THE ORIGINS OF MODERN SCIENCE IN COSTA RICA:
The Instituto Físico-Geográfico Nacional, 1887–1904*

Marshall C. Eakin
Vanderbilt University

Abstract: This essay reconstructs the history of the Instituto Físico-Geográfico Nacional, its scientists, and their activities. After surveying the historical context and the first scientific activities in Costa Rica, it narrates the institutional history of the IFG. Also covered are the main activities of the Instituto—meteorology, botany, agriculture, and ethnography, especially the efforts to map Costa Rica in the 1890s. The work of this institute and the scientists associated with it mark the fitful beginnings of the institutionalization of modern science in Costa Rica. The case of the IFG clearly demonstrates the enormous obstacles facing scientists and scientific institutions in the agro-exporting economies of modern Latin America. As a small country on the "periphery of the periphery," Costa Rica offers an extreme example of the problems of cultivating modern science in developing nations.

The development of modern science in Latin America has been a prisoner of the vagaries of extractive, export-oriented economies since the Spanish Conquest.[1] Although the "Scientific Revolution" helped shape the conquest and colonization of much of the non-Western world and European overseas expansion stimulated the development of Western science, most former European colonies in the developing world exhibit poorly developed scientific cultures, communities, and institutions. Euro-

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1. No single generally accepted definition exists of *modern science* or *Western science*. As used in this essay, *modern science* refers to the methods and activities for studying the natural world that emerged in Europe beginning in the sixteenth century. The term includes both science as a methodology for studying and understanding the natural world as well as activities and institutions for promoting and diffusing the methodology. For a "classic account" of the Scientific Revolution, see A. Rupert Hall, *The Revolution in Science, 1500–1750*, 3d ed. (London: Longman, 1983). An excellent overview of the dilemmas of defining the Scientific Revolution can be found in H. Floris Cohen, *The Scientific Revolution: A Historiographical Inquiry* (Chicago, Ill.: University of Chicago Press, 1994).

peans exported their "new science" and cultivated scientific institutions in their freshly conquered colonies, including those in the New World. In the "core regions" of Spanish America (Mexico and Peru), European science followed the conquest and developed slowly with the growth of the colonial enterprise. In the two centuries since independence in the early nineteenth century, however, the success or failure of scientific institutions and activities has been tied closely to the ups and downs of often-fragile Latin American export economies.

Until recently, the role of science in developing countries was virtually ignored by historians. Most historical literature on science concentrated on Europe and other industrial nations such as the United States. This focus is understandable, given the European origins of modern science and the contributions of countries such as the United States to its growth. As a consequence of this historiographical bias, however, the spread of modern science to developing countries has been little studied and poorly understood. In the past few decades, a few historians and social scientists have turned their attention to the developing world, particularly to Latin America.[2]

Two significant and complementary reasons can be adduced for this recent interest in the history of science in Latin America, one quite practical and the other of a more theoretical nature. Both arise out of a growing awareness on the part of Latin Americans of the critical role that science plays in development. Drawing on the experience of the United States, Europe, and Japan, Latin American governments have begun to stress the need to develop a solid scientific and technological infrastructure as a prerequisite for national development. But the interest of Latin American governments in science is by no means new. It originated in the Enlightenment mentality of the Bourbon and Braganza monarchies in

2. The classic article on the subject is George Basalla, "The Spread of Western Science," *Science* 156 (1967):611–22. Although a long and venerable tradition exists in the history of science in Latin America (especially in Mexico and Argentina), the Sociedad Latinoamericana de Historia de las Ciencias y de la Tecnología was not organized until 1982. *Quipu: Revista Latinoamericana de Historia de las Ciencias y la Tecnología* began publication about the same time. For an excellent survey of the literature, see Thomas F. Glick, "Science and Society in Twentieth-Century Latin America," *Cambridge History of Latin America* 6, pt. 1 (Cambridge: Cambridge University Press, 1994), 463–535 and 601–7. For a review of key works in the field, see Mary B. Anderson and Peter Buck, "Scientific Development: The Development of Science, Science and Development, and the Science of Development," *Social Studies of Science* 10 (1980):215–30. Two recent examples of excellent national studies are Simon Schwartzman, *Formação da comunidade científica no Brasil* (São Paulo: Companhia Editora Nacional, 1979); and Marcos Cueto, *Excelencia científica en la periferia: Actividades científicas e investigación bio-médica en el Perú, 1890–1950* (Lima: Consejo Nacional de Ciencia y Tecnología, 1989). See also *Scientific Aspects of European Expansion*, edited by William K. Storey (Brookfield, Vt.: Variorum, 1996); *Ciencia, tecnología y sociedad en América Latina*, edited by Hebe M. C. Vessuri (Caracas: Nueva Sociedad, 1994); and *La ciencia periférica: Ciencia y sociedad en Venezuela*, compiled by Elena Díaz, Yolanda Texera, and Hebe Vessuri (Caracas: Monte Avila, 1983).

Spain and Portugal and the founders of the republics in the New World as well as in the liberal-positivist notions of their late-nineteenth-century heirs.[3] Although this nineteenth-century intellectual heritage helped promote the creation of new scientific institutions, it was not until the 1940s and 1950s that governments and international organizations created national and regional offices to gather and coordinate scientific research and information. Only in the 1960s did Latin American governments act to study the development of science and to gather systematically statistics and other types of information about scientific activity within their borders.[4]

The second factor has arisen ironically out of rejection of the validity of the European and U.S. experience for Latin America. Many historians and social scientists, especially in Latin America, came to the conclusion that the study of scientific development in the developing world demonstrated the impossibility and impracticality of following European patterns of development. In part, this conclusion came out of the boom in development studies in the 1960s and 1970s. It also emerged with the growth of nationalism and a rejection of the ethnocentricity of North Atlantic social science. Critics of the European and U.S. models of development in economics also began to question the validity of this model for scientific development. They began to ask whether Latin America could not—indeed, should not—develop its own economic and scientific infrastructures along lines more suitable to the needs and aspirations of Latin American peoples, as in studying tropical diseases or conducting agricultural research on tropical ecosystems. The development of science in Latin America, the argument goes, faces problems and obstacles qualitatively different from those confronted in Europe and the United States during the rise of modern science.[5]

This essay contributes to one aspect of the discussion about science and development: the efforts of the state to foster scientific activity in an

3. See for example John Tate Lanning, *The Eighteenth-Century Enlightenment and the University of San Carlos de Guatemala* (Ithaca, N.Y.: Cornell University Press, 1956); Iris H. W. Engstrand, *Spanish Scientists in the New World: The Eighteenth-Century Expeditions* (Seattle: University of Washington Press, 1981); William Joel Simon, "Scientific Expeditions in the Portuguese Overseas Territories, 1783–1808," Ph.D. diss., City University of New York, 1974; Leopoldo Zea, *Dos etapas del pensamiento en Hispanoamérica: Del romanticismo al positivismo* (Mexico City: Colegio de México, 1949); Ralph Lee Woodward Jr., *Positivism in Latin America* (Lexington, Mass.: Heath, 1971); and Charles A. Hale, "Political and Social Ideas in Latin America, 1870–1930," *Cambridge History of Latin America*, 4:367–441.

4. See for example Ronald Hilton, *The Scientific Institutions of Latin America* (Stanford: California Institute of International Studies, Stanford University, 1970).

