

The Environment and the Future

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CONTEXT

The times we are now living – geometrized in round numbers (2000, 500) that suggest packets of centuries – shepherd our reflections to the fantastic historical content of these packets. The media is now the main agent abetting these reflections, unfolding the 500 years of Brazilian history from a host of different angles and doing likewise with history of the Christian era – another fascinating theme, comprising no less than part of the Roman Empire, the entire Middle Ages, the Renaissance, the Industrial Revolution, culminating with the awesome inventions of the 20th century. It is a good time to tell these and other stories, but it is equally important for us to avail ourselves of the right angles in the geometry of history to look ahead and to compel reflections on our future, scrutinizing the epic *Thus Humankind Marches On*¹ from other angles – if only for its title more than for its content.

Agenda 21, one of the few guidelines we have for the future, is a bold initiative for its comprehensiveness and one-century span. Never before were plans made for such a long period. This extended time frame requires methodological adjustments so that conventional one- or two-decade plans can be coupled with prognoses and reflections on the great issues and their interfaces with each sector of society.

Not long ago, still dilettantes, our considerations took into account a world population of 5,5 billion. Today, we would have already exceeded 6 billion people. When will we know the true number of the asymptote of stabilization? What will be the social components of public policies three decades hence? Is it licit to speculate and conclude that environmental degradation is not worse only because more than half the world population lives on the fringe of the consumer society? Even if we use the need to increase the number of consumers as a justification, will we have the determination to strongly promote the expansion of the population with access to consumer goods? Will this improve the quality of life? What will be the environmental impact of each 10% increase in the number of new

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consumers worldwide? Are natural resources exhaustible or not? Will the oceans have risen one meter by the mid-21st on account of the “greenhouse effect”, flooding thousands of ports and tourist cities, not to mention the fertile river deltas all over the world? To what extent will recycling preserve non-renewable natural resources for future generations? Will the automobile retain its allure and hegemony as a means of transportation and status symbol? Will it continue to claim massive investments in road building to the detriment of other demands of society?

DEFENDING THE ENVIRONMENT

The environment is the address of the future to which most demands will converge. We do not need in-depth studies to conclude that the threats to the quality of water are overwhelming, that climate patterns will tend to change drastically over the next century because of the *greenhouse effect* and the diminishing *ozone layer*, and that biodiversity is waning and impoverishing our genetic legacy, precisely at a time when science demonstrates each day that nature is a monumental springhead that harbors bountiful resources for scientific development.

The defense of the environment, a concept that includes restoring ecosystems, comprises activities that had their onset as a set of ordered actions in the mid-20th century and that, for practical purposes, may be divided into three phases, as follows.

The pioneering phase

The simple perception that humankind – which had already regulated its behavior to limit inopportune social attitudes (e.g., the typification of crimes, misdemeanors and conducts that compromise the quality of life in a community) – was increasingly putting environmental resources at risk, under the misunderstanding that things not owned specifically by anyone could be used haphazardly by anyone, led to the spontaneous and simultaneous emergence of the environmentalist movement in various cities of several countries.

Without greater scientific groundwork at first, the protests were against the most obvious predations of the environment and rather outlandish means were used to attract notice to the movement – e.g., climbing on trees to prevent them from being cut down, rallying against topic nuisances of atmospheric pollution, calling attention to the causes of mass deaths of fishes etc.

The elites were quick to disqualify such attitudes, labeling ecological activists with a host of disparaging adjectives while revealing their presentiment that the defense of the environment would inevitably bring some of their privileges to an end or, at the very least, would oblige them to make investments to control the effects of pollution, for instance.

The trenchant and unorthodox protests, however, were recorded by the media, which saw in those strange attitudes at least a matter of journalistic interest. From this to being assimilated by society was a natural step. A mixture of curiosity and agreement with the convictions of the ecologists increased the social will to replace predatory behaviors with others more respectful of nature – even if, individually, this same society was not prepared to actually do its part. Many thought that if others improved the environment, they could personally continue to commit their environmental peccadilloes without drawing attention.

