Strategy for the Training of Environmental Historians in the 21st Century

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ABSTRACT

Environmental history has been practiced by professionals from various disciplines who are traditionally trained in history, anthropology, geography, and other social sciences or humanities. There are even environmental historians who have been trained as natural scientists. This has generated a paradigmatic dispersion: the issues addressed by environmental history generate a problem of cetacean dimensions. At the same time, the environmental sciences have dealt with similar problems, which is why, for the 21st century, the strategy proposed is that historians who become environmental historians study postgraduate studies in environmental sciences. Some advantages that this would bring to environmental history are discussed, and it addresses the example of the Programa Multidisciplinario de Posgrado en Ciencias Ambientales at the Universidad Autónoma de San Luis Potosí. This is with the intention of institutionalizing initiatives in Latin America and the Caribbean that experiment with this training path, and that environmental historians benefit from other organizational strategies presented.

Keywords: training; environmental sciences; collaborative work.

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Environmental history is a hybrid discipline.[4] Its origin implied putting culture and nature face to face. Since then, it has grown to create a border problem of cetacean dimensions, so it is necessary to answer at the same time: what is environmental history, and who can elaborate on it?[5] Which should not mean looking for impostors. Especially because those who cultivate it come from different backgrounds, among which a good part of them have training in history,[6] but scholars can also find environmental historians without undergraduate or graduate degrees in history.

In Mexico, for example, there is no program that grants the title of environmental historian; that title is granted by those who practice the hybrid discipline, and those who practice it are attached to undergraduate degrees in history, geohistory, geography, anthropology, and postgraduate degrees in social sciences, among others. So, they practice traditional disciplines and/or environmental history.

Environmental historians have issues in common with environmental geography, political ecology, ecological economics, and environmental education, among other hybrid disciplines. So, these disciplines have in common the same ubiquity of environmental history and similar problems to it, but among all hybrid disciplines, environmental history has the strength of considering the synchronic and diachronic context, something that can be overlooked from other perspectives.[7] Moreover, of all the hybrid disciplines that deal with environmental issues, environmental history is the one that has the most developed history of its own and the one that can best answer, historically, what it is,[8] yet it is "still in its diapers".[9] Therefore, it would be necessary to improve the answer to what environmental history is? within the framework of the

[4] Gerardo Bocco, Pedro Sergio Urquijo Torres, and Antonio Vieyra, "El Papel de La Geografía En La Licenciatura En Ciencias Ambientales: Evaluación y Perspectivas," in *Procesos de Formación Educativa Interdisciplinaria: Miradas Desde Las Ciencias Ambientales. México*, ed. Andrés Camou Guerrero, Alicia Castillo, and Eduardo García-Frapolli (México: Universidad Nacional Autónoma de México, 2013), 147–62.
[5] Douglas R. Weiner, "A Death-Defying Attempt to Articulate a Coherent Definition of Environmental History," in *Canadian Environmental History. Essential Readings*, ed. David Freeland Duke (Toronto: Canadian Scholars' Press Inc., 2006), 71–85.
[6] Gerardo Morales Jasso, and Jessica Herrera Montelongo, "Epistemología de la historia ambiental a través de una encuesta realizada en el VII Simposio de la Sociedad Latinoamericana y Caribeña de Historia Ambiental," *HALAC* 1, 5 (2016): 74-90.
[7] Pedro Sergio Urquijo Torres, Antonio Vieyra, and Gerardo Bocco, "Articulaciones Entre Geografía, Historia y Ambiente," in *Geografía e Historia Ambiental*, ed. Pedro Sergio Urquijo Torres, Antonio Vieyra, and Gerardo Bocco (Morelia: Centro de Investigaciones en Geografía Ambiental UNAM, 2017), 9-22.
[8] John McNeil, "Naturaleza y Cultura de La Historia Ambiental," *Nómadas*, 22 (2005): 12–22; Richard H. Grove, "Historia Medioambiental," in *Formas de Hacer Historia*, ed. Peter Burke (Madrid: Alianza Editorial, 2003), 301–23; José Augusto Pádua, "As Bases Teóricas Da História Ambiental," *Estudos Avançados* 24, 68 (2010): 81–101, https://doi.org/10.1590/S0103-40142010000100009.
[9] Germán Palacio, "Historia Tropical: A Reconsiderar Las Nociones de Espacio, Tiempo y Ciencia," in *Repensando La Naturaleza: Encuentros y Desencuentros Disciplinarios En Torno a Lo Ambiental*, ed. Germán Palacio and Astrid Ulloa (Universidad Nacional-Instituto Colombiano de Antropología e Historia, Colciencias, 2002): 12.

generation of other disciplines that are adjectivized as environmental, but at the same time, as Weiner states, it is necessary to answer who can elaborate on it, a question that needs attention.

One of the fundamental characteristics that environmental history must have, is attention to historicity, a characteristic that is easy for historians, whose training is based on it. Another would be to possess an abundant knowledge of history and its capacity to connect local, regional, national, and global history. González de Molina indicates that "Latin American environmental historiography must also become involved in the important debates that are currently taking place in the continent, especially those related to critical thinking in the social sciences".[10] But this knowledge should not be limited to the social sciences. It is also essential to develop a vast knowledge of current environmental issues and methods for acquiring new environmental information, especially if environmental history is part of the sustainability sciences,[11] which were developed after environmental sciences and are part of them.[12] Although sustainability sciences are society driven, reflexive, and they place emphasis on the future and are based on the quasi paradigm of sustainability.[13] Therefore, environmental history must become involved in the environmental conscience, and the debates and discoveries of the environmental sciences.

So, what kind of training would help develop that kind of involvement? This text presents an answer from a theoretical perspective that becomes a formative strategy that follows up on the challenges of environmental historiography[14] in the context of the paradigmatic dispersion of environmental history.[15] In that sense, this paper tries to give continuity to important theoretical reflections within environmental history.