5. The classic studies of "underdevelopment" are Fernando Henrique Cardoso and Enzo Faletto, *Dependencia y desarrollo en América Latina* (Lima: Instituto de Estudios Peruanos, 1967); and André Gunder Frank, *Capitalism and Underdevelopment in Latin America: Historical Studies of Chile and Brazil* (New York: Monthly Review Press, 1967). An early example of the studies in science development is Jorge Sábato and Natalio Botana, *La ciencia y la tecnología en el desarrollo futuro de América Latina* (Lima: Instituto de Estudios Peruanos, 1970). See also

agro-exporting economy. The article will examine the efforts made by one Latin American country to establish the foundations of modern scientific institutions in the late nineteenth and early twentieth centuries. It will analyze the travails of scientists and their political patrons as they struggled to create the first modern scientific institutions in tiny Costa Rica. In the 1880s, a small liberal coffee-planting elite hired foreign scientists to organize and run the country's first modern scientific institutions, most prominently, the Instituto Físico-Geográfico Nacional (IFG).[6]

COSTA RICAN SCIENCE BEFORE THE IFG

During the colonial period, the Costa Rican economy was essentially closed and self-sufficient, based primarily on small-scale agriculture. It boasted no mineral wealth of importance and few exportable crops. Situated at the mountainous southern fringes of the Reino de Guatemala, Costa Rica hosted the final stops for mule trains heading south to Panama. Cartago, its capital and single substantial city, was situated in the volcano-rimmed central valley, well-isolated from the rest of the country and the world. Costa Rica thus formed an insignificant part of the Spanish Empire in the New World.[7]

In the two decades following independence in 1821, coffee cultivation emerged as the major economic activity. Revenues from coffee exports financed foreign loans and basic public works such as roads and government buildings.[8] Coffee production also fostered the entrenchment of an agro-exporting elite. A small group of families and their descen-

The Uncertain Quest: Science, Technology, and Development, edited by Jean-Jacques Salomon, Francisco R. Sagasti, and Céline Sachs-Jeantet (Tokyo: United Nations University Press, 1994).

6. For a succinct survey of the history of biology in Costa Rica, see L. D. Gómez and J. M. Savage, "Searchers on That Rich Coast: Costa Rican Field Biology, 1400–1980," in *Costa Rican Natural History*, edited by Daniel H. Janzen (Chicago, Ill.: University of Chicago Press, 1983), 1–11. For an excellent book-length study on the institutionalization of modern science around 1900, see Nancy Stepan, *Beginnings of Brazilian Science: Oswaldo Cruz, Medical Research, and Policy, 1890–1920* (New York: Science History Publications, 1976).

7. See for example Murdo J. MacLeod, *Spanish Central America: A Socioeconomic History, 1520–1720* (Berkeley and Los Angeles: University of California Press, 1973), 330–34; and Ciro F. S. Cardoso and Héctor Pérez-Brignoli, *Centroamérica y la economía occidental, 1520–1930* (San José: EDUCA, 1977), 81–83, 121–25.

8. See for example Carolyn Hall, *El café y el desarrollo histórico-geográfico de Costa Rica*, translated by Jesús Murillo Gutiérrez (San José: Editorial Costa Rica, 1991); Lowell Gudmundson, *Costa Rica before Coffee: Society and Economy on the Eve of the Export Boom* (Baton Rouge: Louisiana State University Press, 1986); Mitchell Seligson, *Peasants of Costa Rica and the Development of Agrarian Capitalism* (Madison: University of Wisconsin Press, 1980); Tomás Soley Güell, *Compendio de historia económica y hacendaria de Costa Rica* (San José: Soley y Valverde, 1940), 43–47; and Rodolfo Cerdas, *La formación del estado en Costa Rica* (San José: Universidad de Costa Rica, 1967).

dants became the major contenders for political power during the remainder of the nineteenth century and a good part of the twentieth. In contrast to their counterparts in many Latin American countries, especially their Central American neighbors, the Costa Rican elite showed an impressive ability to settle intra-elite rivalries short of violence and civil war. Political stability and economic growth characterized Costa Rica throughout most of the nineteenth century.[9]

The political and economic transformation of Costa Rica was accompanied by cultural developments. Bookstores, theatres, and opera houses began to appear in the new capital city of San José and also in the nearby colonial capital of Cartago. The small national population increased from around 100,000 in the 1820s to some 250,000 by 1900.[10] Children of the coffee elite began to seek educations in Europe, and foreign scientists and scholars began to take notice of Costa Rica. Beginning in the 1840s, U.S., Danish, and German scientists visited the country, studied its natural resources, and sometimes trained Costa Ricans in scientific methods.[11]

The foreign "scientists" who visited or resided in Costa Rica prior to 1870 were generally speaking amateurs, none of whom sustained firsthand research.[12] Their acquaintance with Costa Rica derived primarily from personal motivations, rarely from any kind of locally stimulated scientific interests. Three Germans—Alexander von Frantzius, Franz Kurtze, and Ferdinand Streber—conducted some scientific work during this period. Von Frantzius settled in San José in the 1850s to protect his fragile health and earned a living running a pharmacy. For fifteen years, he spent his free time climbing volcanoes, making meteorological observations, and collecting and studying local flora and fauna. He published a good deal on Costa Rica. When he left the country in 1869, he took along his young assistant, José Cástulo Zeledón, who went to work at the Smithsonian Institution in Washington, D.C.[13] Kurtze, an engineer, went to Costa Rica with an unsuccessful colonization scheme and landed a job

9. Charles D. Ameringer, *Democracy in Costa Rica* (New York: Praeger, 1982); Samuel Z. Stone, *La dinastía de los conquistadores: La crisis del poder en la Costa Rica contemporánea*, 2d ed. (San José: Editorial Universitaria Centroamericana, 1976); and José Luis Vega Carballo, *Hacia una interpretación del desarrollo costarricense: Ensayo sociológico*, 4th ed. (San José: Porvenir, 1983).

10. Ralph L. Woodward Jr., "The Aftermath of Independence, 1821–c. 1870," from *Central America since Independence*, edited by Leslie Bethell (New York: Cambridge University Press, 1991), 8; and Ciro F. S. Cardoso, "The Liberal Era, c. 1870–1930," ibid., 38.

11. Rafael Lucas Rodríguez C., *Historia de la biología en Costa Rica* (San Ramón, C.R.: Centro Universitario Regional, 1972), 4; Charles L. Stansifer, "Foreign Scientists and the Economic Development of Costa Rica, 1850–1914," paper presented to the Southern Historical Association meeting, Nov. 1973.

12. By *amateur* I refer to individuals who did not make science a full-time career. Many of the great scientists of the nineteenth century had little formal scientific education but pursued science as their profession, such as Alfred Russel Wallace or John Wesley Powell.

13. "Homenaje del Colegio San Luis Gonzaga y 'La Nación' a 11 científicos costarricenses con motivo de la Semana Científica," *La Nación*, 25 Oct. 1959, p. 12.

with the Ministerio de Obras Públicas. He collected meteorological data and often accompanied von Frantzius in climbing volcanos. Streber created the government statistics office in the 1860s and became the moving force behind the first national census in 1864.[14] Until José Zeledón returned from Washington in the late 1870s, however, the country had no trained Costa Rican scientists, and the government did little to stimulate serious scientific research.

