

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/279943772>

Big Science and the Enchantment of Growth in Latin America

Article in *Global Environment: A Journal of Transdisciplinary History* · January 2012

DOI: 10.3197/ge.2012.051003

CITATIONS

2

READS

39

1 author:



Nicolás Cuvi

Facultad Latinoamericana de Ciencias Sociales Sede Ecuador

81 PUBLICATIONS 196 CITATIONS

SEE PROFILE

Big Science and the Enchantment of Growth in Latin America

Nicolás Cuví

A hundred kilometers away from the American Continent, in the midst of the Pacific Ocean, on the Equator, is a volcanic archipelago anciently referred to as “The Enchanted Isles”, presently known as Galapagos. It got its epithet of “Enchanted Isles” from Spanish sailors due to the difficulty of navigating its waters. The theme was later immortalized by the writer Herman Melville,¹ who referred to the capricious, bewildering currents and winds



that hindered his voyage to such a degree that it took his ship a month to sail between two islands merely 90 miles apart.

The islands turned to be inaccessible to sailors in the same way that a wide range of possibilities are unreachable to those who contemplate them through a glass ceiling. The metaphor of the glass ceiling has been employed by feminists since the early 1990s to describe the obstacles women face when trying to reach high positions of power. No laws or social agreements exist to explicitly hinder women from reaching such positions, but the obstacles are nevertheless there. The glass ceiling allows you to see what lies above, but at the same time it makes it unreachable. A person can spend a lifetime observing what is above the glass, admiring it and yearning to seize it, but it will remain intangible, in the same way that the wind and currents made the islands unreachable for Melville. The sailor believes he will get there, yet he does not, as if he were struggling against some sort of enchantment.

This story introduces the central concept in the present article. I speak of the “enchantment of growth” to refer to a notion that has infiltrated the imaginaries of many Latin American peoples: the notion that welfare is attained through growth. This idea has become more pervasive after World War II as a result of close contact between Latin America and the United States. The enchantment I am referring to leads to believe that by making everything bigger (crops, mines, the economy, cities, raw material extraction, etc.) we will achieve a similar lifestyle to that of the United States. Contrary to this expectation, however, what has actually grown in Latin America is poverty, exclusion, foreign debt, and what is at the core of our discussion now, namely, a negative impact on nature. The enchantment makes Latin Americans imagine that growth and so-called “development” will enable countries to participate in the “First World” or “Developed World”. But while the goal is clear, the physical, mental, economic and political geography of the world prevents its attainment, in the same way that the winds and currents of the Enchanted Isles prevented mariners from reaching them. To reach the core, the privileged

¹ H. Melville, “The Encantadas or Enchanted Isles”, in *Putnam’s Magazine*, 1854.

“center”, one must move away from the periphery; but if everyone moves to the core, who is going, or who will want, to be peripheral?

Criticism of growth is not new; it is a core idea in many forms of environmentalism and since the 1950s has been a central argument in a number of theoretical approaches, including dependence theory, which argues that the development of the peripheral areas of the global economic system (including all of Latin America) is an impossible task under the current historical and structural circumstances.² Several authors have called our attention to the problems that a certain idea of development – the big over the small, agro-farming over peasant economy – has stirred up in Latin American countries. Therefore, my study on the enchantment of growth revisits an old issue on the basis of new sources.

How were notions of “large scale”, “vast intervention” and “pursuit of growth” introduced with the war? What were the material and symbolic consequences of this situation? This is the main topic of this article. I will first tackle some of the material impacts of World War II on the landscapes of Latin America. These impacts were initiated by the construction of military bases, the extraction of raw material, and the intensive opening of the agricultural frontier to export crops grown in extensive monocultures for the benefit of Northern economies. I will then specifically portray the symbolic impacts of a scientific mode of intervention based on “Big Science”. These impacts at first sight appear to be intangible, but once they had crystallized in the imaginary, in people’s subjectivity, the enchantment of growth set in, and this led to further and ongoing repercussions on nature. This historical process shows that what we think of nature, landscape, the environment and natural resources determines what we do with them; that our cultural values inform our behavior; and that ideas are thus ecological agents in themselves.³ Finally, I will

² The dependency theory is quite a popular subject. It was first put forward in Latin America by R. Prebisch.

³ D. Worster, “Appendix: Doing Environmental History”, in *The Ends of the Earth: Perspectives on Modern Environmental History*, D. Worster (ed.), Cambridge University Press, Cambridge/New York 1988.

reflect on how ideas that attained enormous relevance in a context of mass violence, war and international coercion, acquired enough legitimacy in the long run to lead not only to an economic, political and social historical transition, but also to an ecological one. My final reflection will move from environmental history to political ecology. I will argue that striving for minimum impact, thinking on a smaller scale, and rejecting the mirage of eternal growth are essential ingredients in the pursuit of a different model of civilization and a global culture of peace. The model I endorse here would be beneficial not only to nature, but also to humanity as a whole.

