SGEP) in 2005, expanding its composition and redefining its attributions through Ordinance No. 3.071, of December 27, 2012, from the MS (BRASIL, 2012). The Group consisted of representatives of several secretariats and units linked to the MS, other ministries and federal agencies, representatives of state and municipal administrations, organized civil society, and guests.

Regarding the SUS, territorialization is linked to the health policy of rural, forest, and aquatic populations based on five strategic axes: I. Access of rural, forest and aquatic populations to Comprehensive Health Care; II. Health Promotion and Surveillance; III. Continuing Education, Popular Health and Communication Education; IV. Mobilization, Articulation, Participation, and Social Control; V. Monitoring and Evaluation of health actions for rural, forest and aquatic populations.

Health promotion now means creating healthier socioenvironmental conditions and the search for a just and egalitarian society.

Another important legal framework for rural, forestry and aquatic peoples and populations is Decree No. 6.040, of February 7, 2007, which established the National Policy for the Sustainable Development of Traditional Peoples and Communities (PNPCT). Part of the PNPCT's objectives is directly related to health and is an important challenge for the SUS: attending to population diversity without breaking with universal care (BRASIL, 2007). Health promotion now means creating healthier socioenvironmental conditions and the search for a just and egalitarian society.

The National Health Policy for Indigenous Peoples is nested in the National Health Policy, under the provisions of the Organic Health Laws and the Federal Constitution, which recognize the ethnic and cultural specificities of indigenous peoples and their territorial rights (Ordinance No. 254, of January 31, 2002), in this context, looking at social and environmental relationships, integrating them into an essential resource for the preservation or recovery of their health.

6.2 Main challenges and problems

As already mentioned, Brazil is experiencing a continuous reprimarization of the economy that increasingly transfers to the field, forest, and water the environmental pressures and liabilities related to our capitalist development and production model.

For this reason, historical banners such as the agrarian reform, the recognition and demarcation of indigenous and quilombola lands, and the preservation of traditional production modes are increasingly at risk due to the advance of agribusiness based on monoculture and the intensive use of crops, pesticides, and transgenic organisms.

The State has not reduced the conflicts generated by this model, nor has it protected the fundamental rights of the most affected populations; on the contrary, what is seen is the prioritization of instruments that do not break with environmentally destructive accumulation processes (FENNER *et al.*, 2018).

This reality imposes obstacles to the implementation of the PNSIPCFA and promotes a setting of radical social conflicts, with severe consequences for the well-being, illness, life, and death of indigenous peoples, quilombolas, traditional communities, farmers, low-income workers, inhabitants of sacrifice areas in the field, forest, water and in cities (SCHUTZ; MIRANDA; WAISSMAN, 2014). Rural violence, for example, has been setting a stain on the Brazilian social reality, and was responsible for claiming lives, mainly of indigenous people, small farmers, and rural leaders of social movements.

This situation of violence is not only a warning, but requires a rapid response from society and federal security agencies, which must protect the lives of rural workers and traditional peoples. The guarantee of the right to health of the field, forest, and water peoples and populations urgently requires recognizing this socio-biodiversity, which is territorialized and expressed in the Brazilian social cartography.

Just as there is disarticulation between programs and public policies, scientific knowledge also tends to fragment knowledge, reducing nature to its control. On the other hand, the social determinants of health are related to gaps in attributes between individuals, regions, and social groups, and shift from the different economic and social conditions of population groups, such as access to education and health services.

Fiocruz, in turn, has assumed the role of strengthening and operationalizing both the theoretical-methodological model that provides for the interrelation between health, environment, work, and sustainability, and developing important health surveillance, popular surveillance, and health systems.

On the other hand, the relationship between popular education and public health has been developed and adopted by Fiocruz research groups for decades, improving research methodologies, teaching practices, and health knowledge. Also, several projects, departments and scientific centers of the Institution already have a long history of studies on indigenous health, occupational health, and the fight against pesticides.

Human rights, environmental justice, and public policies should be the basis for conducting studies and implementing health programs that dialogue with the territoriality of social groups. Facing the consequences of state deregulation and the flexibilization of the world of work and environmental legislation also involves combating the hegemonic model of development, production and science, increasingly associated with rural violence. Recovering the broad meaning of health, bringing justice to the field, protecting indigenous lands, recovering ecosystems and hydrographic basins seem to be the only way to ensure a comprehensive health policy with strong ties to the culture and knowledge of rural, forest, and aquatic peoples and populations.

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7. OCCUPATIONAL HEALTH

7.1 Conceptual bases and historical milestones

The material conditions and social precariousness of work must be addressed within the different economic, social, and political processes that result from the current fragmentation of worker groups and, above all, from the weakening of work as an organizer of the social fabric (SOUSA *et al.*, 2018). In this context, understanding

In this context, understanding Occupational Health (OH) must start from the analysis of labor activities at the local level, however, jointly with broader scales that involve the contradictions between capital, production relationships, and the popular classes.