The origins of modern scientific work in Costa Rica stem directly from the rise to political power of the Liberals and their efforts to "modernize" the country. The politicians who dominated the scene from the 1880s until well into the twentieth century are known to Costa Ricans as the Generation of '89.[15] Along with Liberals in other Latin American nations in the late nineteenth century, Costa Rican Liberals of the Generation of '89 looked to Europe (especially France and England) and the United States for inspiration and guidance. The conservative parties that had dominated much of Latin America since the 1820s had looked back to the Iberian heritage and values to guide the new nations. The Conservative vision was characterized by a firm belief in hierarchy, centralism, slavery, Catholicism, and government intervention in the economy. In contrast, the Liberals who rose to power in Costa Rica (and much of the rest of Latin America) in the 1870s drew on an Enlightenment-based vision that condemned Catholicism, slavery, and hierarchy while praising individualism, free labor, and laissez-faire economics.[16]

Positivism also exerted a powerful influence on Latin American elites. Auguste Comte and Herbert Spencer both imparted to many Latin American intellectuals and politicians a vision of progress and modernity to be achieved through scientific and technological progress. For Latin American positivists, the path to the future would be made possible by what they saw as the technological fruits of modern science: railroads, telegraphs, electricity, and steamships. Despite the often authoritarian and elitist political vision of much Latin American positivism, it shared with liberalism the "idea of progress." Positivism and liberalism together shaped the views of Costa Rican elites after 1870.[17]

While Liberals in nineteenth-century Latin America often did little to promote individual rights or equality before the law and ignored laissez-faire principles, they zealously pursued material progress. They saw

14. Stansifer, "Foreign Scientists," 5.

15. See for example Eugenio Rodríguez Vega, *Los días de don Ricardo Jiménez* (San José: Editorial Costa Rica, 1971), 19.

16. See the sources cited in note 3, especially Zea, Woodward, and Hale. See also Frank Safford, "Politics, Ideology, and Society in Post-Independence Spanish America," *Cambridge History of Latin America*, 3:347–421.

17. In addition to the sources cited in notes 3 and 15, see E. Bradford Burns, *The Poverty of Progress: Latin America in the Nineteenth Century* (Berkeley and Los Angeles: University of California Press, 1980), especially chap. 2, 18–34.

"public education" as a key to promoting this process. Schools would help create an informed citizenry imbued with the proper Liberal values and would eventually foster the scientists and technicians who would move the country forward toward industrialization and technological sophistication. In fact, the government-financed "public schools" educated the children of the elite, replacing privately paid tutors. Late-nineteenth-century Liberals, anxious to set up public schools, turned to experts from the North Atlantic nations to set up the foundations of government-financed education.[18]

Government efforts to promote public education in Costa Rica began in the 1860s. During the two administrations of President Jesús Jiménez (1863–1866 and 1868–1870), the government created the Colegio San Luis Gonzaga in Cartago and hired foreign scientists to staff the new secondary school. In 1875 the government created a similar institution in San José, the Instituto Nacional, again creating a faculty of foreign professors.[19]

The real drive to attract foreign professors came in the late 1880s, under President Bernardo Soto (1885–1889) and his Liberal entourage. Mauro Fernández, Soto's capable education minister, drew up sweeping educational reforms based on those undertaken by Domingo Fausto Sarmiento in Argentina. The Liberals recognized the importance of public education and the gap between Costa Rican primary schools and its fragile Universidad de Santo Tomás, which served as little more than a law school. Fernández abolished the university and created two public high schools in the capital, the Liceo de Costa Rica for boys and the Colegio Superior de Señoritas for girls.[20] To staff and organize the Liceo and the Colegio, the government hired a group of European academics. Among them were several scientists, notably a thirty-year-old Swiss professor named Henri François Pittier.

THE INSTITUTO FISICO-GEOGRAFICO NACIONAL

Henri Pittier was to play an extraordinary role in the development of modern science and scientific institutions in Costa Rica. Born in 1857 in a small village in southwest Switzerland, he studied at the Lausanne

18. An excellent and unusual study of the efforts to promote scientific and technical education is Frank Safford, *The Ideal of the Practical: Colombia's Struggle to Form a Technical Elite* (Austin: University of Texas Press, 1976).

19. The group was composed primarily of Spaniards. See León Pacheco, *Mauro Fernández* (San José: Ministerio de Cultura, Juventud y Deportes, 1972), 29–30; and Luis Felipe González Flores, *Historia del desarrollo de la instrucción pública en Costa Rica, 1821–1884* (San José: Ministerio de Educación Pública, 1961), 2:71, 258, 287–97.

20. Luis Felipe González Flores, *Historia de la influencia extranjera en el desenvolvimiento educacional y científica de Costa Rica* (San José: Imprenta Nacional, 1921), 99. The Liceo was founded on 6 Feb. 1887 and the Colegio on 27 Jan. 1888. See Archivos Nacionales de Costa Rica, Secretaría de Instrucción Pública, 2540, 1–46 (hereafter cited as ANCR/SIP).

Academy (today the University of Lausanne) in 1875. Pittier received bachelor's and master's degrees from the same institution the following year. In 1880 he added a degree in civil engineering from the Swiss Polytechnic (now the Federal Institute of Technology) in Zurich. He received a doctorate after studying with famous evolutionary biologist Ernst Haeckel in Jena, then became a professor at the Henchoz Institute in Switzerland and later professor of physical geography at his alma mater in Lausanne.[21]

When approached by an envoy of the Costa Rican government seeking professors for the Liceo and Colegio, Pittier jumped at the chance to move across the Atlantic. He signed a contract in August 1887 to work for four years and arrived in Costa Rica in November.[22] Although hired to teach secondary school, Pittier had grander ideas and immediately began to lobby for creation of a meteorological observatory and institute. He stressed the practical applications of climatological knowledge in an agricultural economy. Despite his lack of familiarity with Spanish, within a few months he had convinced local politicians to build an observatory based on his plans and to name him as its first director. The four-story structure, built alongside the Liceo in the heart of San José, was designed to serve both science and pedagogy. While the building was under construction, Pittier began to make daily climatological annotations with instruments in his own backyard.[23]

The Instituto took the shape of a four-story tower twenty meters high and thirty-six meters square at the base. The first floor contained seismological instruments; the second, a mechanical shop and the Liceo's physics equipment; the third, the Instituto's office; and the fourth, a library and scientific instruments.[24] The government supplied Pittier with a mechanic, a student assistant, and modest funds for buying instruments to measure barometric pressure, wind speed, temperature, rainfall, longitude and latitude, and terrestrial movements. With this modest staff and equipment, Pittier began to set up a network of secondary stations in the country's two major ports, Puntarenas on the Pacific Ocean and Puerto Limón in the Caribbean, and anywhere he could find volunteers.[25]

21. Adina Conejo Guevara, "Materiales para una bio-bibliografía costarricense del Dr. Henri Pittier Dormond," Ph.D. diss., Universidad de Costa Rica, 1972, 2 vols; *Henri Pittier* (San José: Ministerio de Cultura, Juventud y Deportes, 1975); *Henri F. Pittier: Centenario de su nacimiento* (San José: Instituto Geográfico Nacional, 1957); and J. McKeen Cattel and Jacques Cattel, *American Men of Science*, 5th ed. (New York: Science Press, 1933), 886.

22. Henri Pittier, *Apuntaciones etnológicas sobre los indios Bribrís* (San José: Museo Nacional, 1938); ANCR/SIP, 2507, 23–27; and Pittier Papers, Museo Nacional de Costa Rica, Manuel María de Peralta to Henri Pittier, 1 Sept. 1887 (hereafter cited as PP/MN).

23. Henri Pittier, *Boletín Trimestral del Instituto Meteorológico Nacional* (San José: Tipografía Nacional, 1889), 1:24–27; and *Gaceta*, no. 8, 12 Jan. 1888, pp. 36–37.

24. *Gaceta*, no. 8, 12 Jan. 1888, pp. 36–37. Located a block from the Teatro Nacional, the building was demolished in the 1960s to make way for the Caja Costarricense de Seguro Social.

25. *Boletín Trimestral*, 1:24–28.