The inspiration for this article was Laakkonen and Vuorisalo's study of the "long shadows of WWII". These authors argue that "WW2 was a *socio-ecological paradox* from an environmental point of view. It was a suppressor but also a facilitator of environmentalism. WW2 had devastating direct impacts but also, perhaps surprisingly, indirect positive impacts. On the one hand, war directly annihilated the notable advances of pre-war environmentalism [...], but on the other hand, war changed structures of societies that indirectly enabled environmentalism to re-emerge after the war in a particular and strong mode".⁴

In the case of Latin America, while the continent did participate in the new rise of conservationism in the second half of the 20th century (the "second wave of environmentalism", as it was called by scholars such as R. Guha),⁵ the long shadow of WWII in the region does not seem to have included ideas related to nature protection; on the contrary, the war appears to have fostered ideas that led to increasing destruction of nature, beyond the rhetoric of conservational public policies or the declaration of protected areas. The conservational policies introduced by multilateral organisms and through international cooperation have remained discursive rather than substantial in their effects, as a look at any regional map of land use or any statistic on pollution will confirm.

⁴ S. Laakkonen, T. Vuorisalo, "Revisiting the Long Shadows: A Hypothesis", paper presented to the Workshop *The Long Shadows. An Environmental History of the Second World War*, Helsinki 7-11 August 2012, p. 1.

⁵ R. Guha, *Environmentalism: A Global History*, Longman, New York 2000.

I obtained many of the primary sources for the present essay at libraries in Washington D.C. (mainly the National Archives in College Park, Maryland, which holds documents that had remained confidential until the 1980s or 90s). I have also relied on theoretical and case-study approaches to environmental history and development. Although the reader might perceive a certain bias towards sources and examples from Ecuador, which are more familiar and easily available to me, I am fully convinced that the ideas expounded here are applicable to the whole Latin American region.

The impacts of WWII in Latin America

World War II did not severely undermine existing Latin American infrastructures, nor caused major traumas to the continent's societies or economies; however, it did have severe impacts on nature, as a result of the construction of military bases, the intensive extraction of vegetable, animal and mineral raw materials, and the opening of the agricultural frontier for monocultures complementary to the production of the United States. The US government built local military bases in nations like Ecuador, Colombia, Netherlands Antilles, Honduras, Nicaragua, Panama, Puerto Rico, Cuba, and Brazil.⁶ As an example of the impacts of this building activity, we can take the case of Baltra Island in the Galapagos, where the United States established an air base with more than 12,000 men in 1942 as a strategic site for the control of the Panama Canal. The air base transformed the physiognomy of the island. The flora and fauna were severely damaged, and the lives of the few colonists living there were disrupted by the dollar rush and the arrival of thousands of civil servants from other parts of the continent. As to long-term effects on nature, the military occupation led to the extinction of the terrestrial iguana in Baltra, the introduction of invasive species such

⁶ Department of the Navy, Bureau of Yards and Docks, *Building the Navy's Bases in World War II: History of the Bureau of Yards and Docks and the Civil Engineer Corps, 1940-1946*, Vol. 2, United States Government Printing Office, Washington D.C. 1947.

as the fire ant, and the extermination of animals as a result of target shooting practice. Currently, some animal and vegetal populations have experienced a slight recovery thanks to human intervention; however, compared to the rest of the archipelago, Baltra is a desert.

If the impacts of the military occupation of Latin America were severe, the results of the intensive extraction of raw material and the opening of the agricultural frontier were devastating. I have analyzed this subject in other texts⁷ which I shall briefly review here. Why was Latin American nature intensively exploited during the Second World War to obtain raw material and promote large-scale monocultures? The crucial factors here were the loss of the Asian raw material supply after the Japanese invasion and the entry of the United States into the WWII conflict.

Research on raw materials in Latin America was already being carried out several years prior to 1941, before the entry of the United States into the war. At the time the war broke out, some companies, such as the United Fruit Company, had long-standing active interests in the region. But after Pearl Harbor all these operations gained the character of an absolute necessity. During the Rio de Janeiro Conference in 1942, urgently convened by the United States, the bases for “Pan Americanism” were set. Bilateral agreements were subsequently signed between the US and its southern neighbors for the exclusive purchase of raw material. The presidents of Latin American nations signed numerous endorsements giving up large quantities of raw materials in exchange for infrastructures (roads for example), machinery, seeds, technical assistance and, above all, loans to be paid back through exclusive buy-sell agreements.