The political and enforcement phase

As social will is the forerunner of political will, the environmental issue evolved into a world movement with the creation of numerous issue-oriented Green Parties, particularly the *Die Grünen*, in Germany. The German case is emblematic, as the perspective of becoming a partner in the government coalition could become a reality with only 8% to 10% of the votes, replacing the Liberal Party (FDP) as the golden mean between the two largest parties (CDU and SPD). And, indeed, that is what happened. Today, the German government is run by the SPD/ Die Grünen coalition.

In Brazil, the Green Party (PV) emerges from every election with more and more elected candidates, progressively occupying a larger political space. The ideological parties from the left have lost their relevance in face of the inexorable advance of capitalism and globalization, opening room for an issue-oriented party with a clear, objective, timely and charismatic agenda, attracting particularly the young.

The pressure from ecological movements, amplified by the media, and the insertion of the environmental issues in the political realm, together with the technical and scientific developments in public institutes dedicated to the defense of the environment in the universities, led government authorities at all levels to enact laws, decrees, technical norms and other enforcement instruments for environmental control. In Brazil, the 1988 Constitutional Convention decided to include a modern and comprehensive chapter on the environment in the Federal Constitution.

Brazil also saw the remarkable engagement of Prosecuting Counsels, both at the federal (Solicitor General) and state levels, pressuring the transgressors of environmental laws on one hand and the authorities themselves of the National Environment System (Sisnama) on the other, according to the scope of their environmental responsibilities. From these actions emerged new demands for environmental control and clean production technologies.

The marketplace phase

The demand for technical services, control equipment, and new clean processes evoked an immediate reaction from the marketplace, instigated also by the academy and by technological institutes. This was not difficult. The technical capabilities required to fulfill the demand for the production of consumer goods was overheated. Making the changes required to manufacture environmental control equipment was very simple, as was adjusting consulting and projects engineering for the new challenges.

More sophisticated market instruments emerged, for instance, with the series of ISO-9000 and ISO-14000 certifications that leave globalized industries no alternative but to manufacture with competence and environmental responsibility. This was an additional factor that contributed to the expansion of the green market.

THE FUTURE

Even the audacious one-century time horizon of the Agenda 21 is irrelevant in face of the responsibilities of our generation as we enter the third millennium and witness the extraordinary scientific and technological explosion, and the unprecedented economic thrust – unfortunately with no adequate countervailing social/ economic and environmental models.

The 21st century will pass in a fraction of a second of the time humankind has existed on Earth. What is worrisome is that everyone desires his or her existence to last not *seconds* on this scale, but days, weeks, years... How can we conciliate the enormous, logarithmic development potential assured by our current knowledge base with the physical limitations of the planet's surface – especially as we furthermore intend to preserve areas of our anthropic occupation as a genetic warehouse for biodiversity and reserves of natural landscapes?

Among other answers, we must believe that our cumulative knowledge can guide us to solutions in the realms of exact and biological sciences. Unfortunately, in the cultural and political realm, as in the realm of other human sciences, history shows us how narrow are the limits of diplomacy, often frayed thin by wars, even when much lesser incompatibilities threatened us than those the future has in store for us. Fortunately, over the last years a new conflict-attenuating ingredient has emerged, one that has expanded the scope of diplomacy: the globalization of the economy. But it is still too early to state that peace is sealed just because trade has created a protective network of interests. After all, a trapeze artist may fall outside the safety net.

Population and development in the social and economic realms

Agriculture, by increasing productivity, has managed to frustrate old prognoses that we might all eventually starve. But one must ask: until when? Further more, when the entire population of the world is adequately fed – something that no one dares not to desire – what political/administrative forces will be able to prevent the Pantanal² from being drained or the Amazon forest from being totally cut down and transformed into pastures or soy fields – as dreamt by part of Brazil's northern elites?

Development, which everyone desires, is also the only currently known peaceful way to control birth rates and stagnate demographic growth. Other components must be reckoned with in Asia and Africa, such as religious and cultural intransigence, with which we must patiently and competently learn to live with – at least until an economic level is finally achieved that arrests population growth by means of intrinsic self-regulating mechanisms.

Education and public policies to expand environmental protection services are activities with a potential to create jobs that have yet to be more than superficially exploited in Brazil.