[10] Manuel González de Molina, "Veinte Años de La Fundación de La SOLCHA: Mucho Que Celebrar," *HALAC* 13, Sup. (November 2023): 32.
[11] Micheline Cariño Olvera, Ananda Monteforte, and René Moreno Terrazas, "De La Historia Ambiental/Ecológica a Las Ciencias Humanas Ambientales," in *Historia Ambiental de América Latina. Enfoques, Procedimientos y Cotidianidades*, ed. Pedro Sergio Urquijo Torres, Addie E. Lazos, and Karine Lefebvre (Morelia: Universidad Nacional Autónomade México, 2022), 42–60; González de Molina, "Veinte Años de La Fundación de La SOLCHA: Mucho Que Celebrar."
[12] Debe decir: Gerardo Morales Jasso, "Las ciencias ambientales. Una caracterización desde la epistemología sistémica," *Nova Scientia*, 9, 18, (May 2017): 646-697.
[13] Martí Boada, "Presentación:Epistemología Política: Ciencia Con La Gente," in *La Ciencia Posnormal Ciencia Con La Gente*, ed. Silvio O. Funtowicz and Jerome R. Ravetz (Barcelona: Icaria, 2000), 7–9; Joachim H. Spangenberg, "Sustainability Science: A Review, an Analysis and Some Empirical Lessons," *Environmental Conservation* 38, 3 (September 14, 2011): 275–87, https://doi.org/10.1017/S0376892911000270.
[14] Christopher R. Boyer and Cynthia Radding, "Las Fronteras Historiográficas Del Medio Ambiente," in *Historia, Medio Ambiente y Áreas Naturales Protegidas En El Centro-Norte de México. Contribuciones Para La Ambientalización de La Historiografía Mexicana, Siglos XVIII-XXI*, ed. Sergio Alejandro Cañedo Gamboa and Cynthia Radding (San Luis Potosí: El Colegio de San Luis, 2016): 17–50.
[15] Douglas R. Weiner, "A Death-Defying Attempt to Articulate a Coherent Definition of Environmental History," in *Canadian Environmental History. Essential Readings*, ed. David Freeland Duke (Toronto: Canadian Scholars' Press Inc., 2006).

DEVELOPMENT

The "challenges of environmental historiography" can be synthesized as "crossing new boundaries", especially disciplinary ones,[16] for 1) most environmental historians pay more attention, in the regions they study, to political issues than to geographic or ecological ones; 2) the archives used are in collections of state institutions, with documents delimited by the state itself, when environmental problems are not limited to political boundaries; so 3) environmental historians must attend to the technical issues of the topics they address, so "there is a need to train specialists from existing disciplines in the various aspects of the environmental crisis",[17] especially when environmental history topics are not part of the traditional curriculum of history training; 4) environmental historians have to strive for a considerable level of skill in ecology, hydrographic engineering, forest studies, among others;[18] 5) the environmental historian requires to know the lines of continuity with social history, but must also establish differences with it: conceptual, methodological, epistemological, and ontological.[19] Otherwise, historians will not be prepared to address the environment[20] if they do not free themselves from the dualism that is intrinsic to history as the result of a modern enterprise. This is because even if they accept that humankind has nature, the role played by non-human actors is not the focus, their focus is more like the Ortega y Gasset aphorism, "Man [or, in this case, Human] has no nature, he [they] has [have] history"[21] (Table 1). Since environmental history has open and fuzzy boundaries, even environmental historians can get carried away by dualistic approaches, but it is possible to identify non-dualistic contributions that are becoming

[16] Christopher R. Boyer and Cynthia Radding, "Las Fronteras Historiográficas Del Medio Ambiente," in *Historia, Medio Ambiente y Áreas Naturales Protegidas En El Centro-Norte de México. Contribuciones Para La Ambientalización de La Historiografía Mexicana, Siglos XVIII-XXI*, ed. Sergio Alejandro Cañedo Gamboa and Cynthia Radding (San Luis Potosí: El Colegio de San Luis, 2016): 13.
[17] Lars Emmelin, "Environmental Education at University Level," *Ambio* 6, 4 (1977): 201.
[18] Christopher R. Boyer and Cynthia Radding, "Las Fronteras Historiográficas Del Medio Ambiente," in *Historia, Medio Ambiente y Áreas Naturales Protegidas En El Centro-Norte de México. Contribuciones Para La Ambientalización de La Historiografía Mexicana, Siglos XVIII-XXI*, ed. Sergio Alejandro Cañedo Gamboa and Cynthia Radding (San Luis Potosí: El Colegio de San Luis, 2016).
[19] Gerardo Morales Jasso, "Isomorfismos e Inconmensurabilidades entre la Historia Social y la Historia Ambiental," in *Más allá de lo disciplinario Enfoques Teóricos, Historiográficos y Metodológicos para el Estudio del Pasado*, coords. Miguel Hernández Fuentes, Miguel Ángel Segundo Guzmán, Miguel Ángel Guzmán López and Graciela Velázquez Delgado (Guanajuato: Universidad de Guanajuato, 2018), 253-286.
[20] Alfred W. Crosby, "The Past and Present of Environmental History," *The American Historical Review* 100, 4 (October 1995): 1177–1189, https://doi.org/10.1086/ahr/100.4.1177.
[21] José Gaos, "Notas sobre la historiografía," *Historia Mexicana* 9, 4 (April-June 1960): 507.

more and more systematic.[22] But there is another challenge that also involves crossing borders, and this is 6) the urgent call imposed by the global environmental change.

Table 1 Inconmensurabilities between environmental history and social history.

Social history	Environmental history
Environment$_1$ means the set of physical, chemical, and biological characteristics that a given space has; it is equivalent to environment, an outside of the social, so it is an alterity with respect to the social, so it is compatible with dualism.	Environment $_2$ is nature socialized, domesticated, and in a certain way, artificialized. ⬇ Environment$_3$ is the articulation of anthroposociety and non-anthropic nature. So it is a system that includes the social as a subsystem of itself.
Practiced in the social sciences and humanities.	It articulates in a non-dualistic way the sciences (social and natural) and the humanities, learning from them in an interdisciplinary way.
The social is a human characteristic.	The social is not an exclusive characteristic of humans; herds, swarms, and biotic communities are also social.
It is linked to disciplines such as sociology, anthropology, and economics.	It cannot be understood without the teachings of environmental sciences as well as ecology and geography.
It accounts for the relationships that occur in anthroposociety. Nature is the backdrop of the human drama.	It accounts for the relationships between anthroposociety and non-anthropic nature.
Humankind does not have nature, it have history.	Nature itself has a history.
History is the science of the human being in time.	There is the history of the human being, of the planet (geology), of the Herrerasaurus (paleontology), and of the Universe (cosmology).