To understand the reasons why nature was devastated to such a degree, it is important to first understand the circumstances of the United States’ intervention. The US created a number of wartime

⁷ N. Cuví, “The Cinchona Program (1940-1945): Science and Imperialism in the Exploitation of a Medicinal Plant”, in *Dynamis*, 31, 1, 2011, pp. 183-206. Id., “Dejen que el diablo haga lo demás’: la promoción de productos complementarios en América Latina durante la década de 1940”, in *Historia Crítica*, 44, 2011, pp. 158-181.

economic agencies in charge of the economic blockade against the enemy and ensuring the monopoly of Latin American commodities. These agencies, besides managing huge financial resources from the war budget, enjoyed the support of Latin American governments, universities and research institutes, hundreds of scientists, the industry, and business and military people from both the United States and Latin America. Thus, the war fought in Latin America was an economic one and therefore both less cruel and less visible than elsewhere. The most prominent of the new agencies was the Foreign Economic Administration, but there were many other notable ones, including Defense Supplies Corporation, Commodity Credit Corporation, United States Commercial Company, Board of Economic Warfare, Office of Economic Warfare, Export and Import Bank of Washington, Office of Inter-American Affairs, Office of Rubber Reserve, Rubber Development Corporation, among others. These agencies could be in charge of specific missions, as in the case of the Cinchona Program, which I will be discussing below. Picture 1 shows the distribution of Foreign Economic Administration offices around the world, from which one can infer the importance of Latin America in the Economic War.

It was within this institutional framework that US public and private institutions began to take control of Latin American natural resources to an unprecedented degree, establishing monopolies on the exploitation and commerce of raw materials. During the 19th and 20th centuries, Latin America underwent unrestrained intensive exploitation promoted by US organizations (most of them private, as in the case of investments in banana crops in Central America). The Smithsonian Institution and the Chicago Field Museum organized expeditions to gain familiarity with the soon-to-be-exploited nature, not only in Latin America but throughout the world. The insatiable appetite of the United States for raw material had been blatant since times immemorial.⁸ Intensive extractions of guano or saltpeter in Peru had already been carried out in the past, notably under the

⁸ R.P. Tucker, *Insatiable Appetite: The United States and the Ecological Degradation of the Tropical World*, University of California Press, Berkeley 2000.

Picture 1. Locations of Foreign Economic Administration Missions



Source: NARA Pictures Room at College Park

Spanish Empire; however, during and after WWII resource exploitation in Latin America was stepped up to a whole other scale, in terms of the size of the organizations and the number of actors involved, the amount of public money invested, and a style of management that in some cases is still being adopted today. A similar shift is observable in Indian forests, where there had been a “long-term [extractive] process since the 1800’s”, which however “accelerated during and immediately after the war”,⁹ and in northern Canada, where “the intensive extractive economy was not generally extended deep into the circumpolar north before the Second World War”, and where “[d]uring the war, the federal government became directly involved in the uranium-mining industry; for example, through the creation

⁹ Id., “The Environmental Legacy of War in the Indian Subcontinent”, paper presented at the Workshop *The Long Shadows* cit., p. 4.

of a crown corporation, El Dorado Mining and Refining, and its auxiliaries. The governments also continually intervened in electric power production, mining, transportation and even fisheries”.¹⁰

An exemplary case of wartime exploitation of raw materials in Latin America is the extraction of *Cinchona* bark¹¹ from the natural forests between Costa Rica and Bolivia and from vast plantations established over a vast area extending from Mexico to Bolivia, under the aegis of the Cinchona Program. The following data is quite illustrative: between 1941 and 1947, the United States imported more than 40 million pounds of bark, clearing broad areas of forest land in order to build roads and settle camping sites. To compare the magnitude of this extraction with that of past exploitations, in the 18th century, when the Spanish crown monopolized the extraction of *quina* for 38 years, only 350 thousand pounds were sent to the *Real Botica Española*. During the Cinchona Program, 114 times more bark was removed in one sixth of the time. In other words, two centuries ago it took six times longer to extract only 1% of the total bark extracted during WWII. The Cinchona Program held offices in all Andean countries, the ones in Colombia and Ecuador being the most important. These offices had the support of laboratories (local and in the United States), dozens of botanists and administration personnel (from various countries), pharmaceutical industries, and a complex web of informants and suppliers. Pictures 2, 3 and 4 show some stations along the cinchona bark route from the Andean forests to the ports of the region, where the bark was shipped to the United States.

Picture 5 shows the cinchona nursery inaugurated in Guatemala, at El Naranjo farm, which became the biggest cinchona nursery in the world.

After the war, the nurseries and plantations were abandoned as workforce and product qualities became cheaper and of superior

¹⁰ I. Massa, A. Bolotova, “The Opening of the Circumpolar World”, in *Ympäristöhistoria Finnish Journal of Environmental History*, 3, 2012, pp. 49-78.

¹¹ The bark of the cinchona trees (*Cinchona* spp.) is the source of four alkaloids used in the prevention and treatment of malaria, of which quinine is the best known because of its effectiveness. Quinine was considered a strategic product during WWII.