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The association between work and health, from the viewpoint of Occupational Health, is not a simple concept, but was established from multiple social struggles. From this perspective, health is strongly determined by social conditions and the organizational capacity of the workers themselves.

In Brazil, OH originated in the 1980s, during the period of political opening and national political redemocratization. It is a field of practices and knowledge whose theoretical and methodological approach arises from collective health and aims to understand and intervene in the work-health relationship.

In this sense, the history of the Brazilian working class is the reference for the establishment of OH as a political field. A retrospective look observes that OH-

related claims gained relevance while the union movement acquired strength on the national scene. The strikes of the automotive sector workers at ABC Paulista in the seventies and eighties are a milestone towards political openness and the consolidation of the workers' right to health.

The First Conference of the Working Class (CONCLAT), which marked the resumption of the trade union movement in the final phase of the military dictatorship; the creation of the Central Workers' Trade Union (CUT) in 1983; and the National Institute of Occupational Health (INST), in 1990, marked the new unionism in Brazil, the guiding axis of a new way of doing health policy in the field of work (SOUSA *et al.*, 2018).

Fiocruz played a leading role in the formulation of OH, through its inclusion in the Brazilian Health Reform movement. The starting point of this process was the establishment of the Center for Occupational Health and Human Ecology Studies (CESTEH) in 1985 and the organization of the First National Congress on Occupational Health (I CNST) in 1986, its important pillars. These movements contributed centrally to the incorporation of the OH in the SUS and the 1988 Constitution.

Health as a universal right, defined by the 1988 Federal Constitution and Law No. 8.080/90, surpasses the previous milestone of the right to social and labor security, in which the State's action was limited to regulating safety and occupational health, and employers were responsible for its implementation.

The last highlight on the relationship between health, work and the environment, was the First National Congress on Environmental Health (CNSA), in 2009. The meeting promoted an interdisciplinary approach between occupational and environmental health, through cross-sectional perspectives and approaches. The final resolution of the CNSA indicated that production processes are no longer restricted to the interior of factories and industries. They extend throughout the territory, with changes in the levels of exposure to environmental risks and disasters. This new face is crucial for the interpretation of changes in the disease and mortality profile of workers and other social groups.

7.2 Main challenges and problems

Two major challenges posed to the field of Occupational Health in this 21st century can be highlighted: the development of a permanent research agenda that addresses the relationship between health, work and the environment, and the mobilization around workers' social struggles for this century.

Assuming its commitment to health and citizenship, Fiocruz understands that the "work-environment" relationship established in the hegemonic economic model is highly predatory for human health.

Assuming its commitment to health and citizenship, Fiocruz understands that the "work-environment" relationship established in the hegemonic economic model is highly predatory for human health. In this sense, it is essential to promote the defense of SUS as a space that guarantees and protects the workers' health rights in the short, medium, and long term. It is necessary to reorient scientific production,

strongly governed by productivist mechanisms, towards a generation of knowledge with a broad popular spectrum (SOUSA *et al.*, 2018).

Faced with the barriers imposed by the control of labor relationships, exercised by large companies and markets, it is urgent to create more robust and profound institutional mechanisms regarding articulation with society and with organizational potential oriented to the defense of workers' rights.