The Instituto was not the first scientific institute in the country, however. Shortly before Pittier arrived, a young Costa Rican named Anastasio Alfaro had persuaded the government to organize a national museum. Alfaro had overcome the obstacles facing any student of the sciences in Costa Rica (such as the lack of mentors and facilities) to become an essentially self-taught naturalist and archaeologist and a collaborator with several important U.S. scientists. Ministro de Fomento Cleto González Víquez, a rising politician who later served two distinguished terms as president, had dispatched Alfaro on a mission to the United States to learn about the latest techniques in museum organization. On Alfaro's return in May 1887, the government funded the creation of the Museo Nacional and named Alfaro its first director.[26] At first the Museo consisted of little more than a collection of birds, minerals, and wood samples that Alfaro and José Zeledón had put together for the Costa Rican National Exposition of 1886. In 1888 a wealthy Cartago merchant, José Ramón Rojas Troyo, died and left his extensive archaeological collection to the Museo.[27]

For a country with so few trained scientists and limited budgetary resources, the separation of the two scientific centers seemed to Pittier a waste of resources. He envisioned consolidation of the Museo and the Instituto into a single center dedicated to executing a map of the entire republic. Pittier astutely realized that the government was well aware of the need for a reliable map as well as the political and economic possibilities that it could open. Border disputes with Nicaragua to the north and with Panama (Colombia) to the south as well as the possibility of an interoceanic canal heightened political leaders' interest in Pittier's proposal to map Costa Rica. The desire to know just what was theirs and how best to exploit it convinced legislators of the benefits of a geographical institute that would produce a national map. Serious earthquakes in December 1888 reinforced Pittier's arguments for the systematic study of the country's geology and geography. On 22 June 1889, the government consolidated the Museo and the Instituto Meteorológico into one center, the Instituto Físico-Geográfico Nacional de Costa Rica. Henri Pittier became its first director.[28]

26. *Gaceta*, no. 66, 20 Mar. 1887; and no. 103, 5 May 1887, p. 457; Manuel María de Peralta and Anastasio Alfaro, *Etnología centro-americana: Catálogo razonado de los objetos arqueológicos de la República de Costa Rica en la Exposición Histórico-Americana de Madrid, 1892* (Madrid: n.p., 1893), xxix-xxx; and Anastasio Alfaro, *Anales del Museo Nacional* (San José: Tipografía Nacional, 1888), 1:xvi.

27. Alfaro, *Anales del Museo Nacional*, 1:xxii; Henri Pittier, *Capítulos escogidos de la geografía física y prehistórica de Costa Rica* (San José: Museo Nacional, 1938), xxx; Alfaro, *Anales del Museo Nacional*, decreto 2, 28 Jan. 1888, 1:xxiii; and *Gaceta*, no. 39, 17 Feb. 1888, p. 195. Alfaro had done much of the collecting for the collection. Many of the pieces came from the Guayabo de Turrialba site. Gómez believes that the French mania for "cabinets" of exhibits influenced the elites to create the Museo. L. D. Gómez P., "El Museo Nacional de Costa Rica," *Museum* 25 (1973):182–84.

28. Pittier, *Boletín Trimestral*, 25–30; ANCR/SIP, 2507, acuerdos 2, pp. 229–30; and Henri Pittier, *Informe del Instituto Físico-Geográfico Nacional, 1891* (San José Tipografía Nacional, 1892).

But only months following integration of the two institutions, the Museo was separated from the rest of the Instituto, to Pittier's angry dismay. He and Alfaro, the two major scientific entrepreneurs in the small country, apparently could not agree how to organize their operations, and each preferred to run his own show. Despite Pittier's protests, the two institutions were not reunited (except for a brief period in 1892) as long as Alfaro remained director of the Museo, until 1898.[29]

Pittier subdivided the Instituto into geographical, meteorological, and botanical sections. He hired German engineer Peter Reitz to handle the observatory and Swiss botanist Adolphe Tonduz to head the botanical section. In 1889 Pittier went to Europe to recruit new secondary-school professors for the Costa Rican government and brought back his brother-in-law, Jean Rudin, to work as the Instituto's draftsman.[30]

Although the Soto administration had been persuaded by Pittier's arguments to form a multipurpose geographical institute, the new administration of President José Joaquín Rodríguez in 1890 clouded the issue. In December of that year, the new administration planned a pair of conferences to determine the best manner of undertaking the projected mapping of the country. Even though the IFG had been created to carry out the job, it now had to fight off competitors and was probably also fighting for its own survival. Gustave Michaud, one of the Swiss professors hired by Pittier in 1889, tried to convince the government that only a recognized European firm could complete the map. Luis Matamoros, a Costa Rican engineer, wanted to create an *oficina de catastro* to handle the work. After much lobbying and many reports, Pittier persuaded the government that his institute could do the job.[31]

Although the government chose to entrust the enterprise to the Instituto, the project fell far short of Pittier's proposal. He requested approximately 25,000 pesos annually (about $12,000 U.S.) to pay the salaries of four engineers, an astronomer, a geologist, a botanist, and a zoologist to carry out mapping work through the IFG. In addition to providing a physical relief map of the country, the team of engineers and scientists would give the government detailed reports on the geological and biological resources of the various regions of the republic.[32] Clearly, Costa Rican politicians chose to finance the mapping work in search of practical benefits for the national economy.

29. *Gaceta*, no. 291, 13 Dec. 1889, p. 679; no. 174, 28 July 1892, pp. 884–85; and Pittier, *Informe . . . 1890*.

30. Pittier, *Informe . . . 1890*, vii-ix; *Informe . . . 1891*, unpaginated; Pittier, *Informe . . . 1892*, 1–2; and Otón Jiménez Luthmer, "Tonduzia," *Revista de Agricultura*, nos. 5–8 (1971):6.

31. *Gaceta*, no. 13, 18 Jan. 1891, pp. 46, 54–55; and Pittier, *Informe . . . 1891*.

32. Pittier, *Informe . . . 1891*, 36–37.

Actual government outlays never reached even half of the proposed annual budget of 25,000 pesos.[33] By 1898 the staff of the Instituto numbered six, with cartographic expeditions dominating the attention of most members. This modest staff consisted of Pittier, a botanist, two geographical assistants, a "geographical calculator," and a janitor. The budget rose from about 2,000 pesos in 1889 to approximately 11,000 by 1898, then plunged to zero in 1899 during a major economic crisis. In 1899 Pittier persuaded the government to restore the Instituto's funds at the unprecedented level of 14,000 pesos. This allocation declined by more than half to 6,000 in 1904 (approximately U.S. $6,500).[34]

The dramatic fluctuations in the IFG's modest budget highlight the major challenge facing any fledgling scientific institution in a small agro-exporting economy. As the price of coffee went up and down on the world market, so went the fortunes of Costa Rica and the Instituto at the turn of the century. More than 90 percent of the country's export revenues and most government revenues came from coffee exports.[35] Beginning in the 1890s, as countries across Latin America saturated the world market with coffee beans, coffee exports prices embarked on a roller-coaster ride. The IFG survived a severe government economic crisis in 1891–1893, but the slow increase in funding in the following years did not meet even the modest needs of a scientific institute intent on mapping a country roughly the size of New Hampshire and Vermont combined (almost twenty thousand square miles).

During the 1890s, the IFG was plagued by lack of space in the Instituto for cartographic work, continual delay in tabulating basic statistical data, and lack of personnel. Toward the end of 1898, plummeting coffee prices and a near war with Nicaragua provoked a severe national economic crisis. In an attempt to cut back on spending, the government eliminated entire agencies and departments. One of them was the Instituto Físico-Geográfico.[36]

Although all the functions of the Instituto did not stop, work on the mapping project ceased, and the economic crisis jeopardized nascent scientific research in Costa Rica. The small staff of the Museo took custodial care of the collections that Pittier and Alfaro had amassed over the previous decade (especially the Herbario Nacional). The former head of the In-

33. Total government revenues in the 1890s approached six million pesos annually (in 1896, 2.15 pesos equaled U.S. $1.00). See Soley Güell, *Compendio de historia económica*, 71–75.