Picture 2. Carrying cinchona bark, Peru



Source: NARA Pictures Room at College Park

Picture 3. Drying bark, Colombia



Source: NARA Pictures Room at College Park

Picture 4. Bark bags at the port of Barranquilla, Colombia



Source: NARA Pictures Room at College Park

**Picture 5. Fostering large-scale plantations:
El Naranjo farm, Guatemala, c. 1944**



Source: NARA Pictures Room at College Park

quality – once again – in Southeast Asia. The wartime Cinchona Program, with its combination of exploration, extraction and production, was the largest program for the exploitation of a single medicinal plant ever carried out in the history of mankind.

Another example of the magnitude of this new wave of exploitation was the fostering of extensive monocultures benefitting the US economy, such as rubber, rice, banana, coffee, cacao and abaca, among others. During the war, the agricultural programs were designed in Washington D.C. and then implemented in Latin American countries. These programs determined which crops would be fostered in each region and were implemented with almost no resistance from Latin American governments. In order to make the programs operative, a variety of agreements were signed. Agricultural stations were either founded anew (under the name of “cooperatives”) or reinforced. They were managed by US personnel, even when they mainly functioned with money from loans (at this time, among other issues, Latin American external debts became huge).

One of the impacts of this mega plantation fostering policy was the expansion of the agricultural frontier in regions such as the Colombian Pacific, the Peruvian Amazon, the Santa Cruz region in Bolivia, the Ecuador coast, and Haiti; in this last country, thousands of hectares of traditional crops were wiped out at the beginning of the 1940s in order to plant rubber trees. A few years later, when the war was over, the non-profitable Haitian plantations turned out to be incapable of competing against the Asian ones and were abandoned. This not only made poverty escalate in the Caribbean country, but had irreversible repercussions on its food sovereignty.

Furthermore, the agricultural model of mega plantations in Latin America was highly dependent on US supplies, machines, technical assistance and technology. This dependence forced the economies of these countries into permanent debt, which sustained and promoted the burgeoning production of complementary crops. At the same time, a slowdown was imposed on the production of competitive crops such as cotton or wheat. Moreover, once the war was over, certain national productions were dropped altogether, due to strong subsidies and the introduction of US food under the label of “development aid”.

It was through these war projects that the seeds of a new model of agricultural production were sown, not to mention new models of forest exploitation and mining. This model was complementary to US production and took hold and expanded on a large scale throughout the second half of the 20th century, through several mechanisms variously known under headings such as “Development Aid”, “Green Revolution”, “Technical Cooperation”, etc. Far from being helpful - in spite of the rhetoric of governments all over Latin America, whether left or right wing, socialist or dictatorial, populist or oligarchic –, when these seeds grew the fruit they yielded was agricultural (under)development based on the predation of nature and the rise of enclave economies favouring large capitalist investments over peasant forms of production and reproduction. This mode of production impacted the environment in many ways: indiscriminate opening of agricultural frontiers, soil erosion, many forms of pollution, loss of food sovereignty, unfair income distribution at the domestic level, exacerbation of poverty, unplanned urban growth, and the increase of global inequalities.

It is thus during the carnage of WWII, the modernization of Latin American agriculture, dependant and exclusionist as it has remained to this day, was seeded, along with the model of exportation of raw materials with no added value (regardless of the import substitution rhetoric).

Why and how was this model fostered, even after the War? How was crop production intensified for the extraction and export of raw materials, fostering a deep dependence on the United States, which led to a radical transformation of Latin American landscapes and nature? At this point I will go back to the concept of “enchantment of growth”. There was a transformation in the collective imaginary (of both Latin and North Americans) that changed people and governments’ perception of what was, and what was not, the right thing to do. What was particularly reinforced at a subjective and discursive level was the belief in an inexhaustible, unlimited nature that would channel economic growth, if its scientific and technological exploitation was well planned. This exploitation was seen as a mandatory step towards “modernity”, US modernity. A new historic dimension

was conjured up, that of intervention on a huge scale, partly justified and sustained by a new model of conducting science, known as “Big Science” (a designation institutionalized by A. Weinberg in 1961),¹² which had demonstrated its efficiency during the war.

“Big Science” in Latin America

A contributing factor that strengthened the idea that “big is good and small is stupid” was the arrival, assimilation and consolidation of a way of building knowledge dubbed “Big Science”. In the second half of the 20th century, this approach not only permeated an important part of scientific research in the United States and Europe, but also – I claim – led to a belittling of how regions such as Latin America (mis) understood “doing science” and “intervening on nature” in order to achieve “development”. With more or less success, Latin America tried to imitate a model that was theoretically easy to grasp, but almost impossible to put into practice. The region’s inability to implement this model contributed to an increase in dependency instead of bringing about the intended development. The Big Science model also helped establish concepts such as “underdevelopment”, “backwardness”, “inability”, “periphery”, etc. as legitimate and unchallengeable.¹³

It would be a mistake to state that the first scientific projects for large-scale appropriation of the American Continent’s nature were implemented during WWII. In addition to cases mentioned before (such as that of the banana monocultures), in colonial times numerous scientific expeditions to the South American Spanish colonies, such as those led by Hipolito Ruiz, Josef Pavon and José Celestino Mutis, had been sent to search for cinchona and other commercially exploitable plants. It is clear that economic botany, with its advanced – for those times – equipment and the Crown’s support of trade, was

¹² A.M. Weinberg, “Impact of Large-Scale Science on the United States”, in *Science*, 134, 3473, 1961, pp. 161-164.