Source: Table reproduced from Gerardo Morales Jasso, "Isomorfismos e Inconmensurabilidades entre la Historia Social y la Historia Ambiental," in Más allá de lo disciplinario Enfoques Teóricos, Historiográficos y Metodológicos para el Estudio del Pasado, coords. Miguel Hernández Fuentes, Miguel Ángel Segundo Guzmán, Miguel Ángel Guzmán López and Graciela Velázquez Delgado (Guanajuato: Universidad de Guanajuato, 2018), 272."

[22] Gerardo Morales Jasso, "Apuntes teóricos brasileños a la historia ambiental. Un paso impostergable en la constitución de una historia Ambiental latinoamericana y caribeña," *Revista de El Colegio de San Luis* 9, 18 (2019).

In the context of the paradigmatic dispersion that arises from the diversity of formations that environmental historians have and from the youth of the hybrid discipline itself, how can environmental history face the challenges just mentioned?

For the first challenge, although one should not seek to leave aside the question of power, something that is in line with the post-structuralism highlighted by Weiner;[23] it is necessary to emphasize that environmental history is more than political history, even if the latter has environmental content.

The next challenges point to a methodological opportunity, as already posed by Febvre:

> History is made with written documents, no doubt. When there are. But it can and must be done with everything that the historian's ingenuity allows him to use... Therefore, with words. With signs. With landscapes and with tiles. With the shapes of the field and the weeds. With the eclipses of the moon and with the harnesses of draught animals. With the geologists' stone appraisals and the chemists' analyses of metal swords.[24]

The problem is that Febvre said all these since 1952, and not enough progress has been made in this respect. So, it can be said that the historian generally, does not use more evidence than documentary evidence. In fact, since the 1970s, environmental historians have suggested that we expand the evidence beyond written documentation, but the methodological expansion has, mainly, been carried out by professionals from other disciplines who already had the training to apply it[25]. So how to do something that historians have not been taught? Therefore, how should we face this challenge and the following three?

Arthur Soffiati shows one possibility: a) the autodidact, so historians can continue to be trained in history but become interested in other disciplines and renew

[23] Douglas R. Weiner, "A Death-Defying Attempt to Articulate a Coherent Definition of Environmental History," in *Canadian Environmental History. Essential Readings*, ed. David Freeland Duke (Toronto: Canadian Scholars' Press Inc., 2006).
[24] Lucien Febvre, *Combates Por La Historia* (Barcelona: Editorial Ariel, 1974): 232.
[25] Diogo de Carvalho Cabral and André Vasquez Vital, "Las fuentes escritas a la luz de la noción de coautoría humano-animal," in *Historia ambiental de América latina Enfoques, procedimientos y cotidianidades*, coord. Pedro S. Urquijo, Adi E. Lazos and Karine Lefebvre (Morelia: CIGA-Universidad Nacional Autónoma de México, 2022): 275-293.

their work by learning from readings far from the discipline they studied.[26] Considering each of the challenges mentioned above, this possibility could confront and overcome them. This possibility is embodied by Worster in "The Two Cultures revisited",[27] where he posed to increase communication between environmental history and environmental sciences but reduces the communication between environmental science and environmental history to mutual reading, to the historian's familiarity with concepts, theories, and works of scientists, which would begin to "open the door" to something not commonly found in history texts. It opens the door for environmental historians to environmental sciences and environmental scientists to history, but it does not invite them to get in, to break bread (*cum*, *panis*: companion). The strategy he raised is that historians should make more effort, that they should broaden their field of research beyond history, but he stops short of inviting the historian through the door to team up with the environmental scientist. Although in other texts he stressed the need for interdisciplinary work[28].

The next possibilities are those of multidisciplinary training. The historian could complement his or her training by b) studying a graduate degree in geography or c) environmental studies (or environmental humanities), options that could help to address the five challenges more systematically.

The last possibility for multidisciplinary training is d) for environmental historians to study a postgraduate degree in environmental sciences. The difference between studying a graduate degree in environmental sciences or in geography is that, although the topics of geography are close to those of environmental sciences, studying geography will link him/her mainly to the theories, methods, and knowledge of geographers; while studying environmental sciences will allow the environmental historian to learn alongside agronomists, ecologists, chemists, environmental engineers, and health specialists, among other academics who study this type of

[26] Arthur Soffiati, "Fundamentos de Eco-Historia," Rede Brasileira de História Ambiental, May 10, 2013; Arthur Soffiati, "Como Concebo a História Ambiental," *Rede Brasileira de História Ambiental*, February 24, 2013.
[27] Donald Worster, "The Two Cultures Revisited: Environmental History and the Environmental Sciences," *Environment and History* 2, 1 (1996): 3–14; Mark D. Hersey and Jeremy Vetter, "Shared ground: Between environmental history and the history of science," *History of Science* 57, 4 (2019): 13
[28] Worster en Alberto Guillermo Flórez Malagón, *El campo de la historia ambiental Perspectivas para su desarrollo en Colombia* (Bogotá: Instituto de Estudios Ambientales para el Desarrollo, Pontificia Universidad Javeriana, 2000).

postgraduate degree, and, therefore, be exposed to a diversity of theories, methods, and knowledge, including geographical ones.[29]

Meanwhile, the difference between conducting environmental studies, or environmental humanities, and environmental sciences is that environmental studies have been thought of since the 1970s from a social and qualitative emphasis,[30] environmental humanities have been theorized from post-humanism, that is an umbrella term that encompasses perspectives that dialogue with deconstruction, technology (Cyborgs), among others perspectives and are opposed, for instance, to human exceptionalism.[31] Nevertheless, one perspective is shy about approaching reality quantitatively, and the other is open to postmodernism, which poses strong barriers to dialogue with natural and environmental scientists. Meanwhile, environmental sciences emerged from the environmentalization of natural scientists, although they recently went through a process of questioning reductionism and the ideological bases of society, for which they required knowledge from the social sciences and humanities, which are increasingly present in the proposals of environmental sciences in a non-positivist and non-postmodern way. O'Sullivan calls this stage of development softening,[32] but it is more appropriate to call it thirdculturization.[33] Thus, this rupture of dualism generated changes in environmental sciences, which now include not only pure, basic, and applied sciences but also engineering, technologies, technosciences,[34] and the humanities.