34. Budgets were taken from the *Gaceta*, 1889–1904.

35. Victor Bulmer-Thomas, *The Political Economy of Central America since 1920* (New York: Cambridge University Press, 1987), 3.

36. Rafael Obregón Loría, *Conflictos militares y políticos de Costa Rica* (San José: Imprenta La Nación, 1951), 85. The government also closed down the Escuela Nacional de Bellas Artes, the Biblioteca Nacional, and the Archivo Nacional. See *Gaceta*, no. 6, 8 Jan. 1899, p. 21.

stituto's observatory continued to tabulate daily meteorological observations. Pittier reluctantly returned to teaching in the Colegio de Señoritas and the Liceo de Costa Rica. On his own, however, he continued to publish scientific articles in Europe and the United States and made regular field expeditions into the countryside.[37]

Pittier lobbied continually for revival of the IFG. Recognizing more than ever the dependence of any funding on practical results, he turned with his accustomed energy to intensive work in economic botany. He and politician-planter Manuel Aragón published an agricultural bulletin for a short time.[38] In 1900 Pittier investigated the "Panama disease" that had begun to attack the Caribbean banana plantations of the United Fruit Company, the largest banana producer in Latin America.[39]

Surprisingly and despite continuing financial problems, the Costa Rican government revived the Instituto Físico-Geográfico in 1901. Pittier had apparently persuaded politicians of the practical benefits that his research in economic botany could bring. Resuscitation of the Instituto undoubtedly embodied the government's desire to promote agricultural development at the time when the nation was feeling the worst consequences of coffee monoculture. The reconstructed IFG employed seven persons in four divisions and received a budget nearly 50 percent larger than it had been given in the past. Most of these funds went to the agricultural division, and the Instituto began to dedicate the greater part of its efforts to agricultural research. It worked closely with the newly formed Sociedad Nacional de Agricultura and began to publish a monthly bulletin devoted mainly to agriculture and only secondarily to pure science.[40]

The new IFG absorbed the Museo Nacional as one of its divisions. Over the previous decade, Anastasio Alfaro had put together fine ornithological and archaeological collections that he exhibited at international expositions in Madrid (1892), Chicago (1893), and Guatemala (1897). Alfaro had even created a small zoological collection with live specimens for public viewing.[41] When Costa Rica and Nicaragua came to the brink of war in 1898, Alfaro was called up to serve in the artillery units on the border. A Spaniard named Juan Fernández Ferraz replaced Alfaro

37. *Gaceta*, no. 6, 8 Jan. 1899, p. 21; no. 91, 22 Apr. 1900, p. 365; and no. 34, 9 Aug. 1899, p. 139. The Costa Rican government financed an expedition to the Isla de Cocos in the Pacific during this period. See Henri Pittier, "Apunteamientos preliminares sobre la Isla de Cocos, posesión costarricense en el Océano Pacífico," a pamphlet, in *Ministerio de Fomento (1899)*, 141–54.

38. Henri Pittier and Manuel Aragón, *Boletín de Agricultura Tropical*, 1–12 (San José: Imprenta y Librería Española, 1899).

39. Henri Pittier, "Notas y reflexiones sobre la agricultura en Costa Rica," *Cultura Venezolana*, no. 91 (1929):6.

40. Henri Pittier, *Boletín del Instituto Físico-Geográfico* 1 (1901):31–32. The *Boletín* became the official publication of the Sociedad Nacional de Agricultura.

41. The government evidently viewed these exhibits as valuable publicity for Costa Rica.

and managed to remain in the position after Alfaro's return.[42] With Alfaro out of the picture, Pittier again succeeded in uniting the two main scientific institutions in the country.

Pittier now understood that the Instituto could survive only by dedicating itself to applied agricultural research. Although willing to engage in applied science, by 1902 Pittier had become disenchanted with the constant maneuverings of local politicians and with the limited possibilities for turning the IFG into more than an agricultural research center. Frustrated, he began to look for more promising positions outside Costa Rica.[43] In 1902 he traveled to the United States, partly to search for a position with a U.S. institution. In the preceding decade, he had become intensely interested in doing an ethnographic survey of the Indians along the border region between Costa Rica and Panama. As a fallback, he made arrangements to work for the United Fruit Company doing plant research.[44]

After a bitter falling out with the government over its handling of preparations for a Costa Rican exhibit at the St. Louis Exposition in 1904, Pittier angrily resigned the directorship of the IFG.[45] He immediately went to work for United Fruit, and in January 1905, he went to Washington, D.C., to work for the Bureau of Plant Industry of the United States Department of Agriculture.[46] With his departure, the Instituto lost its creator and engine, and Costa Rica lost a dynamic and prolific scientist.[47]

Within a month, Anastasio Alfaro became the new director of the Instituto. The government assigned an assistant to care for the collections in each of the three sections: the Museo, the observatory, and the herbar-

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The budget for the Chicago exhibit alone was sixty-four thousand pesos, nearly ten times the Museo's normal annual budget. *Gaceta*, no. 222, 24 Sept. 1893, p. 6. See Anastasio Alfaro, *Informe . . . 1895*, 5–6; and Correspondencia del Museo Nacional, ms. no. 265.

42. Juan Ferraz, *Informe del Museo Nacional, 1898*, 3, 11; *Gaceta*, no. 44, 23 Feb. 1898, p. 199; and Doris Stone, *Biografía de Anastasio Alfaro González* (San José: n.p., 1956), 16.

43. Pittier remarked to one correspondent at this juncture that he wished to be "freed from the *caciquillos costarricenses*." See PP/MN, letter from Pittier to Karl Sapper, 2 Feb. 1904.

44. *Gaceta*, no. 88, 11 Oct. 1902, p. 399; and PP/MN, letter from Pittier to O. F. Cook, 24 Aug. 1903; also letters from Pittier to W. H. Holmes, W. J. McGee, Albert Gatschet, and Franz Boas.

45. *Gaceta*, no. 54, 1 Sept. 1903, p. 277; PP/MN, letter from Pittier to W. H. Holmes, 24 Jan. 1904; and Pittier to O. F. Cook, 7 Feb. 1904.

46. Cattel, *American Men of Science*, 886; PP/MN, letter from Pittier to Alfaro, 25 May 1904; and Agnes Chase, "Henry Pittier in Washington," *Henri F. Pittier*, 45.