¹³ This idea has been developed by a number of scholars. To avoid too long a list of references, I will limit myself to citing a recent edited book by V. Bretón, *Saturno devora a sus hijos. Miradas críticas sobre el desarrollo y sus promesas*, Icaria, Barcelona 2010.

already practiced before WWII. However, I insist on the fact that until the 1940s there was not a single case in the history of botany comparable to the Cinchona Project, in which public and private institutions, personnel, scholars, researchers, economic resources and military mobilization articulated in a transnational network. The Cinchona Program, the Forest Program, the Rubber Program, the agricultural cooperative stations projects, just to mention a few, are a prime example of the drive towards the construction of a phenomenon that is unique to the mid twentieth century: Big Science.

Although Big Science's most memorable realizations were the Manhattan Project and the development of radar, both of which helped establish physics as the science of WWII, other disciplines, too, developed new "big" methodologies. If the new world order had depended on biological weapons, the story of science might have been different.¹⁴ Still, while physicists were working on weapons that would make history, anthropologists, botanists, biologists and other scientists were providing information such as the standard range of human head-sizes to design gas masks, or methods to obtain fresh water from the sea, or even drawing maps of shrimp migration routes that would confuse the enemy's sonar so that ships could sail undetected. Botanists were able to tell between edible and poisonous plants, prepare survival manuals, and test fungicides and optical material, bacteria, biological weapons, camouflage, defoliants, etc. Botanists in Australia and New Zealand examined the vegetation surrounding military bases and suggested measures to prevent typhus or eradicate mosquitoes.¹⁵ A plant physiologist even worked on a painting that simulated chlorophyll in such a way that military bases photographed from the air would not be reflected in the infrared (the formula is still a military secret). Herbicides were developed to destroy agricultural production. They were not used in WWII,

¹⁴ R.M. MacLeod, *Science and the Pacific War. Science and Survival in the Pacific, 1939-1945*, Kluwer Academic Publishers, Dordrecht 2000.

¹⁵ R.A. Howard, "The Role of Botanists During World War II in the Pacific Theatre", in *Botanical Review*, 60, 2, 1994, pp. 197-257. Id., "The Role of Botanists During World War II in the Pacific Theatre", in MacLeod, *Science and the Pacific War* cit.

but were the forerunners of the infamous Agent Orange. Smithsonian scientists organized and spread scientific information, and entered into collaborations with war agents and the military for the supplying of botanical knowledge. This was neither the first nor the last time that botany would serve war: the appearance in Vietnam of malaria strains resistant to synthetic antimalarial chloroquine caused the resuming of cinchona bark exploitation in Bolivia and a new surge of research on antimalarial plants.¹⁶

There were also “big” projects in biomedicine, such as the search for synthetic anti-malarial plants,¹⁷ which has still not been analysed historically, and chemical investigations.¹⁸ There was also a “Big Agronomy” based on case studies of plantations and analyses of agricultural station projects associated with large monocultures.¹⁹

These prospecting and extraction programs carried out in Latin America during WWII can be considered manifestations of Big Science, belying Aronova, Baker and Oreskes’ claim that the first official biological Big Science program was the International Biological Program (IBP), characterized by the accumulation of large amounts of information, large teams, and a transnational character.²⁰ The Cinchona Program had those features more than 20 years earlier, the main difference being that it was circumstantial to the war. These programs were forerunners of a new way of organizing scientific work, as exemplified by the careers of biologists such as Raymond F. Fosberg, who participated in the Cinchona Program in Colombia and Ecuador, and was later involved in major projects for the ecological assessment of the impact of nuclear weapons, as well as in the IBP.

¹⁶ Ibid.

¹⁷ F.Y. Wiselogle, *A Survey on Antimalarial Drugs 1941-1945*, Voll. 1-2, J.W. Edwards, Ann Arbor, Michigan 1946.

¹⁸ W.A. Remers, *Chemists at War: Accounts of Chemical Research in the United States During World War II*, Clarice Publications, Tucson 2000.

¹⁹ Cuví, *Dejen que el diablo* cit.

²⁰ E. Aronova, K.S. Baker, N. Oreskes, “Big Science and Big Data in Biology: From the International Geophysical Year through the International Biological Program to the Long Term Ecological Research (LTER) Network, 1957-Present”, in *Historical Studies in the Natural Sciences*, 40, 2, 2010, pp. 183-224.