Consumption demand

Avoiding mistakes that might compromise our reasoning, we may state that one-third of the world population – almost two billion human beings – make up the so-called *consumer society* in its entirety. Another third, except for bare and meager survival, live outside any type of consumption. And a further third live in an intermediate situation, hoping to ascend to the privileged world of consumers.

Considering the environmental impacts of manufacturing, transporting, marketing, using and disposing of consumer goods and services, at the levels we see today, especially in emerging countries such as Brazil, the mere extrapolation of such impacts to a society in which practically everyone is a voracious consumer is enough to send a chill up and down our spine. However, this is the mechanism that, paradoxically, leads on one hand to the stagnation of population growth and, on the other, to a more homogeneous society and, thus, a society more receptive to public recycling policies, to greater individual discipline in defense of the environment and to a collective awareness of the need to bestow future generations with quality life conditions. The fundamental prerequisite to reach this stage is education, in the broadest sense, and specifically environmental education, which tends to be a natural consequence of a more sweeping process. In Brazil, the 1988 Constitution made environmental education mandatory at all school levels in the country. The law has yet to be fully obeyed, however, and, as always, the greatest hindrance is that not all children here have access to school.

PROTECTION OF WATER

Much has been said lately about the threat of water being insufficient to meet the demands of the 21st century. The issue is rendered more dramatic with insinuations that water – or the lack of it – might actually become the cause for wars. This makes all the more sense when we observe the neglect with which governments and society as a whole manage our water resources. One need only look at any urban river or stream to understand the dramatic condition of our waters, soiled by domestic sewage, industrial residues, and garbage of all kind. In rural areas, the situation is not much different. Pesticides are released on the ground with no understanding that the next step is the lixiviation of these poisons into the rivers – the same being true for chemical fertilizers. Widespread deforestation contributes to the silting of rivers, but even the few existing regulations to protect water resources, e.g., the preservation of riparian vegetation or waterside forests, are widely ignored. Although efforts to enforce the rational use of water are more complex and comprehensive than might seem at first glance, they are nevertheless possible, as outlined below in an obviously abbreviated form.

Control of deforestation

Preserving the forest coverage in steep slopes – even homogeneous forests planted for economic purposes – is the most adequate way to preserve subsoil waters and regulate river flows.

Native forests are better suited for this because they also preserve other natural resources – biodiversity, in particular. Preserving the biodiversity of larger animals requires extensive areas connected by forest corridors. Isolated woodlands mean little for species at the top of the food chain.

Reforestation policies

The Floram Project, developed ten years ago by the Institute of Advanced Studies of the University of São Paulo, continues to be the most comprehensive proposal of ecological forest policy, inasmuch as it takes into account the greenhouse effect, the preservation of biodiversity, the restoration of landscapes, economic-oriented forestry, the prevention of soil erosion and river silting, the recovery of the quality of water resources and the regulation of subsoil and surface water flows. At the core of the Floram Project is the occupation of every soil deteriorated by inadequate exploitation, of deforested soils with irregular topography, of low-fertility soils for agriculture, and of soils in the process of desertification, and their restoration by means of a combination of fast-growing forests (60% to 70%) and the reconstitution of native forests (30% to 40%) – a continuous mosaic of forest coverage, alternating groves of native vegetation with homogeneous manplanted woodlands. The management of homogeneous forests is the key to the economic sustainability of the undertaking, while the reintroduction of expanded native riparian vegetation and forests in slopes recomposes the basis of biological diversification in the various strata of the wildlife food chain. In addition, thanks to the social viewpoint enmeshed in the environmental outlook of professor Aziz Ab'Sáber, an additional component was introduced in the Floram Project, namely, subsistence farming for the people engaged in silvicultural activities. The Floram Project has been acknowledged internationally and received the “Hopes for the Future for a Sustainable World” gold medal from the International Academy of Sciences in Munich and from the International Union of Air Pollution Prevention Associations (IUAPPA), a committee chaired by Nobel laureate professor Yuan T. Lee, from Taipei's Senica Institute in Taiwan. In spite of these high-value international honors and the simplicity of Floram's proposals, the project has not yet been taken on as the official forest policy in the country where it was conceived –

although isolated projects with similar approaches are being tentatively implemented to compensate carbon dioxide emissions.