47. After spending a few years in the United States, Pittier went on to a long and distinguished career in Venezuela until his death in 1950 at the age of ninety-three. See Tobías Lasser, "Apuntes sobre la vida y obra de Henri Pittier," *Boletín de la Sociedad Venezolana de Ciencias Naturales* 13, no. 76 (1950):1–6. See also Stuart McCook, "The Husbandry of Nature: Henri Pittier and Ecological Explanations for the Decline of Venezuela's Coffee Industry, 1900–1935," paper presented to the Conference on Latin American History, New York, 2 Jan. 1997; and McCook, "The Agricultural Awakening of Latin America: Science, Development, and Nature, 1900–1930," Ph.D. diss., Princeton University, 1996, chap. 4.

ium. In effect, the Instituto was reduced to a collection of plants and an assistant who made daily meteorological observations. In 1910 the observatory became an official division of the Museo Nacional, and the Instituto essentially ceased to exist in name as well as fact.[48]

The Map

The principal activity and perhaps the raison d'être of the Instituto was the mapping of Costa Rica. Henri Pittier had arrived with his skills and energy at a moment distinctly favorable for executing a map of the country. The maps in use at that time were based on approximations, guesswork, and second- or third-hand sources. Longstanding boundary disputes with Panama (then part of Colombia) and Nicaragua waxed hot, and several proposed interoceanic canal routes ran along the disputed boundary with Nicaragua (the San Juan River).[49] Costa Rican politicians in the late 1880s had hopes of sharing in the rewards that a canal might bring. In a more general vein, the Liberals of the era desperately wanted to attract foreign immigrants (preferably Europeans) to colonize and develop the underpopulated and underutilized countryside. A map would facilitate both the flow of immigrants and exploitation of the land.[50]

The first mapping expeditions did not begin until 1891. The project was well underway when the world financial crisis of 1893 rocked the coffee-export economy. The IFG and the mapping project weathered the crisis, however, and by 1894 the government had granted modest budget increases for the Instituto's work. Pittier structured his modest staff along the lines of the U.S. Geological Survey. The team in the field usually included Pittier, who took cartographic measurements; Adolphe Tonduz, collecting botanical specimens for the national herbarium; and the German head of the meteorological section, Peter Reitz, who recorded climatological data, along with Pittier. Various assistants helped with measuring, collecting, and caring for specimens and data. At times, the Museo's naturalist, George Cherrie from the United States, would accompany the team, as would the Museo's botanist Paul Biolley, a Swiss professor.

The excursions lasted from a few days to several weeks or months. The southern regions of the country became the focus of much of the work in the 1890s. Completely uncharted and sparsely inhabited by Native

48. *Gaceta*, no. 74, 30 Mar. 1904, p. 300; no. 148, 29 June 1905, p. 659; no. 56, 18 May 1910, p. 440; and Stone, *Biografía de González*, 17.

49. The dispute over the border between Costa Rica and Colombia/Panama underwent international arbitration in 1886 (in Spain), 1900 (in France), and in 1910 (in the United States). It was not settled until 1941. See Didier García Zúñiga, "Don Ascensión Esquivel: Su personalidad y su labor de estadista," Ph.D. diss., Universidad de Costa Rica, 1956, 42, 95.

50. See for example González Flores, *Historia de la influencia extranjera*, 43.

Americans, the south attracted Pittier's attention for cartographic, botanical, zoological, geological, and ethnographic work. The team normally took advantage of the dry season (December to May) for extended trips to the south every year from 1891 to 1898 (except during the national economic crisis of 1893). Economic considerations dictated the major movements of the expeditions. In addition to the efforts to demarcate the southern border clearly, Pittier gave special attention to planning roads, the navigability of rivers, and the possibilities for exploiting local natural resources.[51]

Pittier made two extensive excursions dealing directly with the planning of proposed interoceanic canal routes. In June 1890 and June 1895, he accompanied canal commissions during their reconnaissances of the region surrounding the border between Nicaragua and Costa Rica. Pittier, Tonduz, and Cherrie supplied information and reports to the commissions, hoping to convince them to locate the canal along the San Juan River.[52]

The map gradually took shape as the Instituto completed work in different sections of the country. Partial maps of the areas covered by expeditions appeared regularly as the amount of data slowly accumulated. But by 1898, the government had grown impatient. Pittier had to assure the minister of public instruction (his immediate superior) that the remaining areas could be charted within three years.[53] Nevertheless, impatient politicians suppressed the Instituto soon afterward, during the 1898 economic crisis.

Pittier continued to work on the map even after the IFG ceased to exist. When it was revived in 1901, he once again launched into intensive work and mapping excursions. When the map was finally ready for publication, however, an unexpected difficulty arose. Costa Rica and Colombia were in the midst of delicate negotiations over the location of their common border, and the government did not want to jeopardize its case by demarcating a boundary on the map. The government finally ordered the printing of Pittier's map in February 1903—without a southern boundary. Final touches by Pittier and the diplomatic negotiations delayed publication for nearly another year.[54] In accuracy and scope, the IFG's map was unequaled in any Central American republic and was as good as similar work done in other Latin American countries with much greater scientific resources, such as Mexico and Colombia. Several revised editions of the map appeared in the following decades until the 1940s and

51. See for example Henri Pittier, "Exploración en Talamanca, año de 1894," *Boletín de las Escuelas Primarias* 37 (1895); and Pittier, *Informe . . . 1892*.

52. Cajas Diplomáticas/AN, no. 92, letter from Manuel María Peralta to the minister of foreign relations, no date. See also Pittier, *Informe . . . 1896*, 73.

53. Pittier, *Informe . . . 1897*, 87, 89.

54. Karl Sapper arranged for the map to be published by Justus Perthes in Gotha, Germany. PP/MN, letter from Sapper to Pittier, 3 July 1900; and J. B. Calvo to Pittier, 13 and 26 Jan. 1903, 13 Feb. 1904.

1950s, when aerial photography and the work of the new Instituto Geográfico Nacional finally surpassed Pittier's work.

Other Activities

Although the geographical work of the IFG became its primary mission, Pittier and the Instituto also carried out important botanical, meteorological, ethnographic, and agricultural research. Perhaps the most lasting scientific contribution of the Instituto was its work on Costa Rican flora. The botanical section, in the hands of Adolphe Tonduz, rapidly amassed a large collection that became the Herbario Nacional. Between 1889 and 1895, the botanical collection expanded to embrace more than ten thousand specimens.[55] Pittier and Tonduz set up a classification system based on exchanges with a network of botanists in Europe and the United States. They collected two specimens of each plant, sending one to a prominent specialist and keeping the other for the herbarium. The expert helped them classify the plant and kept the specimen as payment for services. The IFG had exchange relationships with botanists in Baltimore, Brussels, Paris, and Geneva.[56]

The botanical work suffered from the same budgetary problems that plagued mapping, however. The Instituto never had enough storage space for specimens, and materials for sorting, storing, and protecting the specimens were always in short supply.[57] The financial ups and downs of the IFG finally drove Tonduz to more secure employment with the United Fruit Company. Collecting stopped after 1898, and a caretaker looked after the collection, a great loss for Costa Rican science, given that the work of the Instituto had added more than four thousand new species to the known flora of the country. Paul Standley, a renowned botanical expert on Central America, considered the collection without equal in Latin America.[58]

The meteorological section of the Instituto was not as tightly tied to the mapping work as the botanical section. Until the founding of the observatory, the collection and analysis of meteorological data in Costa Rica had been sporadic and amateurish.[59] The IFG marked the beginning of modern meteorology in Costa Rica. By 1901 the meteorological section was coordinating a network of two dozen recording stations around the country.[60] The central observatory measured air and soil temperatures, at-

55. Pittier, *Informe . . . 1895*, 85.

56. Pittier, *Informe . . . 1892*, 96.

57. Pittier, *Informe . . . 1891*, 9; *Informe . . . 1893*, 8–9; and *Informe . . . 1897*, 95–96.

58. Paul Standley, *Flora of Costa Rica*, Botanical Series (Chicago, Ill.: Field Museum of Natural History, 1937), vol. 18, t. I.