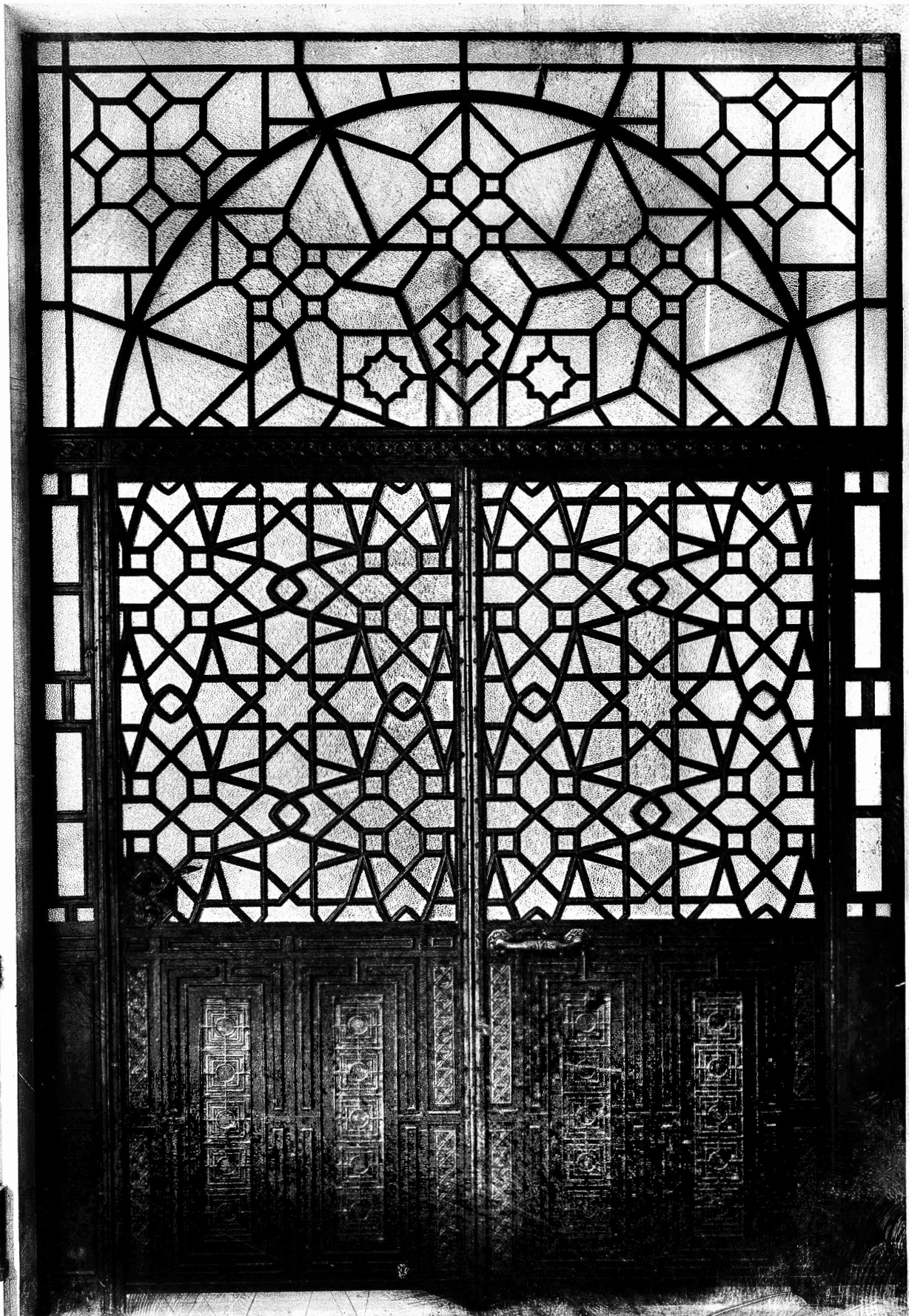
With regard to social struggles, a broad organization becomes increasingly difficult due to the fragmentation generated by the current production mode. Likewise, recent changes in labor legislation weaken the social organization of workers and serve as an exploitation and dispossession instrument by companies that seek to profit at all costs. Furthermore, the weakening of primary care in Brazil, generated by severe budget cuts, has unleashed a series of other negative effects on health.

This precarious employment situation and people's deteriorated living conditions, mainly in rural areas and in peripheral urban settlements, additionally burden a weakened health system. Furthermore, the SUS, which is central to addressing these problems, suffers from its contraction and a growing limitation to meet the primary and PHC demands of workers.

The current moment of flexible accumulation and productive restructuring on a global scale is based on flexible labor processes and contractual models. Collective contracting mediated by unions and other organizations is giving way to other types of contracting, such as temporary, intermittent, outsourcing, self-employment, and teleworking.

It is evident that it is necessary to align the production of research and knowledge with social struggles and the new context of production relationships in the 21st century, mainly in terms of the organizational capacity of workers at different socio-spatial scales. For example, scientific, political, and technical aspects must be incorporated into the SUS labor and defense claims platforms, so that new mechanisms for regulating work and health protection can be established. Amid the financialization of social relationships, developing innovative forms of struggle means articulating places, cultures, and experiences while integrating socio-ecological systems to the health of the communities.

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THE STRATEGIC ROLE OF FIOCRUZ: CONTRIBUTIONS AND FUTURE CHALLENGES



After presenting a brief summary of the issues that helped define basic concepts and establish the pillars of a new HES agenda at Fiocruz, in this final part of the text, we give visibility to the institution's performance in this field. Considering its strategic role as a PAHO/WHO Collaborating Center in Public Health and the Environment, Fiocruz has been working to contribute to the expansion of the network of Collaborating Centers (CCs) in the global South-South axis. Its performance has been based on conducting socioenvironmental diagnoses, producing qualified information for monitoring purposes and by monitoring impacts related to the environment, climate, and public health.

As of 2018, CC activities began a strong relationship with actions related to the strategies and objectives of the 2030 Agenda. Some of the commitments adopted for the period 2018-2022 were research in HES aligned with the needs of national, regional and international cooperation; transfer of knowledge, technologies, and methodologies; support to the training of human resources in health, environment, and sustainability, and participating in and consolidating

networks, including promotion and exchange with the network of Collaborating Centers of the Americas, in dialogue with strategies and actions related to the 2030 Agenda.