Moreover, if we follow the state from Arthur McEvoy and Donald Worster that environmental history has three main forms of practice, this means that one form is linked to the natural sciences, another to the social sciences and technologies, and the third is linked to the humanities.[35] So, from this perspective, environmental history

[29] An example of how enriching geography is for environmental history is the book *Geografía e historia Ambiental*, ed. Pedro Sergio Urquijo Torres, Antonio Vieyra, and Gerardo Bocco (Morelia: Centro de Investigaciones en Geografía Ambiental UNAM, 2017).
[30] Michael E. Soulé and Daniel Press, "What Is Environmental Studies?," *BioScience* 48, 5 (May 1998): 397-405, https://doi.org/10.2307/1313379; Iclal S. Hartman and Leonard J. Soltzberg, "Creating an Interdepartmental Environmental Science Major," *Journal of Chemical Education* 72, 11 (November 1, 1995): 981, https://doi.org/10.1021/ed072p981.
[31] Rosi Braidotti, *The Posthuman* (Cambridge: Polity Press, 2013).
[32] Patrick E. O'Sullivan, "Environmental science and environmental philosoohy-part 1 environmental science and environmentalism," *International Journal of Environmental Studies* 28, 2-3 (1986): 97-107.
[33] Charles Percy Snow, *The two Cultures and the Scientific Revolution* (New York: Cambridge University Press 1959).
[34] Javier Echeverría, *La revolución tecnocientífica* (Madrid: Fondo de Cultura Económica, 2003).
[35] Donald Worster, "Appendix: Doing Environmental History", in *The Ends of the Earth: Perspective in modern Environmental History*, Donald Worster (ed.) (Cambridge: Cambridge University Press, 1988), 293; José Augusto Pádua, "As Bases Teóricas Da História Ambiental," *Estudos Avançados* 24, 68 (2010): 94, 95; David Arnold, *La naturaleza como problema histórico* (México: Fondo de Cultura Económica, 2000).

would not fit into environmental studies or the environmental humanities but into the systemic environmental sciences. Therefore, although traditionally environmental history has been developed from the so-called environmental humanities, it is epistemically valid to place them within the environmental sciences, which necessarily requires as starting point critiques such as those made by Karl Popper, as well as Alan Sokal and Jean Bricmont.[36] to facilitate communicability between the two cultures (sciences and the humanities).

The same training of environmental scientists has generated problem-solving courses ranging from multi- to interdisciplinary[37] to strengthen the mutual learning of this diversity of previous training. Even if there were similar educational strategies in postgraduate environmental studies, as stated above, environmental studies and environmental humanities reproduce dualism by avoiding a greater dialogue with environmental scientists. Meanwhile, environmental sciences are divided into two positions: reproducing dualism (which leaves out the social from the environment) and overcoming it (which requires social sciences and humanities).[38] In both possibilities, environmental sciences are dominated by engineers and natural scientists, but they tend to see in a non-dualistic way the dualistic branches of the tree of knowledge,[39] and if environmental history is a third culture, immersion in not only one of these but also

[36] Karl Popper, La miseria del historicismo (Madrid: Alianza Editorial, 2014); Alan Sokal and Jean Bricmont, *Imposturas intelectuales* (Barcelona: Paidós, 1999).

[37] Natalie Linnell et al., "Supporting Classroom Discussion with Technology: A Case Study in Environmental Science," in *37th Annual Frontiers in Education Conference - Global Engineering: Knowledge without Borders, Opportunities without Passports* (IEEE, 2007), F1D-4-F1D-9, https://doi.org/10.1109/FIE.2007.4418126; Daniel Cohen et al., "Experiencias de Integración En La LCA: Una Perspectiva Desde Los Estudiantes," in *Procesos de Formación Educativa Interdisciplinaria: Miradas Desde Las Ciencias Ambientales* , ed. Andrés Camou Guerrero, Alicia Castillo, and Eduardo García-Frapoli (México: UNAM, 2013), 177–86; Francisco Mora Ardila et al., "Evaluación de Actividades de Formación Académica Interdisciplinaria: El Caso de La Práctica de Integración En La LCA," in *Procesos de Formación Educativa Interdisciplinaria: Miradas Desde Las Ciencias Ambientales*, ed. Andrés Camou Guerrero, Alicia Castillo, and Eduardo García-Frapolli (México: Universidad Nacional Autónoma de México, 013), 93–109; Tamara Ortiz-Avila and Elisa María García Calleja, "Práctica de Integración En La Licenciatura En Ciencias Ambientales: Perspectivas de Estudiantes y Profesores," in *Procesos de Formación Educativa Interdisciplinaria: Miradas Desde Las Ciencias Ambientales* (México: Universidad nacional Autónoma de México, 2013), 163–76; María Sandín Vázquez et al., "Trabajando La Integración Interdisciplinar: Evaluación de Una Actividad Puente Entre Dos Asignaturas Del Grado En Ciencias Ambientales," *Revista De Docencia Universitaria* 14, 1 (2016): 245–60; León Felipe Cubillos Quintero, "La Interdisciplinariedad Como Principio Orientador Del Currículo Integrado En La Formación Ambiental," in *La Interdisciplinariedad En Las Ciencias Ambientales: La Problemática Ambiental Del Territorio Como Categoría de Investigación Para Los Estudios Ambientales* (Pereira: Editorial Universidad Tecnológica de Pereira, 2020), 279–331; Cara Steger et al., "Science with Society: Evidence-Based Guidance for Best Practices in Environmental Transdisciplinary Work," *Global Environmental Change* 68 (May 2021): 102240, https://doi.org/10.1016/j.gloenvcha.2021.102240; Teresia Svensson, Julie Wilk, and Kajsa Gustafsson Åman, "Information Literacy Skills and Learning Gaps– Students' Experiences and Teachers' Perceptions in Interdisciplinary Environmental Science," *The Journal of Academic Librarianship* 48, 1 (January 2022): 102465, https://doi.org/10.1016/j.acalib.2021.102465.

[38] José Augusto Drummond and Cristiane Gomes Barreto, *Introdução Às Ciências Ambientais: Autores, Abordagens e Conceitos de Uma Temática Interdisciplinar* (Curitiba: Appris editora, 2020).