59. Pittier, *Boletín Trimestral*, 9–10.

60. Pittier, *Informe . . . 1895*, 6; *Informe . . . 1898*, 114–16; and *Boletín*, no. 4 (1901):108–10. Most of these stations were staffed and run by the United Fruit Company.

mospheric pressure, humidity, and rainfall. The meteorological section established the exact latitude and longitude of the capital and the official time for the country. It also carried out two exploratory studies on magnetic declination and weather patterns.[61]

The ethnographic work of the Instituto arose out of the enormous intellectual ambitions of Henri Pittier. An acute observer of the natural world, Pittier also developed an intense interest in the last "natural inhabitants" of the remote regions of Costa Rica—its small indigenous population. The ethnographic work developed as an offshoot of the cartographic expeditions to the south, when Pittier first encountered indigenous peoples. For fifteen years, Pittier developed his ethnographic skills by working with Carlos Gagini, a Costa Rican educator and linguist, and several foreign anthropologists and archaeologists.[62] Pittier's passion for ethnographic work, especially linguistics, grew so large that he wanted to make it his life's work. He began corresponding with leading U.S. anthropologists and published a number of articles on the customs, languages, and physical anthropology of Costa Rican Indians.[63] Pittier's ethnographic work on rapidly disappearing indigenous languages and traditions was the first modern anthropological research in Costa Rica. It was not resumed until decades after his departure in 1904.

Ultimately, agricultural research became the primary objective of the Instituto. Although it had been enumerated as one of the primary activities of the IFG in the founding decree, before the reorganization of 1901, Instituto personnel conducted little agricultural research. Pittier had always stressed, whenever possible, the practical benefits of his expeditions for national agriculture, yet during the first decade of its operation, Costa Rican agriculture received few direct benefits from the work of the IFG.

The reorganized Instituto became in essence an agricultural research institute. After the crisis of 1898, Pittier recognized the need to stress the practical benefits of scientific research and began working closely with Manuel Aragón in publishing the *Boletín de Agricultura Tropical*. This monthly journal (initially financed by Aragón) publicized the latest advances in agricultural science and research. After 1901 the journal became the *Boletín del Instituto Físico-Geográfico*, carrying mainly articles

61. Pittier, *Informe . . . 1890*, vii; *Informe . . . 1891*, 3; *Informe . . . 1893*, 1; *Informe . . . 1898*, 113–15; and *Gaceta*, no. 32, 10 Feb. 1892, p. 171.

62. See, for example, Pittier, *Anales del Instituto Físico-Geográfico* 7 (1894):141. Gagini was a major intellectual figure in early-twentieth-century Costa Rica and the author of *Diccionario de barbarismos y provincialismos de Costa Rica* (San José: Tipografía Nacional, 1893); *Los aborígenes de Costa Rica* (San José: Imprenta Trejos Hermanos, 1917); *Diccionario de costarriqueñismos*, 2d ed. (San José: Imprenta Nacional, 1919); and a novel, *El arbol enfermo* (1918), published in English as *Redemptions: A Costa Rican Novel*, translated by E. Bradford Burns (San Diego, Calif.: San Diego State University Press, 1985).

63. See, for example, Pittier, "Primera contribución para el estudio de las razas indígenas de Costa Rica," *Anales del Instituto Físico-Geográfico* 7 (1897):141–51; and Pittier, "Folk-lore of

on agriculture and cattle ranching, with essays on the natural sciences and geography taking a back seat.[64]

The budget of the IFG after 1901 reflected its new focus and mission. With a budget 50 percent larger than its previous high, 40 percent of resources went to the agricultural section, 45 percent to mapping operations, and the remaining 15 to the Museo and the meteorological division. Other than the technical work of finishing up the map and agricultural research, the Instituto did little else of significance after 1901.

The economic crises of the 1890s spurred Costa Rican politicians to search for practical ways to end the country's extraordinary dependence on coffee-export revenues and to pursue alternative crops. In addition to redefining the mission of the IFG, politicians and agriculturalists (often the same individuals) formed the Sociedad Nacional de Agricultura. The ex officio president of the society was the minister of development, and the director of the IFG served as an ex officio member of the administrative council, the governing body of the society.[65] The administrative council included in its ranks a former president, a future president, and the head of the United Fruit Company, along with numerous major politicians, bankers, and coffee planters.[66] Henri Pittier became the general secretary and helped draw up the founding statutes of the society, a sure sign of its close relationship to the IFG and its agricultural work. The society held its meetings in the Instituto and at its first meeting adopted the *Boletín* as its official publication.[67]

Despite the vigorous efforts of Pittier and the Instituto to develop new crops, promote scientific methods, and improve traditional crops such as coffee, the IFG during its brief revival had little time to make a mark on Costa Rican agriculture. As the world market for coffee improved after the turn of the century, the Sociedad and the Instituto, along with their efforts to promote scientific agriculture, faded quickly after Pittier's departure in 1904.

Scientific Collaboration

Scientific progress ultimately depends on the diffusion of research, and the Instituto became a small but exceptional center for organizing and dispersing knowledge about Costa Rican flora, fauna, geography, and eth-

the Bribri and Brunka Indians of Costa Rica," *Journal of American Folklore* 16, no. 60 (1903):1–9; "Numeral Systems of the Costa Rican Indians," *American Anthropologist* 6, no. 4 (1904):447–58; and Henri Pittier and Carlos Gagini, *Ensayo lexicográfico sobre la lengua de Térraba* (San José: Tipografía Nacional, 1892).

64. *Boletín del Instituto Físico-Geográfico* 1, no. 1 (1901):31–32.

65. *Gaceta*, no. 98, 30 Apr. 1903, p. 414.

66. *Boletín del Instituto Físico-Geográfico*, 1903:2–3.

67. *Boletín del Instituto Físico-Geográfico*, 1903, 3, 11–12, 19, 42, 62, 66.

nography. It maintained correspondence with scientists in Europe, Africa, Asia, and the Americas. While the contacts with Asia and Africa never involved much more than the exchange of publications, the U.S. and European correspondence encouraged much important scientific collaboration.[68]

European scientists played the most prominent collaborative role during the first decade of the Instituto's operations, hardly surprising considering that almost all the IFG staff had recently arrived from Europe. Pittier immediately began to exchange publications and information with meteorological centers in Switzerland, Austria-Hungary, and the Netherlands.[69] The most important contacts in Europe were botanists who worked closely with Pittier, Tonduz, and Biolley to identify and classify the extensive collections of specimens brought back by the Instituto's expeditions. The Boissier Herbarium in Geneva, the Paris Museum, and the Royal Herbarium of Brussels were the closest collaborators of the IFG.[70]

Dr. Théophile Durand of the Royal Herbarium in Brussels carried on a voluminous correspondence with Pittier and became the primary classifier of Costa Rican flora. Durand and Pittier coauthored *Primitiae Florae Costaricensis*, which was published in installments throughout the 1890s. In combination with Pittier's *Ensayo sobre las plantas usuales de Costa Rica* (1908), this botanical corpus remained the Bible of Costa Rican botany until Paul Standley's monumental *Flora of Costa Rica* was published in 1937.[71]

By the turn of the century, U.S. scientists had replaced Europeans as the Instituto's principal collaborators. John Donnell Smith, a botanist at the Johns Hopkins University, worked with Anastasio Alfaro and Pittier and made two trips to Costa Rica in the 1890s.[72] The Instituto regularly sent botanical specimens to collections in Boston, New York, and Washington, D.C. Botanists at the Plant Bureau of the U. S. Department of Agriculture eventually became the Instituto's principal collaborators in the United States. Pittier maintained a vigorous exchange relationship with Frederick Coville, G. N. Collins, and O. F. Cook, all of whom were specialists in tropical and economic botany.[73] Collins and Cook visited Costa Rica in 1903 to study the rubber plant (*castilloa*), and Cook later wrote the prologue for Pittier's *Ensayo*.