SDG 3 establishes that it is necessary “to ensure a healthy life and promote the well-being of all, at all ages”, thus, in the face with this broad challenge, Fiocruz has

We aim to show the leading role of Fiocruz in teaching, scientific production and multiscale political

action in the field of HES.

been acting institutionally in alliance with key social movements and organizations to confront socioenvironmental inequalities. It is a global effort to share knowledge and create permanent links around the right to health and the environment in a sustainable way.

To this end, and based on these challenges, four dimensions of interdisciplinary work, which articulate and link the seven strategic themes indicated in the previous item, are presented below. We aim to show the leading role of Fiocruz in teaching, scientific production and multiscale political action in the field of HES. Moreover, the institutional arrangements and activities mentioned below comply with the guidelines and goals established by the 2030 Agenda, and begin to respond to the calls and provocations set by the HES agenda for the coming decades.

Monitoring the impacts on health and the environment and new information production tools

Throughout the document, we addressed the need to advance in the elaboration of a multidisciplinary evaluation of environmental impacts that can contribute to improving and coordinating technical instruments and the different sectoral public policies. The health sector, for example, must be aware of the effects generated by the productive system based on the exploitation

and high consumption of natural resources. The sector must dialogue and qualify the methodologies used to identify and work with exposed populations, improving technical studies that support environmental licensing processes, health impact assessments, and the construction of public policies.

The example addressed on the subject related to large companies and their effects on health made it clear that public managers do not have the tools to face the complex and multidimensional problems produced by these structures. Municipalities and local social groups still face technical and political limitations in controlling the licensing stages and deciding about whether or not to implement these projects.

In general, there are no municipal plans both for the execution of resources derived from the implementation of industrial or rural projects and for the monitoring and evaluation of the impacts of large works, for example. In most cases, local policies and administrations, even today, do not even have satisfactory legal instruments to establish the mandatory inclusion of health aspects in most of these processes, and much less with the power of veto against the power of the big economic groups.

As a contribution, Fiocruz has developed research and technical advice on the monitoring and analysis of impacts on the health of peoples, populations, and territories in large project areas and regarding the occurrence of socioenvironmental disasters. Two important examples can be specified by the Large Companies Epidemiological Monitoring Laboratory (LabMep) and the Center for Studies and Research in Health Emergencies and Disasters (Cepedes).

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Created in the 1980s, LabMep is a research, teaching, and innovation center belonging to the Samuel Pessoa Department of Endemic Diseases, of the Sergio Arouca National School of Public Health (ENSP/Fiocruz). It is an interdisciplinary space that develops its work from the perspective of social epidemiology in Latin America, in which health-disease processes are understood as a result of the socio-spatial organization of society.

In recent years, for example, LabMep has been tracking major industrial plants in the country. Linked to the national development project, these projects act on different dimensions of life and different ecosystems. An emblematic case is the Itaboraí Petrochemical Complex (Comperj), a Petrobras investment inaugurated in 2009 and located in the Metropolitan Region of Rio de Janeiro. Besides monitoring the impacts in this region, Fiocruz works in the specialization and training of health professionals and in supporting the development of doctoral theses whose central theme is the problem of epidemiological impacts in areas of implementation or operation of big projects.

Cepedes was established in 2012 to face the challenges of socioenvironmental disasters, with a mission of “developing research that supports disaster risk reduction strategies in the SUS, the development of teaching materials and courses, training of high-level personnel in masters and doctorates, and technical and scientific production on the subject” (XAVIER; GRACIE; BARCELLOS, 2018, p.57). The implementation of Cepedes was part of the National Health Plan 2012-2015 and the Strategic Agenda of the Health Surveillance Secretariat of the Ministry of Health. Also, the website of the Center for Knowledge in Public Health and Disasters¹ was launched to disseminate information on disaster risk reduction, a reproduction of the PAHO portal in Portuguese, also resulting from the coordination between the CCs.

These devices produce knowledge, data and information. They require an approach with different social actors and environmentally vulnerable territories

1 The website of the Center for Knowledge in Public Health and Disasters can be accessed at: <http://andromeda.ensp.fiocruz.br/desastres/>

to expand their field of action and technical intervention. It is necessary to face the conflicts produced by the confrontations between scales and economic flows, mobilized by structuring projects, and that in many cases are imposed on local life projects, generating injustice, disease, and violence.

In an attempt to recognize these environmental conflicts and incorporate them into technical environmental studies, Fiocruz, through its researchers, participates in the Brazilian Environmental Justice Network (RBJA). This Network coordinates social movements, workers' unions, environmental entities, and experts and research centers. One of its actions is the "Map of Environmental Injustice and Health Conflicts in Brazil", which aims to demarcate the environmental conflicts linked to the hegemonic development model. The information provided by the "Map" is an important input that can be included in the analyses of the environmental viability of the projects and the ability to foresee damages through the inspection and systematic processes throughout the licensing stages.