[39] Gerardo Morales Jasso, Ricardo David Martínez Vargas, Ernesto Iván Badano and Leonardo Ernesto Márquez Mireles, "¿Qué son las ciencias ambientales? Una introducción a sus problemas epistémicos," *Revista Del Centro De Investigación De La Universidad La Salle* 15, 57 (May 2022): 1-28.

dabbling in the other is necessary. If both, sociocentric and naturalistic approaches, are timid for environmental research,[40] training in environmental sciences will allow the environmental historian to improve the dialogue with natural scientists, and with other hybrid disciplines, even more than he or she could do with other multidisciplinary, or even better, interdisciplinary approaches.

We know that the hyperspecialization of history is not conducive to dialogue,[41] so it would be beneficial for historians to study environmental sciences, as then "environmental history would benefit from greater attention to the material, as opposed to the ideational".[42] Because, since its origin, environmental history "has embraced science as a tool that provides useful ways of understanding nature [...]. But a look at environmental histories reveals that the role of science is less than one would expect".[43] According to Russell, this is due to practical barriers such as lack of training in science or the belief in lack of talent for them, for which, by the way, he provides several tips.[44] Therefore, if historians who aspire to become environmental historians study a postgraduate degree in environmental sciences, it will provide them with theoretical and methodological tools that will benefit environmental history: it will strengthen the links between environmental history and the other environmental sciences,[45] it will establish environmental historians in a context of plural training that will be pedagogically rich, and it will facilitate collaborative learning, which, in turn, may favor collaborative work once they graduate.

The sixth challenge implies that research in environmental history need to be transformed in applied history due to the urgency to address Global environmental change, which consists of climate change (change in temperatures, alteration of precipitation, alteration of the nitrogen cycle), changes in ecosystem coverage (habitat loss, change in land use, landscape fragmentation, desertification), and biological invasions (introduction and expansion of exotic species). To address these problems

[40] Drummond and Barreto, *Introdução Às Ciências Ambientais: Autores, Abordagens e Conceitos de Uma Temática Interdisciplinar*.
[41] Mauricio Tenorio Trillo, "Liaisons Dangereuses Memoria y Olvido Historiográfico México-Estados Unidos," in *Cincuenta Años de Investigación Histórica En México*, ed. Gisela von Wobeser (México: Universidad Nacional Autónoma de México, Universidad de Guanajuato, 1998): 31–43.
[42] Johannes Persson et al., "Toward an Alternative Dialogue between the Social and Natural Sciences," *Ecology and Society* 23, 4 (2018): 14, https://doi.org/10.5751/ES-10498-230414.
[43] Edmund Russell, "Science and Environmental History," *Environmental History* 10, 1 (2005): 80–82.
[44] Edmund Russell, "Science and Environmental History," *Environmental History* 10, 1 (2005).
[45] Gerardo Morales Jasso, "La importancia de los seminarios multidisciplinarios en la formación de científicos ambientales," *Jandiekua Revista Mexicana de Educación Ambiental* 7, 9 (January 2023): 6-13.

with urgency, it is necessary to nurture the ways of approaching them from technosciences, applied sciences, technologies, and designs[46] by adopting a historical perspective.

In summary, environmental historians who have a background in both history and environmental sciences will be able to expand the methods of historicity to which they have access through laboratory methods, e.g., dendrochronology and pollen analysis in soils and sediments;[47] they will have access to chemical, ecological, and engineering knowledge more easily than environmental historians who do not share this dual background; and they will have networked not only with historians, but with a diversity of environmental scientists that will facilitate the integration of multifaceted environmental research. Natural and environmental scientists have approached some problems by adopting historical perspectives (longitudinal studies), for example, studies of climate change. In studies of this type, common ground can be found between scientists and historians. As an example, the applications of dendrochronology and palynology are discussed below.

APPLICATIONS OF DENDROCHRONOLOGY AND PALYNOLOGY

Dendrochronology involves a specific history and methodology that can be applied [48] to the solution of a variety of problems to determine:

- Integration of a paleoclimatic database, i.e., historical reconstruction of climatic variables such as precipitation, temperature, atmospheric pressure, etc.
- Study of hydroclimatic fluctuations over time (floods, droughts), and reconstruction of water flows in hydrological systems (rivers).
- Global climatic changes due to deforestation, pollution, and global warming.

[46] Wouter De Groot, *Environmental Science Theory Concepts and Methods in a One-World, Problem Oriented Paradigmm* (Leiden: Leiden University, 1992).
[47] Stefania Gallini, "Invitación a La Historia Ambiental," *Tareas*, 120 (2005).
[48] Teodoro Carlón Allende, et al., "Interpretación de eventos históricos a partir de anillos de crecimiento de árboles", in *Historia ambiental de América latina Enfoques, procedimientos y cotidianidades*, coord. Pedro S. Urquijo, Adi E. Lazos and Karine Lefebvre (Morelia: CIGA-Universidad Nacional Autónoma de México, 2022): 456-479.

- Ecological studies (vegetation structure, fire frequency, pests, diseases, etc.) for conservation and restoration of ecosystems.
- Ecological studies for the conservation of ecosystems and endemic flora and fauna species.
- Growth rates of economically important forest species for sustainable use.
- Study of global atmospheric circulation patterns (El Niño, Southern Oscillation, Monsoon in the southwestern United States and northern Mexico, Pacific Decadal Oscillation, cyclones, convective storms, etc.).
- Economic and social repercussions of climate change, food production, and epidemic outbreaks.
- Anthropological studies, e.g. causes of the disappearance of ancient civilizations, dominant climatic conditions during the establishment, flourishing and decline of civilizations, etc.