What distinguished the intervention in Latin America during WWII from the other interventions that followed was its objective of supporting an Economic War and consolidating hegemony over natural resources in the region. The goal was not to create a weapon, or collect large amounts of scientific data, but to obtain raw materials and prevent the enemy from accessing them and thereby changing the world equilibrium of power.

Was there also a Big Botany? I would say yes, even though it may be surprising that this aspect has not been examined so far, given the long-standing tradition of botany in the history of science. I cannot but speculate that for the historians of twentieth-century science, other biology fields – such as ecology or biotechnology – have proven more attractive, overshadowing botany. Attention was diverted to projects such as the IBP, the Long Term Ecological Research Network (LTER), the Human Genome Project, and all of today’s “nomic” scientific projects. Another detail worth noting – as Aronova, Baker and Oreskes have done for the IBP and the LTER –²¹ is that the Cinchona Program and other similar programs, contrary to other Big Science projects, did not require much heavy equipment or very sophisticated labs, but rather good field data; which, of course, does not make them any smaller in scope.

Not everybody has praised Big Science. Although it has contributed to the scientific establishment of the United States, including mega-ventures such as the Human Genome Project or the Space Program, and has also triumphed in Europe with projects such as the CERN (European Organization for Nuclear Research), Big Science has been criticized ever since the 1960s. Its critics question whether it is the best model for science; indeed, in the light of its application in Latin America, many see it as harmful to the welfare of nations, people and nature. Biodiversity loss, energy-related problems and pollution, to mention only some of the issues involved, require comprehensive, systemic, *ad hoc* solutions – not necessarily *big* ones – anchored in local communities; they require local and social technologies at smaller scales.

²¹ Ibid.

Big Science was one of the agents of what I call the “enchantment of growth”, this irresistible, fascinating idea that improvement is synonymous to growth. I call it “enchantment” because, while Latin Americans were lured into believing that this was the proper way to do science, their countries faced the reality that, whatever effort they made, they would have never been able to emulate the scientific achievements of the US academic-industrial-military complex; and that this was so not only for science, but also for any of its applications, such as “big” industrialization.

While these countries were heading into what they truthfully believed to be “modernity”, this modernity was proved to be directly associated with capitalism, which in its turn was inextricably associated with local, regional and global inequalities. Therefore, the enchanted path turned out to be – and still is – an empty shell, a fantasy, because both regions cannot prosper under the same system. Not all of us can do Big Science, which demands economic resources, personnel, academic and research institutions, industries, military, sophisticated instruments and mega-laboratories. Not all of us can profit from this system, touted as the ideal way of global science.

Today, this model of science and technology development is still summoned up, for instance, when comparisons are made in terms of variables such as amount of resources, size of equipment, or scientometrics, which are all quantitative parameters rather than criteria based on quality or appropriateness. Latin American countries still seem unaware of this bias. They are still obsessed with reaching “development” through “bigness”, obsessed with growth, even though what has mostly grown in the region is poverty and inequality.

The ideal of bigness, which has held sway in Latin America since WWII, worsened environmental impacts because extraction was boosted to a whole new scale. One notable effect was that it became more difficult for smaller agricultural projects to obtain funding. It was mostly the large-scale projects that attracted resources. The imperative was to “develop” – with all the subjective, political burden this word carries – by imitating a model that strived to do everything *big*: big plantations, big mines, big oilfields, big agriculture, big fishing, big deforestation... *ad libitum*. This was the implicit line

of US President Harry Truman's 1947 call for development: a call for growth.

With blind conviction, local scientists embarked in the pursuit of this "bigness". They saw in Big Science the only way to do science and obtain legitimate and attractive results. This was the only way to be acknowledged as modern: to progress together with the northern friend. These scientists may or may not have been aware of the debates questioning this model, even in the United States; in any case, they went with flow, obtunded by their optimistic growth mirage. A scientist, technician, or politician who wanted to be part of that vanguard had to assimilate the paradigm of the immense and place it before any other alternative at any other scale focusing on local needs rather than foreign trade.

An important factor in the consolidation of the enchantment of growth in the 1940s was the creation of education and training centres like the Zamorano (Panamerican Agricultural School) or the Inter-American Institute for Cooperation on Agriculture (IICA), or programs offering Latin American technicians governmental scholarships to study in US universities. The hundreds of Latin American technicians educated at these institutions fully subscribed to this model, which reinforced dependence and undermined the sustainability of their countries, and went back to their countries to foster the importation of technology and know-how, and the exportation of the products of intensive agriculture and mining, adhering to a model of large-scale nature appropriation that only served US interests and those of the Latin American elites. These technicians were themselves under the spell of the enchantment of growth.