Furthermore, Fiocruz has been developing the Climate and Health Observatory² jointly with several other institutions, such as the Ministry of Health (MS) and the National Institute for Space Research (INPE). This project collects and combines varying data to facilitate the analysis of the relationship between climate and health.

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² The portal of the Climate and Health Observatory can be accessed at: <https://climaesaude.iciet.fiocruz.br/>

The proposal aims to build subnational vulnerability indices with the potential to estimate the impacts on the population and the risks generated by global warming and climate change in territories and regions. The indicators that make up the indices seek to consider exposure, sensitivity, and adaptive capacity at the municipal level³.

Biodiversity, climate and citizenship: towards universal sanitation

The basic premise to overcome the barriers to universal access to sanitation, especially if we start from the perspective of human rights and health promotion, is that the theoretical and technical fields of this sector must advance beyond the dominant economic aspects that have historically guided

urban infrastructure policies in Brazil. It is essential to also include territorial elements, whose social, political, and cultural dimensions produce distinctions between places and population groups.

The lack of evaluations on the future conditions of maintaining sanitation interventions, the unilateral vision of technical solutions, and the hegemonic position that sanitation solutions are reduced to the field of engineering become limiting factors for universal access to water.

The lack of evaluations on the future conditions of maintaining sanitation interventions, the unilateral vision of technical solutions, and the hegemonic position that sanitation solutions are reduced to the field of engineering become limiting factors for universal access to water. Faced with this situation, the demands established by the services and urban infrastructure market end up dictating the governing bases of sanitation policies.

3 The set of indices and vulnerability indicators can be accessed at: <https://projeto.vulnerabilidade.fiocruz.br/>

This condition, in turn, weakens the link between sanitation, urban regulation, the health sector, and environmental policies, an unfeasible element to serve social segments with less financial capacity to pay the fees charged for the provision of water and sewerage services, for example. It so happens that the privatization impulse of water resources is being experienced in Brazil and globally. The Brazilian State, through a review of the sector's legal framework, has been creating institutional and financial mechanisms to encourage the privatization of state-owned companies and private control of water and sewerage services (HELLER *et al.*, 2018).

Sanitation must be approached in such a way as to connect it to different territories, such as rural areas, and areas of knowledge, such as "Occupational Health" and "Biodiversity and Health". This multidimensional and complex characteristic requires a level of articulation between policies – such as the National Rural Sanitation Program (PNSR) and the National Basic Sanitation Plan (PLANSAB) – and actions that intertwine the different dynamics of life and health of the populations in rural areas and urban centers.

From this perspective, Fiocruz has research groups, laboratories, scientific centers, and departments developing a wide range of studies and programs that address the relationship between sanitation, health and the environment. Some works are related to the monitoring of parasitic diseases, the development of social technologies, the living conditions of the inhabitants of favelas and urban peripheries, environmental disasters, and health promotion through environmental justice. Besides this production and projects, the institution helped create and develop several observatories related to the health of the territories.

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In the field of biodiversity, Fiocruz contributed to the development of the Brazilian National Strategy and Plan of Action for Biodiversity (EPANB). The

document prepared by the Institution was sent to the Ministry of the Environment and the activities contained therein were part of the Fifth National Report of Brazil for the Convention on Biological Diversity. In total, the institution collaborated with 13 of the 20 national goals. The following action can be highlighted among those that propose to develop a broader vision of health and are articulated with other fields, such as sanitation:

A. **The Wildlife Health Information System (SISS-Geo)**, linked to the Institutional Biodiversity and Health Program, Fiocruz Presidency. With the help of a mobile application, the system allows the knowledge and monitoring of wild animals for the development of emergency alerts for biodiversity-derived zoonoses. The SISS-Geo also supports species and ecosystem management plans in the Tapajós-Arapiuns Extractive Reserve (RESEX) and in the Serra dos Órgãos National Park (PARNA), and disseminates health bulletins and materials in a language accessible to society on wildlife and human health.

B. **Map of conflicts related to environmental injustice and health in Brazil**, managed by Fiocruz and the Federation of Social and Educational Assistance Organizations (FASE). The Map aims to support the struggle of countless populations and groups affected in their territories by projects and policies based on a vision of development that is unsustainable and harmful to the health of these populations. The platform systematizes and socializes the available information, giving visibility to the complaints presented by communities, social movements, and partner organizations. It contributes to the monitoring of actions and projects that face situations of environmental injustice and health problems in different territories and urban, field, and forest populations, including coastal areas.