Generation of tree chronologies in semitropical, temperate, and arid zones for sustainable use studies.[49]

The importance of paying attention to climatic variability, prolonged droughts, and poor yields in history is exemplified by the Mexican Altiplano, where long tree-ring chronologies have made it possible to reconstruct annual maize yields for late pre-Hispanic, viceroyalty, and modern times. This has allowed us to obtain a strong concordance between tree growth, crop yields, and social crises. In San Luis Potosí, a chronology dating from 1574-1996 A.D. was generated, with trees exceeding 1000 years, correlating significantly with precipitation. Increasing dendrochronological research not only helps to better understand our history, but can also be applied to ecological, archaeological, and hydrological characterizations, among others.[50]

For its part, the study and analysis of pollen grains is not only useful for allergology; it can also be used for taxonomy, genetic and evolutionary studies, and

[49] José Villanueva-Díaz et al., *Elementos Básicos de La Dendrocronología y Sus Aplicaciones En México* (Gómez Palacio: Instituto Nacional de Investigaciones Forestales, Agrícolas y Pecuarias, 2004).
[50] Ibid.; José Villanueva-Díaz et al., "Estado Actual de La Dendrocronología En México," *Revista Mexicana de Ciencias Forestales* 25, 88 (2000): 5–36.

forensic studies, monitoring the historical vegetation of populations and communities, generating correlations between deposits and assigning relative dates, and studying climate change and human impact on vegetation in the past.[51]

Once these technical tools that historians can learn in postgraduate programs in environmental sciences have been presented, it is necessary to carry out this strategy, but not before showing the existence of a last possibility whose importance is that it is complementary to all the previous ones: e) interdisciplinary work in multidisciplinary teams.[52] This possibility does not require specific training, but it does need to encourage collaborative work among environmental historians through training, since neither humanists nor social scientists excel in collaborative work.[53]

STRATEGY TO ACHIEVE ITS INSTITUTIONALIZATION

To encourage the next generation of environmental historians to study environmental sciences, it will require finding postgraduate programs in environmental sciences with the openness to accept historians into such programs, whether during their studies they conduct research in environmental history or in another environmental sciences.

For example, in Mexico, there are nine postgraduate programs in environmental sciences (for this counting, if a university has a master's degree and a doctorate, they are taken as one program. In this case, postgraduate programs in Environment and Development, Environmental Management, or or Environmental Education are not considered), of which the following are the ones that are open to the acceptance of social scientists and humanists:

[51] Emilio Ibarra-Morales and Beatriz Stephanie Fernández-Galán, "El Estudio Del Polen Antiguo: Problemas y Estrategias En El Laboratorio," *TIP. Revista Especializada En Ciencias Químico-Biológicas* 15, 1 (2012): 62–66.
[52] Christopher R. Boyer and Cynthia Radding, "Las Fronteras Historiográficas Del Medio Ambiente," in *Historia, Medio Ambiente y Áreas Naturales Protegidas En El Centro-Norte de México. Contribuciones Para La Ambientalización de La Historiografía Mexicana, Siglos XVIII-XXI*, ed. Sergio Alejandro Cañedo Gamboa and Cynthia Radding (San Luis Potosí: El Colegio de San Luis, 2016); Juan Carlos Villa Soto and Norma Blazquez Graf, "Política Científica Para El Fomento de La Interdisciplina En México: La Experiencia Interdisciplinaria de La Comisión Dictaminadora Del Sistema Nacional de Investigadores," *Revista Iberoamericana de Ciencia Tecnología y Sociedad* 18, 53 (July 31, 2023): 143–70, https://doi.org/10.52712/issn.1850-0013-382.
[53] Gerardo Morales Jasso, Gabriela Morales Aguilar and Víctor Manuel Bañuelos Aquino, "Oportunidades para las ciencias sociales y las humanidades en tiempos de crisis," *Revista Sarance* 51 (April 2023): 40-65.

- M.Sc. and Ph.D. in Environmental Sciences (Benemérita Universidad Autónoma de Puebla)
- M.Sc. and Ph.D. in Environmental Sciences (Universidad Autónoma del Estado de México)
- Multidisciplinary Postgraduate Program in Environmental Sciences (Universidad Autónoma de San Luis Potosí)
- Master of Science in Environmental and Sustainability Studies (Instituto Politécnico Nacional)

In fact, in the Multidisciplinary Postgraduate Program in Environmental Sciences at the Universidad Autónoma de San Luis Potosí, not only historians have studied but also professionals in engineering and natural sciences. These formations have collaborated in the completion of nine theses (until March 6, 2024, there have been 604 graduates, i.e., 0.015% of the theses in this Program are in environmental history) [54] and six environmental history papers as part of their training in environmental sciences.[55] However, the researchers' contributions to environmental history transcend those linked to environmental history thesis, as shown by Antonio Reyes Agüero, Claudia

[54] Marco David González Grijalva, "Evolución Espacio-Temporal de La Calidad Del Agua Subterránea En El Acuífero Cedral-Matehuala: Alternativas de Uso" (Master Degree. diss., Universidad Autónoma de San Luis Potosí, 2009); Natalia de Gortari Ludlow, "Agua y Tierra En La Cuenca Del Río Verde, SLP, México, y Sus Diferentes Regímenes Jurídicos, Siglos XVI-XVIII" (Master Degree. diss., Universidad Autónoma de San Luis Potosí, 2009); José Antonio Ávalos Lozano, "Formación de Paisajes Mineros En El Altiplano Potosino: Siglos XVIII y XIX" (Ph.D. diss., Universidad Autónoma de San Luis Potosí, 2009); Francisco Aguilar Ortega, "Evolución Reciente y Estado Actual Del Aprovechamiento Del Agua Subterránea de La Llanura de Rioverde, San Luis Potosí, México" (Ph.D. diss., Universidad Autónoma de San Luis Potosí, 2010); Arcelia Amaranta Moreno Unda, "Efectos Ambientales Del Programa Nacional de Desmontes, México, 1972-1982" (Master Degree. diss., Cologne University of Applied Sciences, Universidad Autónoma de San Luis Potosí, 2011); Paula Andrea Martínez Chaves, "Historia Ambiental Del Municipio de Cerro de San Pedro, San Luis Potosí, México" (Ph.D. diss., Universidad Autónoma de San Luis Potosí, 2012); Yuritzi Hernández Fuentes, "Usos Del Agua En La Ciudad de San Luis Potosí, 1831-1887" Master Degree. diss., Universidad Autónoma de San Luis Potosí, 2013); Carlos Eduardo Castillo Cardona, "Historia Ambiental de Las Inundaciones En San Luis Potosí: 1930-1940" (Master Degree. diss., Universidad Autónoma de San Luis Potosí, 2019); Lucía Calla Durandal, "Historical Trajectory of the Mangrove's Loss in the Gulf of Guayaquil, Ecuador" (Master Degree. diss., Universidad Autónoma de San Luis Potosí, 2022).