Erosion control

Preserving the quality of water is highly dependent on the quality of the drainage regime. If erosion is combated, silting can be brought under control. Together with other sustained management policies for hydrographic basins and micro-basins, this restrains floods to the marshlands, which are properly the domain of the rivers. And flood control reduces the catastrophic dragging of houses, automobiles, wood, tires and other debris that contribute to increased silting and help to trigger other, even more dramatic floods.

Control of agricultural pesticides

Pest control technology has done its part to protect the environment by producing agrochemicals with short-lasting active ingredients, translating into lower accumulation of these toxic elements in the environment. Specifically, biotechnology has gone even further, producing biological predators crop-damaging pests as well as more resistant species – even if ongoing research in this field, when involving genetic manipulation, treads on ground where ethical limits have yet to be defined.

Whatever the outcome of evolving techniques to increase agricultural productivity, the use of chemical products is today a major factor in the deteriorating quality of water resources. We may be optimists as to the future in terms of chemical pollution from agricultural pesticides and herbicides, but we must be cautious as to the effects of genetic manipulation in biotechnology.

Agricultural fertilizers

Regarding the use of chemical fertilizers, future procedures are less complex from the technological point of view, inasmuch as plants require macro- and micronutrients and the soil has a limited capacity to provide these inputs. There is not much left to be invented. Practically everything that should be done can be found in the books about organic and organomineral fertilization written by Professor Edemar José Kiehl, from the Luiz de Queiroz Agricultural College (ESALQ), in Piracicaba, state of São Paulo.

What we really need is an ideological shift (ideology being understood in its broadest, and not only political, sense) in agronomy colleges, currently dominated by the easy recipe of applying chemical fertilizers. Particularly in soils with low clay content, the

absence of colloidal binders can be compensated with the introduction of humus, found both in peat and in organic compost.

As a source of organic matter for the production of compost, we might mention that half the urban garbage produced in Brazil is an excellent raw resource for composting. And we might add to this the residues from the food industry, also rich in compostable inputs, and also vegetable and animal residues of various kinds.

Control of water pollution

The contours defined by the items mentioned above embody contents that outline the size of challenges we face to assure quantity and quality water for the future. Technologies to treat water, or rather, to prevent it from being contaminated, already exist, and are being developed more under the laws of the marketplace than those enacted by legislatures. The spectrum of the lack of water in the future is quite real and should permanently distress our conscious and our unconscious if we hope to leverage political and administrative decisions, both from the private sector and, mainly, from the government. Governments, through public works or policies, bear by far the greatest responsibility for environmental decay in general and for the deterioration of water resources in particular.

– *Pollution from agroindustrial activity.* The agricultural industry comprises activities that have a strong potential for organic pollution of water. This means that a sugar or ethanol mill, or a factory making paper and cellulose, for instance, may kill every fish in a river over an extension of several kilometers – a situation further worsened if we have to deal with not only one, but several mills, as often happens depending on the economic vocation of a state or region. A dead river generally resuscitates downstream, after the microbiological activity of the river itself has had time to act and has digested the pollutants – which, in this case, are predominantly organic, that is, biodegradable.

– *Pollution from industry in general and from the chemical industry in particular.* The chemical, petrochemical and fertilizer industries are examples of activities whose toxic residues can alter the characteristics of water – and, not being biodegradable, are rarely digested and may accumulate in the food chain, causing damage to those who ingest fish or crustaceans. The classic case is the Minamata disease. The contamination from mercury discharged by a soda manufacturer caused a biochemical reaction in the slime at the bottom of the Minamata Bay, in Japan, transforming metallic mercury into methylmercury that benthonic organisms could assimilate. As the size of the fishes that had fed on other

fishes or crustaceans grew, the concentration of mercury in their organic tissue also increased. After more than a decade, symptoms arose in the population, who found in fish their main source of protein. Deformation in adults and congenital malformation reached epidemic proportions. After this alert, other cases were detected, including one in the Tainheiros Cove, in Salvador, in our state of Bahia. Sometimes – when, for instance, the flow of a river increases with more voluminous water coming in from its tributaries – contaminants are diluted and their power to interfere in the ecosystem is apparently reduced. This is what happens in the Tietê river. This river is heavily contaminated in the metropolitan region of São Paulo but downstream, after Barra Bonita, it apparently becomes clean waterway. What has disappeared is the growing amount of slime that has accumulated and remains at the bottom of reservoirs in Santana do Parnaíba, Pirapora, Rasgão, Salto and Barra Bonita, to mention only those that have the more aggressive sludge cocktails – veritable poison bombs ready to detonate with any climatic event resulting from less common hydraulic maneuvers.