C. **The Water Atlas** – Digital system for the visualization and analysis of water quality, sanitation, and health indicators. Produced and administered by the Institute of Communication and Scientific and Technological Information in Health (ICICT/Fiocruz) and by the Health Surveillance Secretariat (SVS/MS), the Atlas aims to collect indicators and data on health, water and basic sanitation conditions in Brazil. It produces thematic maps and portrays the conditions of sanitation systems, water quality, and water-borne diseases in Brazilian municipalities. Finally, it allows public managers and social organizations to use this information to minimize risks to the population and develop public policies on sanitation and water resources.

Combat pesticides to ensure human rights and occupational health and promote the health of rural, forest, and aquatic peoples and populations

Reducing the sale and consumption of pesticides in Brazil and globally does not only mean improving the health of rural workers and offering healthy food to the population. Fighting the use of pesticides represents facing the unsustainable model of agribusiness. This challenge requires debating the production process and legitimizing science itself. The dispute is not only economic or conservationist; it is mainly cultural and political.

This struggle must, therefore, be extended to different spheres and segments of society. It implies facing the economic system, developing new techniques, recognizing traditional production forms, respecting the ecosystem's time of environmental recovery, and ensuring safety in the field.

As a signatory member of international agreements and agreements of several agencies of the United Nations (UN), such as the United Nations Food and Agriculture Organization (FAO), WHO, and the International Labor Organization (ILO), Brazil has the obligation to review and improve the legal bases to re-evaluate the use of pesticides in the country. The articulation between policies, control agencies, social movements, NGOs, and research institutions is a crucial factor for the success of any sustainable agenda.

The National Food and Nutrition Policy, for example, is recognized by the Ministry of Health as one of the strategies to implement the guide to promote adequate and healthy eating. While the social and environmental impacts of the intensive and industrial agriculture model are recognized, agroecology is advocated as a way to move towards a healthier food system. National Occupational Health policies and the Comprehensive Health of Rural, Forest and Aquatic Populations, follow the same perspective.

As examples of activities developed by Fiocruz on the subject of Pesticides and Health, we can highlight the construction and implementation of the National Toxic-Pharmacological Information System (SINITOX), managed by ICICT/Fiocruz, and laboratory support for diagnosis and quality control of products and services related to the use of agricultural inputs. Likewise, there is a whole

work of dissemination of technical-scientific knowledge and communication with society and rural social movements, emphasizing the Dossier Abrasco: a warning about the impacts of pesticides on health; and support for audiovisual production through the Canal Saúde (Health Channel).

Processes and Activities of HES Actions-Training

Fiocruz has strengthened and operationalized the theoretical-methodological model, which provides for the interrelation between health, environment, work, and sustainability. Thus, it develops important training-action processes for the general population and, in particular, health workers and professionals, attending to the specificities and health conditions of rural, forest, and aquatic peoples and populations.

It also brings up essential themes for reflection and for the current debate, such as an ecosystem vision of health; health and environment monitoring; information production; climate change that can promote pre-existing health problems, affecting the balance of already established systems and ecosystems; and confronting the impacts of pesticides, health surveillance, and popular and health surveillance.

In this context, Fiocruz materialized the project Professional Master in Labor, Health, Environment and Social Movements, which addressed these issues. The consolidation of knowledge about the scientific method, critical theory, development around the relationships between health, environment and work, brought at the same time the historical-dialectical process and the search for the formation and understanding of the human being in its multiple potentialities.

Another strategic axis for the training-action of SUS professionals is the Multiprofessional Residency in Rural Health, the result of a process of social struggles in defense of training that includes a political-pedagogical plan per the specificities of rural subjects, playing a leading role in the reflection on the health professional and the local reality. Fiocruz develops throughout this path integrated Research, Teaching, and Education in Health, Environment and Labor actions, such as:

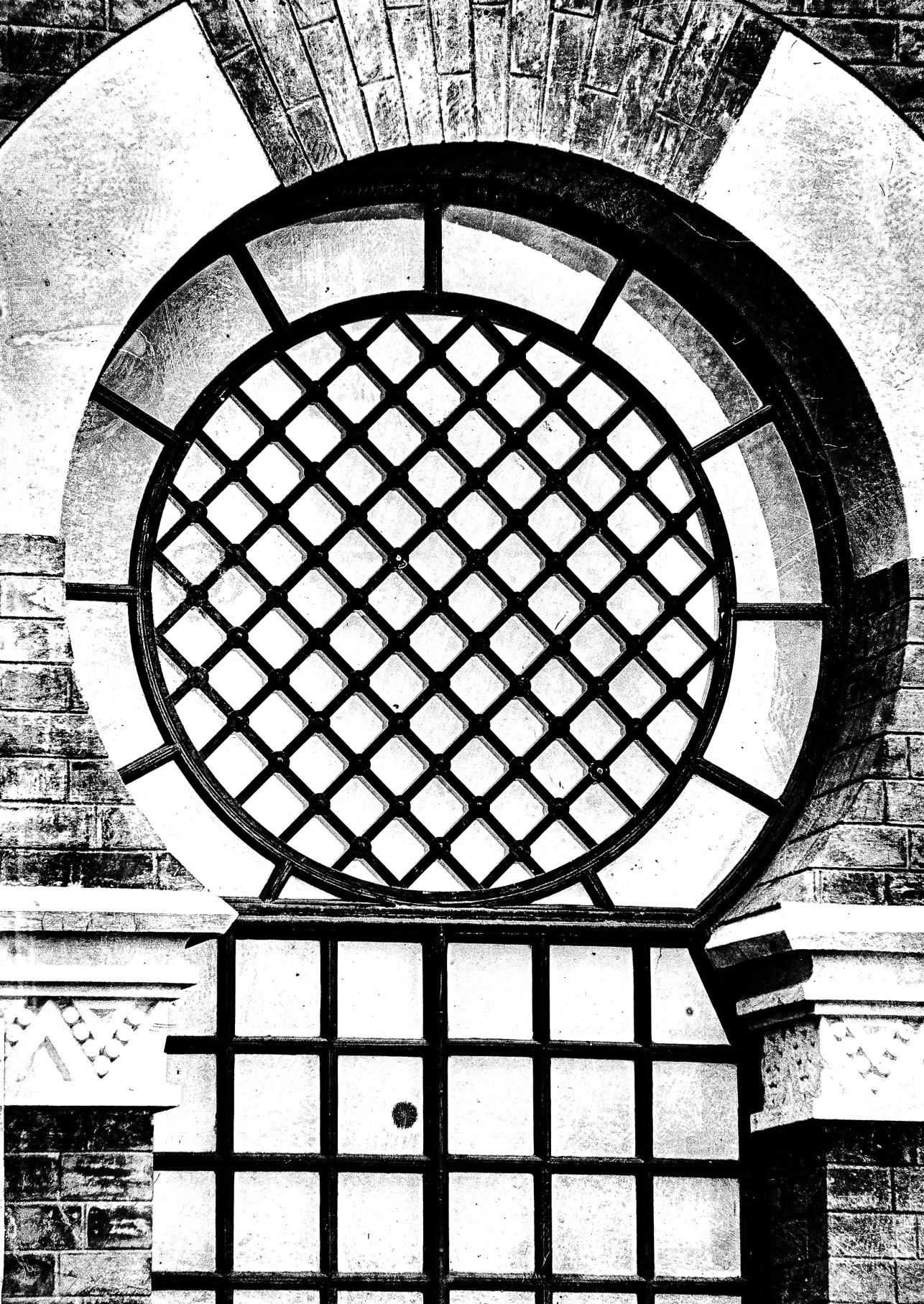
- The Formation of Leaders for Rural, Forest and Aquatic Peoples and Populations;

- Free lato sensu postgraduate courses aimed at training professionals in the fundamentals of biodynamic agriculture in the production of medicinal plants in agroforestry, to promote healthy and sustainable territories;
- Stricto sensu postgraduate course – Professional Master in Public Health Policies to train health workers and ancillary areas and social movements;
- Free lato sensu postgraduate course focused on Health, Environment and Labor focused on the qualification of health workers, social movements and the community; and
- Courses for popular rural health workers, to positively intervene in the territory and health care, especially during the COVID-19 pandemic, where care is necessary for health promotion.

Moreover, we have research-action projects to promote healthy and sustainable territories, such as a proposal for the qualification of the work of community health workers (ACS) in the Semi-arid; research-action in a traditional fishing community; and observing and strengthening Agroecology strategies and contextualized education in social reproduction, health and, especially, in public policies, for coexisting with the Semi-arid and SUS management. It is also worth mentioning that Fiocruz has a set of institutional projects and we list only a few experiences focused on HES.

Digital inclusion is a challenge at a time of the COVID-19 pandemic for teachers and students alike, who had to adapt to different devices, requiring didactic strategies for remote activities in the face of social distancing, considering the difficulties, such as internet access or mastering the tool. A myriad of digital platforms allowed virtual participation, the exchange of texts, videos, images on computers, which required strategies and practices of teachers to adopt these resources, especially considering the cultural and socioeconomic diversity of students and workers.

This recent experience showed us the need for a more coordinated and articulated decision-making, to train its professionals for the development of their activities, considering the specificities and singularities of territories and populations. Finally, corroborating this idea, Freire (2002, p. 68) points out that “no one educates anyone; no one educates himself; men educate each other, mediated by the world”.