In fact, it was not easy to place oneself at odds with the main trend, especially when politicians were able to show large and rising figures to waive away criticism. Even though this type of production fostered dependence on Big Science and on technology and facilities that were locally unavailable in Latin America – large databases, equipment, budgets, schools, etc. – a great deal of intellectual confrontation was necessary before people were able to actually address this dependence and start looking for something different. In the 21st century, certain ideas such as small scale and complex agriculture, agroecology – not neces-

sarily dependant on inputs provided by large industries and corporations – have been gaining strength and credibility, while the growth system is in crisis. However, these credible practices are still considered marginal, even dangerous ideas, in Latin America, where the *Via Campesina* movement is growing. The small-scale local approach is still countercultural. Today, what has a low budget and a small infrastructure, despite being in close contact with nature, is hardly valid to an economic model founded on huge extraction and export policies.

With the collective imaginary mesmerized by the idea of growth, optimistic attempts have been made to colonize even unsuitable ecological areas. In addition, Big Science has legitimized discourses delegitimizing the knowledge and practices of peasants and natives, a knowledge that does not have to do with size, modernity, progress or development, but with community, family, reciprocity and complementarity (although not the “hemispheric complementarities” advocated by the United States). Big Science even contributed to delegitimize prospective proposals from Latin American scientists, technicians and engineers, who got used to feeling incapable of emulating a model they considered appropriate, but which in fact they did not manage to come to grips with. Nowadays, the agricultural practices applied in Latin America are so alien that products are often sown which are not consumed locally, and the people who grow them do not even know what they are for; at the same time, the same people euphorically welcome new technologies packaged in black boxes.

Latin American scientists such as Víctor Manuel Patiño in Colombia, Misael Acosta Solís in Ecuador, or Efraim Hernandez Xolocotzi in Mexico (to mention just three examples) welcomed, spread and consolidated the emerging model of a “big” commercially oriented botany during the 1940s. This model was oriented to the opening of borders and crop cultivation for export. There were (and still are) similar cases all over the region. Such scientists have influenced governments, education and the public opinion, indoctrinating them with the importance of assimilating the US paradigm. While recognizing that this model needs to be adapted locally, they were unable to achieve this adaptation because – as became clear in the following decades – *it is not an adaptable model*.

But the model nevertheless kept spreading, generating megaprojects like the shrimp or banana-tree projects in Ecuador, or other more region-wide projects, such as transgenic soya or mega plantations of agrofuels in Brazil, Colombia, and other countries. All of these countries were thus increasingly mesmerized by the enchantment of growth.

A current example of this today controversial approach, which has fabricated pseudo-solutions to all sorts of problems – including environmental ones –, solutions all based on “growth” and “thinking big”, is the City of Knowledge in Ecuador (*Ciudad del Conocimiento, Yachay*), a multimillion-dollar investment striving to emulate similar projects in Korea and promising to solve all of Ecuador’s problems by virtue of its sheer size. The shortcomings of this megalomaniac proposal came to the surface when it became evident that the intention behind it was to produce knowledge for the production of export commodities, and thus to address global problems rather than domestic ones. The underlying notion that large-scale projects are conducive to improvements of the quality of living is thus a proven fallacy, and so is the government rhetoric backing the project with the pretension that it is aimed at rescuing ancestral knowledge: this knowledge was produced and reproduced at small scales, and according to models bearing not even a remotely resemblance to Korean, European or North American ones.

It is local technicians who promoted the idea that development is something “big”. Big Development was believed to be actually possible, since Latin American nature itself is big. Or at least, it was: in the twenty-first century we have come to the realization that the vast landscapes of the American Continent – hitherto considered boundless, a vast *terra incognita* – are finite.

To allege that “thinking big” has had a positive effect on the development of Latin America is a fallacy if we look beyond the figures of mere economic growth. We need to go beyond the GDP and look at the state of life-supporting global and local systems. In the wide range of existing opinions on the subject, those based on ecology stand out powerfully, demonstrating that unlimited growth is unnatural. Biology tells us that all things are born, grow, reproduce and die. No entity

can be born and then grow, grow and grow *ad infinitum*. No system can develop forever. Material limits do exist, even to capitalism.

Conclusion: the relevance of the history of war and the environment to the present

According to W. Cronon, one of the key abilities of environmental historians should be creating metaphors rather than solving problems.²² I subscribe to his argument, but find it incomplete. In the context of an environmental global crisis, environmental historians cannot stop at this ability. Their history cannot be limited to the creation of metaphors or catch phrases, such as “enchantment of growth”. Although they cannot actually solve problems, they should at least shed some light in the direction of a solution. In the case of the theme of this paper, the historian should help to point to possible ways of breaking the spell and awaken the sailors from their enchantment. Otherwise – as Cronon indeed observes in his article – we run the risk of environmental history leading our interlocutors to depression and, I would add, inaction.

For this reason, although this paper is essentially an historical essay, I will conclude by looking at the lessons that history can bring for the addressing of current environmental issues. This will be – I hope – a way of giving more agency to our thoughts, because it is clear that if we have been prisoners of the enchantment of growth, with the consequent impacts on the environment, it has undoubtedly been because it was our society’s choice and not an inevitable outcome of deterministic forces.