– *Pollution from domestic sewage.* The most scandalous form of water pollution is the one we see at urban settings, where most of the people now live and where we can see and smell the stench of polluted streams – knowing full well that each one of us, either personally or through the economic activity in which we participate, contributes to this desolate picture without, as a rule, displaying any gesture of revolt. This infuriating conformism is reflected on the priorities of public investments, which never seem to include the collection and treatment of sewage (society rarely demands this from government) or do so in an incomplete and halfhearted manner.

The case of Ibirapuera park in São Paulo is quite representative of such incompetence. The drainage basin of the Sapateiro stream has by now been totally urbanized. It is part of the Vila Mariana district, where all streets are fully served by a sewer network and a separate rainwater catchment network. All the sewage should be channeled to the sewer network. However, a tangible part of this sludge ends up in the rainwater mains, eventually emptying into the Sapateiro stream – which, in turn, flows into the Ibirapuera lake, compromising the quality of its water and, consequently, the aesthetics of the entire park. Although the park is one of the city's postcards, political idiosyncrasies and the technical incompetence of state sanitation authorities have spoken louder and a dramatic situation has become eternized. In addition to the aesthetic aggression to the park users, this case is an affront to the city as a whole and a major cause for concern: if the authorities cannot reach an agreement even in regard to the Ibirapuera park, what can we

expect in terms of sanitation for the rest of the city and, in particular, for the forsaken, forgotten and poverty-stricken outskirts?

Jorge Murata/Agência USP



Ibirapuera park (lake).

This case is not only *not* unique, it reflects a shocking insensitivity. Public sanitation works are not seen as undertakings to clean rivers; they are just public works, involving huge investments that are exhausted in themselves. The important thing is to obtain funds, contract a generous construction company, bury the mains, measure out the services and pay! Connecting home and apartment building sewers is apparently a secondary detail: it will happen in due time, when the owner of the house requests – something that, as a rule, does not occur. In Santos, state of São Paulo, although the city has been served for decades by a series of sewage collecting networks, its famous canals remain filthy, to such a degree that authorities, in order to reduce the pollution of the beaches, have chosen a rather unorthodox solution: capturing the water from the canals and discharging it, through enormous drains, into the oceanic interceptor that runs under the canals with idle capacity. The same happens in Joinville, state of Santa Catarina, discussions raged on the convenience of diverting the Mathias stream and other mucky affluents of the Cachoeira river and discharging their water into the interceptors of the

city's underused sewer system – a public works that has consumed loads of money over the last three decades, without producing any practical results in terms of depolluting the Cachoeira river, the Saguacu lagoon and the Babitonga bay.

Urban sanitation works are expensive and impact a city's day-to-day life during construction. One often hears that mayors prefer not to build them in order to avoid political wear and tear during execution and because, once finished, no one remembers them. This inference is precipitate and simple-minded, portraying the technical poverty of city hall social communication officials. In terms of social communication, there is no such thing as a public work with greater or lesser public appeal. What exists is greater or lesser competence of social communicators. Any work, if necessary, becomes a political critical mass capable of projecting the public officer who made the decision to implement it. Choosing competent communicators, however, is quite another story.

So far, this item has dealt with direct sewage pollution. Looking over the next centuries of the new millennium, we must see further. It is not enough to treat sewage. The end product still contains a sizable load of components that science is beginning to identify and that, in the long run, may affect public health and the environment. We must seriously consider re-circulating treated water for secondary uses, e.g., irrigation of parks and gardens, for industrial purposes or even for less quality-intensive domestic uses. Urban rainwater captured through proper networks must also be treated, because they carry contaminants stored on rooftops, sidewalks, streets, and gutters. The water of rivers and lakes should be the cleanest of waters in order to fulfill their fundamental ecological role, namely, preserving the genetic stock of aquatic life – quantity- and quality-wise – in every river or lake, as no two ecosystems are alike. Each has its own characteristics, depending on altitude, water temperature, rate and turbulence of flow, natural input of nutrients, interaction with the soil and atmospheric elements of the ecosystem to which it belongs etc.