CONCLUSION



This publication aims to endorse the work carried out by Fiocruz in the field of HES. By establishing an analysis timeline, the text articulated the historical trajectory of the Institution, the political-institutional maturity of the Foundation, acting as a Collaborating Center of PAHO/WHO, and the definition of thematic agendas that strengthen of the 2030 Agenda.

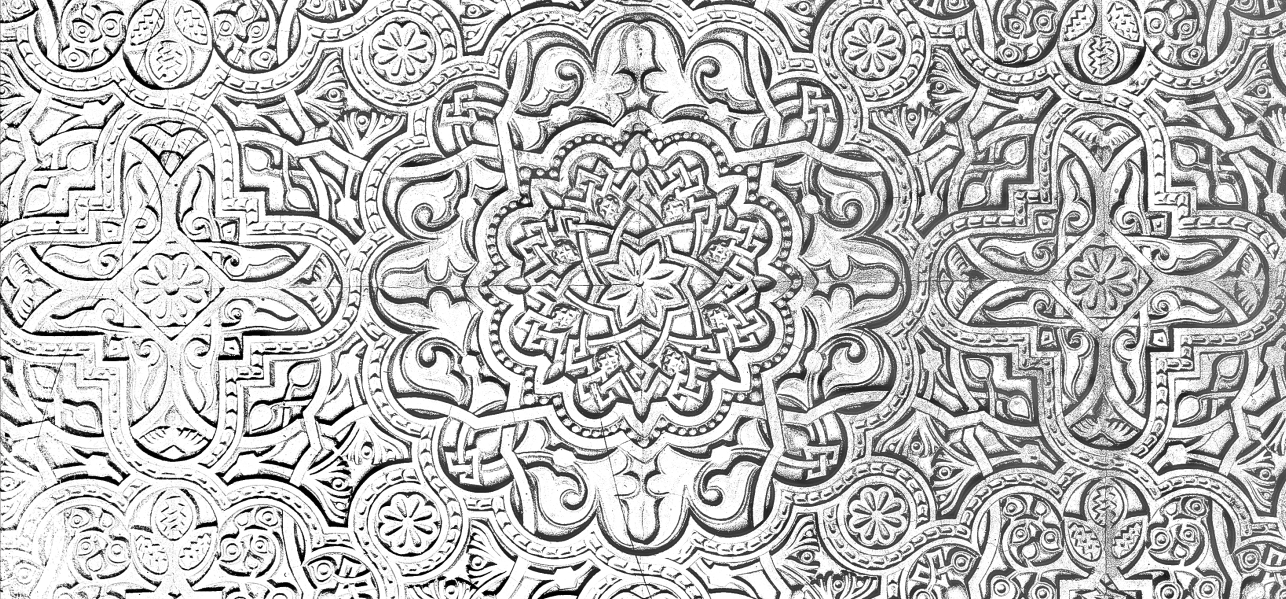
This is an excerpt of a long history and vast academic production, which elevated Fiocruz to the rank of a strategic agent to confront inequities and socio-environmental injustice on a local, regional and global scale, and to fulfill the goals stipulated by the SDGs.

By emphasizing the different approaches in HES, we intended, on the one hand, to highlight the issues and challenges imposed on society by the current development, production, and consumption trends. On the other hand, we aimed to present the results achieved in addressing these issues,

through the action of several research groups, social movements, NGOs, and government programs.

In this sense, we believe that there is already a broad knowledge base, developed social technologies, and a sociocultural diversity available, sufficient to advance in breaking with the current development model, thus establishing new paths for sustainability, promoting the health of the population and the protection of ecosystems.

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ANNEX I

ORIGINAL DOCUMENTS OF THE HES COLLECTION



Volume I - History and governance

https://portal.fiocruz.br/sites/portal.fiocruz.br/files/documentos/01_hg.pdf

Volume II - Pesticides and Health

https://portal.fiocruz.br/sites/portal.fiocruz.br/files/documentos/02_agrotoxicos.pdf

Volume III - Biodiversity and Health

https://portal.fiocruz.br/sites/portal.fiocruz.br/files/documentos/03_biodiversidade.pdf

Volume IV - Climate, Health, and Citizenship

https://portal.fiocruz.br/sites/portal.fiocruz.br/files/documentos/04_clima.pdf

Volume V - Large Companies and Health Impacts

https://portal.fiocruz.br/sites/portal.fiocruz.br/files/documentos/05_grandes_empres.pdf

Volume VI - Sanitation and Health

https://portal.fiocruz.br/sites/portal.fiocruz.br/files/documentos/06_saneamento.pdf

Volume VII - Health of Rural, Forest, and Aquatic Peoples and Populations

https://portal.fiocruz.br/sites/portal.fiocruz.br/files/documentos/07_saude_povos.pdf

Volume VIII - Occupational Health

https://portal.fiocruz.br/sites/portal.fiocruz.br/files/documentos/08_saude_trabalhador.pdf



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