We face a double challenge. The first is to acknowledge that growth based on raw material extraction for export to global economies is a destructive mirage, advocating unsustainable growth patterns under the fallacy that growth is synonymous with “development”. The sooner we awaken from this bedazzlement the better, lest the story ends up not like the one of the princess kissing the

²² W. Cronon, “The Uses of Environmental History”, in *Environmental History Review*, 17, 3, 1993, pp. 1-22.

frog and magically transforming it back into a prince, but as a daily awakening to an unhappy reality ever after.

The second challenge is, once we have awakened and realized the impossibility of persevering in the direction of mindless growth, to accomplish a shift towards the sustainable, the local – which may include the complex –, to what is contingent on immediate reality, and reject the mirage of globalization and the desire to be admitted in, or acknowledged by, globalization. Many authors agree that one of the possible solutions to the problem of real development may be to find space for the “small”. The question is: how can we grant space to the small when all that is considered mainstream is “big”? How can space for the small be achieved when scale is not only a measurement for land or property, but an idea, a subjective construct, a symbol exerting its influence across all spheres of human life?

We face a road strewn with rocks, since to go down it we need to smash the paradigm that tells us that to live well, to reach social welfare, it is necessary to be big. This paradigm was built up over decades, and it is indeed one of the long shadows of WWII. It also is, I would argue, its darkest shadow, at least in Latin America. The paradigm is so strong that we are afraid of whatever comes across as criticism to the system of capitalist growth based on material extraction at any cost, the system that took hold in the post-WWII era. We are afraid of an environmental approach valuing life over money and prefer to stay on the path of the enchantment of growth. Today, “multinational companies and “circumpolar” governments are waiting impatiently to tap the huge natural-resource potential of the circumpolar north. The core countries will support the resource companies and give them generous support, because they want to protect their high-energy societies”.²³ We are speaking of the same kind of approach that has been applied to South America – with the expansion of transgenic crops, oil fields and mining all over it, promoted by all governments, whether left, right or center –, as well as China, Africa, etc.

So how can environmental history and environmental thought help break this enchantment? There is no simple answer, but the re-

²³ Massa, Bolotova, *The Opening of the Circumpolar World* cit., p. 72-73.

flection on the relationship between war and the environment could become another clue argument. Contemporary Latin America was born from violent processes, first the European conquest, then a cruel colonial domination. The reaction to the latter was itself violent, when the independence wars broke out at the beginning of the 19th century. Once independent in the political sphere, Latin American countries engaged in bloody civil and national wars over land, hegemony, and natural resources. The Chaco, saltpetre, guano and oil wars of the 19th and 20th centuries are just a few examples among many. During the 1960s and the 1980s, further violent events took place in the region, leaving their mark on the local collective imaginary. Military dictatorships came to power, some of them with very visible environmental impacts, as in the case of Guatemala. Today the region is still plagued by wars, especially the prolonged armed conflict in Colombia and the more recent – and bloody – war in Mexico, both fuelled by drug trafficking and organized crime threatening to spread all over the region. These wars are causing harmful environmental effects, which in their turn give rise to new kinds of violence, like a dog chasing its tail. And I am not referring only to the violence of warfare, but also to other, more silent forms of violence, such as impoverishment, marginalization, racism and social exclusion. So how can we stop the dog from chasing its tail? Where can we look for more peaceful alternatives?

Apparently, war has shaped our mind sets and environment more than peace. The territorial organization of Latin America and its local, regional and global articulation were established under military governments. We could even hypothesize that the present state of the environmental crisis is partly a consequence of a militaristic culture. It was through war (active or cold, secret or economic) that the United States sowed and cultivated the seeds of its hegemony over Latin America and other parts of the world. This would have been more difficult to achieve without war, without its ability to shape the organization of societies, institutions, territories, and international relations.

If over the centuries war, as violence against both people and nature, has played a more important role in constructing us than peace, and if the result of this has only been that we are becoming more and

more violent, it is arguable that peace is a more interesting opportunity than war for rebuilding ourselves, sustaining global life-supporting systems, and keeping these systems as healthy as possible for ourselves and for the generations to come. If the idea of an unending growth was in part a result of war, it could be replaced with ecology and environmentalism as global objectives in the context of global peace.

Acknowledgments

I would like to thank Richard Tucker, who proposed a round table to discuss the impact of mass violence in 20th century Latin America in the Sixth Latin American and the Caribbean Environmental History Symposium, held in June 2012 in Villa de Leyva, Colombia. I also want to thank Guillermo Castro Herrera, who made inspiring comments to this paper during the said round table, and Victor Bretón, who commented on the first version. Finally, I want to acknowledge the work of Fernando Intriago, who carefully prepared the final English version and also commented on the article.