It should be noted that our descendants' attitude toward rivers, lakes, seas, and oceans will probably change much more than, for instance, our generation's attitude toward wildlife. Who could have imagined only a few decades ago that today's safaris would involve only observing and photographing wild animals in their natural habitat? And that, for this very reason, safaris would be mass-marketed with minimum impact on the life of the animals?

– *Pollution from solid residues.* Together with the sewage problem, the definite disposal of solid residues – including waste from domestic, urban, rural, commercial,

industrial and health care activities, with solid, pasty or even liquid characteristics –, when toxic, is Brazil's greatest unsolved urban environmental problem and may spread to most of the world.

Although much less expensive in terms of investments than a solution for the sewage problem, very little in this field has been implemented in the Third World (if this expression makes any sense...). The cause is just one: the absence of political will, deriving from a lack of social will. Just as city dwellers learn to live with filthy rivers, they also learn to live with vacant lots and roadsides filled with the most varied assortment of garbage and refuse, including highly dangerous toxic residues.

All this muck is carried, or at least lixiviated, into urban streams and rivers, enhancing this diabolic broth of water poisons. The solution involves the adoption of new recycling concepts, as described below. If the management of solid residues is accomplished on proper economic and technical bases, the deterioration of waters caused by dragged and lixiviated garbage is also reduced. It should be noted that I only approach the problem with such optimism in this essay because there is no time limit for implementing the measures I propose. It is worth keeping in mind that if we speak here in terms of decades, centuries or even the entire millennium, then such time frames might actually be necessary to implement the solutions if we are not competent enough to change the predatory culture of our society.

RECYCLING

More than 3 million metric tons of all types of garbage are generated in the world each day – and this does not include industrial residues and the refuse from mines, which is practically incalculable. When we observe the contents unloaded by garbage trucks in the operation fronts, even the most impervious and properlybuilt American sanitary landfills will attest to the incompetence of today's societies and their governments in dealing with the problem.

Many approaches have already been tried to this clamorous problem. An expression was even coined: the “3 R's” – Reduce, Reuse, Recycle. We have been harping a lot on the “reduce” string, but this might be unproductive, because consumer society always tends to expand and garbage disposal comes as a natural consequence. Actually, if the consumption of goods and services were to hypothetically regress, we should reflect what this would mean in terms of job losses – in addition to those being cut by the rationalization enabled

by technological development and promoted by competition and the constant search for productivity gains. As for the other two “R’s”, we may in truth deal with as only one: Recycling.

Recycling is the most promising concept and the most important fact to arise in the environmental milieu in the last years. Seen from a pragmatic viewpoint, it is the way to conciliate the worldwide trend of globalization (which embeds the trend to universalize consumer society and, as a consequence, increase garbage generation) with the economic activity of processing residues.

It is not by chance that each year the world’s greatest environmental trade shows – such as those in Munich, Cologne and Atlanta, to mention only three – offer new and creative technologies to recycle the most varied components of garbage. Thus, the solution to this huge problem begins to enter the marketplace phase (see item *The marketplace phase*).

Based on more than 30 years observing the evolution of proposed solutions for the definite disposal of garbage both in Brazil and around the world – either through direct management or by assessing the trials and errors of other officials – and, above all, on placing all contents in the modern economic context, the concept of *macrorecycling* eventually arose. This concept is described below as the author’s contribution to promote profound changes in the administration of urban sanitation services.

Macrorecycling assumes that all garbage should be processed in order to reduce landfills but that its disposal should obey the laws of the marketplace.

The basic principle of this concept is a slightly different way of packaging domestic garbage, compared to what is already practiced in many cities, but which becomes fundamental when we are dealing with macrorecycling: separating humid organic matter (discarded foodstuff, “green scraps” from pruned plants) from so-called dry refuse (packages, metal, plastic, glass, rubber etc.) in two separate containers.