[55] Miguel Aguilar Robledo and Gabriela Torres Montero, "Ambiente y Cambio Ambiental: ¿ejes Para Deconstruir y (Re)Construir a La Historia Ambiental?," *Vetas. Revista Del Colegio de San Luis*, 19 (2006); Yuritzi Hernández Fuentes, "Entre La Escasez y La Inundación. Manejo Del Agua En La Ciudad de San Luis Potosí, 1776-1888," *Historia 2.0. Conocimiento Histórico En Clave Digital* 4, 7 (2014); Yuritzi Hernández Fuentes and Alexander Betancourt Mendieta, "Agua y Abastecimiento: Gestión de Cuerpos de Agua En La Ciudad de San Luis Potosí (México), 1831-1887," *HiSTOReLo. Revista de Historia Regional y Local* 7, 14 (June 30, 2015): 60–98, https://doi.org/10.15446/historelo.v7n14.45382; Erika Loyola Martínez et al., "Cambio Climático y Variabilidad En La Dinámica de Los Ecosistemas de Wirikuta, Municipio de Catorce (1950-2010)," *Revista Geográfica de América Central* 2 (2011): 1–19; Paula Andrea Martínez Chaves et al., "Procesos Históricos y Ambientales En Cerro de San Pedro, San Luis Potosí, México, 1948–1997," *Región y Sociedad* 22, 48 (April 13, 2016), https://doi.org/10.22198/rys.2010.48.a438; Arcelia Amaranta Moreno Unda, Miguel Aguilar Robledo, and José Antonio Ávalos Lozano, "El Programa Nacional de Desmontes En México," in *La Historia Ambiental En México: Estudios de Cas*, ed. Miguel Aguilar Robledo, Humberto Reyes Hernández, and Óscar Reyes Pérez (San Luis Potosí: Universidad Autónoma de San Luis Potosí, Universidad Autónoma de Zacatecas, 2019): 117–28.

Heindorf and Rogelio Aguirre Rivera's research,[56] which is an example from *The Columbian Exchange* in the 1950s.

This program consists of five areas: Comprehensive environmental health, Prevention and control, Environmental assessment, Environmental management, and Renewable natural resources. The professors in this program are academics with backgrounds in biology and chemistry, agriculture and agroecology, environmental engineering, health sciences, social sciences, geography, engineering, education, and behavioral sciences, as well as the humanities. Since its creation in 2002, this postgraduate program has offered the course "Environmental History: Theory and Praxis", which, after the retirement of Miguel Aguilar Robledo (environmental historian from Carl Troll's School of Landscape through Karl Butzer), is offered as "Theory of Environmental History" and is offered by Leonardo Ernesto Márquez Mireles (environmental historian from Ángel Palerm's school of cultural ecology through Alba González Jácome). In addition to this course, there are others such as "Dendroecology and climate change" and "Environmental assessment and spatial analysis supported by RS [remote sensing] and GIS [Geographic information system]",[57] which provide other tools for historians; "Ecology", "Introduction to statistics", "Statistical methods for researchers", which lay theoretical foundations to promote dialogue between historians and scientists; "Integral health of ecosystems", "Ecotoxicology", "Applied climatology", "Environmental engineering", which can complement the training of environmental historians; "Wastewater treatment", "Remediation of contaminated sites", "Planning and management" that allow to take actions against the urgency of global environmental change, as well as "Sustainable development", "Environmental education", "Risk communication and environmental health", "Nature and society: An introduction to recent theoretical positions", which are closer to the skills that social scientists and humanists can provide to environmental sciences. In addition, students in this program can take courses from the Postgraduate Program in Latin American

[56] Juan Antonio Reyes Agüero, Claudia Heindorf, and Juan Rogelio Aguirre Rivera, "Olga Costa y La Fiesta de La Diversidad Frutícula de México," *Ciencia* 71, 3 (2020): 78–84.
[57] Read Carina Emilia Guzmán Bullock, "Investigación histórica, los SIG y las nuevas posibilidades epistemológicas y metodológicas," in *Geografía e Historia Ambiental*, ed. Pedro Sergio Urquijo Torres, Antonio Vieyra, and Gerardo Bocco (Morelia: Centro de Investigaciones en Geografía Ambiental UNAM, 2017), 193-214; Karine Lefebvre, "Colonialismo y paisaje ¿Cómo explotar los datos históricos para reconstruir el territorio colonial?," in *Geografía e Historia Ambiental*, ed. Pedro Sergio Urquijo Torres, Antonio Vieyra, and Gerardo Bocco (Morelia: Centro de Investigaciones en Geografía Ambiental UNAM, 2017), 215-242.

Studies in Territory, Society, and Culture of the Universidad Autónoma de San Luis Potosí (with courses like "Environmental history in Latin America and the Caribbean" and "Territorial and environmental theory")and the graduate programs in Water and Society, History, and Anthropological Studies from El Colegio de San Luis, and include within their thesis committee to scholars from this programs.

As each generation is multidisciplinary, students with prior training in social sciences and the humanities learn not only from the professor but also from students with backgrounds in natural and environmental sciences, and engineering, who also learn from those with social and humanities backgrounds. Thus, this Program has produced theses on ecological restoration, environmental chemistry, environmental engineering, agroecology, zoonotic diseases, and water treatment, but also on environmental education, risk communication, anthropology and environmental sociology, environmental psychology, environmental law, and environmental disaster studies.

This diverse and enriching context, in addition to the broad scope of analysis, is what historians can benefit from by studying this or similar environmental sciences postgraduate programs[58], so that environmental historians can dialogue more frequently and intensely with other academics that study environmental issues or seek to address them.

Moreover, this training would allow dialogue with the natural sciences, facilitating the development of the history of environmental sciences, in particular, and the history of sciences in general, that also had worked to bridge history and science.[59] This is extremely important considering that it is necessary for environmental historians to be able to understand the sciences they learn as historical phenomena with competing paradigms or scientific research programmes.[60] Environmental science

[58] On Brazil, see Sandro Dutra e Silva and Valdir Fernandes, "Historia y racionalidad ambiental en el lado sombrío de la modernidad," in *Historia ambiental de América Latina Enfoques, procedimientos y cotidianidades,* coord. Pedro S. Urquijo, Adi E. Lazos and Karine Lefebvre (Morelia: CIGA, Universidad Nacional Autónoma de México, 2022): 61-77.
[59] Mark D. Hersey and Jeremy Vetter, "Shared ground: Between environmental history and the history of science," *History of Science* 57, 4 (2019).
[60] Imre Lakatos, *The methodology of scientific research programmes Philosophical papers* (New York: Cambridge University Press, 1980); Thomas Samuel Kuhn, "Reflection on my critics," in *Criticism and the Growth of Knowledge Proceedings of the International Colloquium in the Philosophy of Science, London, 1965*, Imre Lakatos & Alan Musgrave (eds.) (New York: Cambridge University Press, 1970), 231–278.

training could also facilitate contributions to history from genetic studies[61] and contributions to Big History, among other interdisciplinary possibilities that would result in cross-fertilization in several fields.

For the case of Mexico, a Mexican Society of Environmental History was only recently projected at the 2023 Symposium of the Latin American and Caribbean Society for Environmental History (SOLCHA by its Spanish acronym). SOLCHA is therefore in a position to make agreements with graduate programs in environmental sciences in Mexico, which will not only influence the training of environmental historians but will also allow teachers and students of environmental sciences to be influenced by history so that they can place environmental problems in their historical context and help them to see that their models of nature are also historically constructed and that the environmental sciences can temper the almost absolute certainty they inherited from the natural sciences and deal with uncertainty.[62]

Also, the National Academy of Environmental Sciences (Academia Nacional de Ciencias Ambientales) holds its annual conference, which accepts participants on education, diffusion, and environmental values; environmental management: sociology and law; environmental pollution; renewable energies; sustainable architecture and urban planning; biotic-abiotic processes and interactions; biodiversity, conservation, and environmental restoration; environmental technology and biotechnology; also ecotoxicology and environmental health. In these Conferences there is a copious participation of panels in which an environmental historian could participate. So, while the Mexican Society of Environmental History is being organized (or even after it is created), it could be linked to this Academy and establish dialogues with other scholars of these Conference through their continued participation.

Once the strategy has generated enough experiences, these should be evaluated to improve the strategy itself and to face more efficiently the challenges of environmental history and its impact on the environmental problems of the present

[61] Rafael Omar Mojica González, "Contra la barbarie: los orígenes de los pobladores de los Altos de Jalisco a través de sus historias y genomas," (PH D, diss., Centro de Investigaciones y Estudios Superiores en Antropología Social, 2020)
[62] William Cronon, "The Uses of Environmental History," *Environmental History Review* 17, 3 (September 1, 1993): 1–22, https://doi.org/10.2307/3984602; Donald Worster, "The Two Cultures Revisited: Environmental History and the Environmental Sciences," *Environment and History* 2, 1 (1996); Silvio Funtowicz and Jerome R. Ravetz, *La Ciencia Posnormal. Ciencia Con La Gente* (Buenos Aires: Icaria, 2000).

and the future. Such an evaluation will allow us to rediscuss the space of experience of environmental historians and their horizon of expectations, perhaps modifying the theory of environmental history.

CONCLUSIONS

The fact that environmental historians will be trained in environmental sciences and/or work with environmental scientists will help to keep them up to date with the findings and discussions relevant to address environmental problems. Because of their training in statistics, environmental historians will be able to understand the sociolects of other environmental scientists, their axiologies (hierarchies of, for instance, technical, epistemic, economic, and ecological values),[63] and their material practices[64] which will facilitate more ambitious environmental history projects, and will enhance their ability to apply natural science tools in historical analysis. This will shape environmental historians as part of the extended community of environmental scientists. Additionally, these strategies can be adapted for those environmental historians who come from other social sciences and humanities. In the case of natural or environmental scientists who will develop environmental history, it would be necessary to appeal to the sociology of science to find adequate strategies that go beyond the investment of the possibilities described here.

North American environmental historians "have proven, on balance, far more likely to lament the field's distance from the sciences, while European environmental historians", have worked "more closely with scientists".[65] The enormous influence of U.S. environmental history in Latin America points to a similar deficiency. Then, if carried out institutionally, the strategy could be reproduced in other countries by SOLCHA, and other Environmental History Societies could reproduce it in other regions. But if it is not carried out through SOLCHA, a similar project could be developed in another region beforehand. We have the opportunity to take the lead in

[63] Javier Echeverría, *La revolución tecnocientífica* (Madrid: Fondo de Cultura Económica, 2003).
[64] Mark D. Hersey and Jeremy Vetter, "Shared ground: Between environmental history and the history of science," *History of Science* 57, 4 (2019).
[65] Mark D. Hersey and Jeremy Vetter, "Shared ground: Between environmental history and the history of science," *History of Science* 57, 4 (2019): 17.

institutionalizing a close relationship between environmental history and other environmental sciences. By doing so, it would be easier to "put the human mind back in the world"[66]

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[66] Linda Nash, "The Agency of Nature or the Nature of Agency?," *Environmental History* 10, 1 (January 2005): 69

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Estrategia para la Formación de Historiadores Ambientales en el Siglo 21

RESUMEN

La historia ambiental ha sido practicada por profesionales de diversas disciplinas, quienes tradicionalmente tienen formación en historia, antropología, geografía y otras ciencias sociales o humanidades. Incluso hay historiadores ambientales que han sido formados como científicos naturales. Esto ha generado una dispersión paradigmática: los temas que aborda la historia ambiental le generan un problema de dimensiones cetáceas. Paralelamente, las ciencias ambientales han lidiado con problemas similares, por lo que, para el siglo XXI, se propone que los historiadores que devengan en historiadores ambientales estudien posgrados en ciencias ambientales. Se abordan algunas ventajas que esto traería a la historia ambiental y se aborda el ejemplo del Programa Multidisciplinario de Posgrado en Ciencias Ambientales de la Universidad Autónoma de San Luis Potosí. Esto con la intención de que se institucionalicen iniciativas en Latinoamérica y el Caribe que experimenten con este camino formacional, y que los historiadores ambientales se beneficien de otras estrategias orgaizacionales planteadas.

Palabras clave: formación; ciencias ambientales; trabajo colaborativo.

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