Simultaneous selective collection is the next step. The two kinds of residues are transported in the same truck, but in different compartments. The third step is processing both fractions (the organic and the dry) separately in a CRDR – Center for Recycling and Disposal of Residues. Special effort is made not to mix humid organic matter with dry refuse, so that one fraction does not contaminate the other. This enables the manufacture of better quality organic compost and an improved selection of dry refuse, because it is not impregnated with mucky food residues.

From this point on, each case should to be treated according to its own peculiarities. Officials may, for instance, choose to employ more labor or to mechanize more processes – the latter requiring more capital at first but leading to greater productivity gains later on. In each case, corporate performance should be collated with social benefits and, obviously, with the quality of the environmental solution as seen from every angle. The solution must not impact, pollute or disturb its surroundings, but should nevertheless strive to recycle as much as possible, inasmuch as this is the great legacy that will be passed on as a model for future generations.

Recycling is to be understood as an effort that involves not only the selection of materials (such as tin or aluminum cans, glass, plastic bottles, paper, cardboard, tetrapak etc.), but also the manufacture of organic compost to be used as agricultural fertilizer, the extraction of energy (biogas, obtained from the anaerobic fermentation of organic matter, the first phase of the composting process), the appropriation of thermal energy derived from the rejects of dry refuse (only for very large cities), the recycling of tires and batteries, and the packaging of pesticides for the rural area of the city.

However, a good technical notion is not enough for the great technological turnaround that macrorecycling represents. The new concept also embodies a corporate proposal based on granting service contracts for longer periods – 10 to 20 years, renewable – so that the contractor, who will have to make huge investments to process and market the residues on an industrial basis, can obtain rates of return equivalent to those of other business opportunities. In terms of taxation, the idea also contains innovations. Garbage fees would be collected by the organization responsible for water and sewage (or, as another option, by the electric utility), according to a statistically-determined formula for each case correlating a household's water consumption and its garbage generation – much the same way sanitary sewer services are charged today. The water & sewage agency would transfer part of the garbage fees to the contractor responsible for urban sanitation, retaining a percentage to cover its own administrative costs. When water & sewage services are managed by a municipal company, the solution is even simpler, because this agency would be empowered by the city government to contract and inspect the contractors in charge of urban sanitation.

The first specific and complete master plan for macrorecycling services has just been concluded in the city of Jaraguá do Sul, encompassing four other neighboring cities in Santa Catarina. In addition to garbage collection, the deal will include sweeping public spaces, cleaning and washing street markets, removing green garbage (pruned trees and

residues from the maintenance of public and private gardens and parks), maintaining rainwater mains, removing toxic residues from the rural area, and disposing of the residues from commercial establishments, industries (a significant percentage in this specific case) and health service organizations. Processing and recycling all these residues at a CRDR and harmonizing the landscape of the CRDR will be carried out in a vast park in the Atlantic forest, where two-thirds of the total area will be preserved as a buffer zone and only one third used for operations, fully occupying a hydrographic basin, up to topmost watersheds.

CONCLUSION

The technological conditions are already in place. And today there is reasonable collective awareness of the need to apply these techniques through plans, programs and projects in order to deflect the *path of humankind* from the current collision route with the garbage generated by our collective irresponsibility with deep historical and cultural roots.

The anxiety of those who study such problems derives from the slow pace of political/administrative decisions to stimulate mechanisms that might revert the syndrome of environmental collapse. The speed of reaction and the decisions to unleash corrective and preventive processes do not keep up with the galloping depredation of the sources that sustain life, brought about by reckless collective behaviors. If it is the social will that determines our almost inexistent environmental political will, we must creatively invest in the process of creating awareness, by making strong dramatic statements and attracting the attention of the media – not so much to reaffirm what has been exhaustively denounced as to stress the irreplaceable role of the media in forming our social will. The faster we can speed up the process to change environmental behaviors, the less dreadful will be the already triggered catastrophes that will occur and that we were not able to avoid in due time.

NOTES:

1. Literal translation of the Brazilian title (*Assim Caminha a Humanidade*) for George Stevens' 1956 epic film *Giant*.
2. The world's largest floodplain, located in southwestern Brazil. The flora and fauna of its unique ecosystem are found nowhere else in the world.