Pittier also carried on an extensive correspondence with leading figures in U.S. anthropology and archaeology, including Albert Gatschet, W. J. McGee, W. H. Holmes, and Franz Boas. Pittier's closest contact in the

68. For a sample of the IFG's early contacts, see *Anales del Instituto Físico-Geográfico* 1 (1888): 34–38. By 1895 the number of correspondents numbered around 300. Pittier, *Informe . . . 1895*, 100.

69. *Anales del Instituto Físico-Geográfico* 1 (1888):30.

70. Pittier, *Informe . . . 1892*, 6; and *Informe . . . 1987*, 95–96.

71. The correspondence is part of PP/MN. See Standley, *Flora of Costa Rica*.

72. Pittier, *Informe . . . 1894*, 9; and *Informe del Museo Nacional de 1896*, 2.

73. For biographical sketches, see Cattel, *American Men of Science* 65, 68, 70.

United States was Swedish anthropologist C. V. Hartmann, who worked in the United States and published in English. Between 1896 and 1903, Hartmann carried out the first modern archaeological excavations in Costa Rica, working in every major archaeological zone in the country. He also maintained an active correspondence with Pittier and arranged several exchanges of artifacts between the IFG and collections in the United States.[74]

Although the Instituto maintained productive contacts with European and U.S. scientists, its collaboration with scientists in other Latin American countries was minimal. Argentine, Brazilian, Chilean, Cuban, Mexican, and Venezuelan scientists corresponded with the Instituto, but the contacts rarely went beyond exchanging publications.[75] The poverty of these contacts reflected both the quality and influence of scientific institutions in Europe and the United States, as well as the underdevelopment of scientific institutions in Latin America.

The Instituto nonetheless stimulated a flurry of scientific activity and collaboration within Costa Rica during the IFG's brief life. Adolphe Tonduz, Pittier, and Paul Biolley effectively founded modern botanical science with their studies, and they hosted numerous foreign botanists on collecting expeditions. Peter Reitz (a German), along with Pedro Nolasco Gutiérrez, continued the earlier meteorological work of von Frantzius, placing meteorological science in a tradition that would continue long after the demise of the IFG.[76]

Unfortunately, Pittier became an adversary of the major Costa Rican scientific figure, Anastasio Alfaro, for reasons that remain unclear. The Museo and the Instituto nevertheless evolved into something of a functional division of scientific labor. The Museo tended to focus on zoological and archaeological collecting, while the Instituto concentrated on mapping, botany, meteorology, and agricultural research. José Cástulo Zeledón (a Costa Rican who largely worked on his own) and George Cherrie (a U.S. scientist and the Museo's ornithologist) assembled a first-rate ornithological collection at the Museo. Zeledón and Cherrie often accompanied the mapping expeditions of the IFG. After Cherrie returned to the United States in 1894, he was replaced by another U.S. scientist, Cecil Underwood.[77]

74. C. V. Hartmann, *Archaeological Researches in Costa Rica* (Stockholm: Royal Ethnographical Museum, 1901); *Archaeological Researches on the Pacific Coast of Costa Rica*, Memoirs of the Carnegie Museum 3, no. 1 (Pittsburgh, Pa.: Carnegie Museum, 1907). The correspondence forms part of PP/MN.

75. *Anales del Instituto Físico-Geográfico* 1 (1888):34; and Pittier, *Informe . . . 1892*, 10.

76. Gutiérrez worked in the government statistics bureau for many years and edited the *Primer almanaque católico costarricense* (San José: n.p., 1892).

77. Luis Felipe González, "Homenaje a don José C. Zeledón," *Benefactores de Heredia* (San José: Imprenta Gutenberg, 1930); *Anales del Museo Nacional* 1 (1888), xxiv; González Flores, *Historia de la influencia extranjera*, 214; and *Gaceta*, no. 217, 19 Sept. 1894, p. 1213.

One of the most important collaborators in Costa Rica was Minor C. Keith, the founder of the United Fruit Company. From the Instituto's early beginnings, Minor and his brother John Keith assisted its work. Company employees staffed pluviometric stations in the Atlantic watershed. Pittier and John Keith regularly exchanged publications, and both played an active role in the Sociedad Nacional de Agricultura. Instituto staff and visiting foreign scientists frequently received free passage on the company-controlled railway between San José and the Caribbean. Pittier, Tonduz, and their assistants all worked in close conjunction with United Fruit personnel on banana plantations after 1900, and Pittier and Tonduz eventually went to work full-time for United Fruit.[78]

CONCLUSION

The history of the Instituto Físico-Geográfico demonstrates clearly how the growth of science in Costa Rica, as in many other developing nations, has been shaped and constrained by the limitations of an economy dependent on agricultural exports. The IFG arose out of the cultural and political ferment that Costa Rica experienced under the so-called Generación de '89, which was in turn built on a half-century of economic growth generated by coffee cultivation. The relative affluence produced by coffee exports helped create a small elite of families who dominated the national political scene and profoundly influenced Costa Rican society. Imbued with the liberal-positivist thinking of the late nineteenth century and craving the fruits of economic growth, this elite sought out the talent and expertise of European and U.S. immigrants who could help discover and develop the nation's resources. Liberals hired foreign professors who laid the foundations of the nation's modern secondary educational system and, as a by-product, initiated science education and the first modern scientific institutions in Costa Rica. For the Costa Rican political elite, particularly the Liberals and positivists, science appeared to be an instrument for developing their society. They had a utilitarian vision of science. They hoped that modern education would spread scientific values, that the application of science to agriculture, geology, and the study of national resources would promote economic development and their vision of progress.

Throughout its brief existence, the IFG reflected some of the basic conflicts of science in the developing world. A bona fide scientific research institute needs adequate funding and political support to function and survive. As Henri Pittier learned, building political and financial support for scientific research in a small agro-exporting country like Costa Rica ul-

78. *Anales del Instituto Físico-Geográfico* 1 (1888):viii; PP/MN, letter from Pittier to J. Keith, 3 Dec. 1902; letter from Pittier to O. F. Cook, 26 June 1903; letter from Pittier to Cook, 24 Aug. 1903; and letter from Pittier to J. Keith, 17 Nov. 1903.

timately hinged on selling the practical benefits of science. Much more so than in the North Atlantic economies, basic science became an unaffordable luxury. Although basic science has always been difficult to sell to politicians, greater economic stability and affluence have made it easier to finance and promote in more developed economies. In tough times, politicians in the United States or Germany might cut back expenditures on scientific research, but they do not eliminate it entirely.[79] Costa Rican politicians saw the IFG as a means of promoting economic development. The decisive factors behind the creation and survival of the Instituto were the need for an adequate map that could be used in settling boundary disputes, in bargaining for a trans-isthmian canal, and in planning the exploitation of underutilized areas of the country.

Despite enormous handicaps and minimal financial resources, the IFG made important contributions to Costa Rican and Latin American science. The map of Costa Rica was probably unsurpassed in the Caribbean Basin in its accuracy (with the exceptions of Mexico, Colombia, and Venezuela).[80] The Instituto's meteorological studies were the first sustained and systematic calculations of the basic indexes in Central America. During the IFG's existence, perhaps only Mexico, Brazil, Argentina, and Cuba surpassed Costa Rica in the quality and quantity of national meteorological studies in Latin America.[81] The Instituto made its most lasting contribution to science in botany through the work of Pittier and Tonduz. Their work produced what was arguably the finest herbarium in Latin America at the turn of the century.[82]

By 1904 the IFG's cartographic, meteorological, and botanical research had made Costa Rica one of the best centers for scientific research in Latin America, in the rank of the far more cosmopolitan centers of Mexico City, Rio de Janeiro, Buenos Aires, and Havana. This was no small feat, given the relative poverty of Costa Rica's educational and intellectual traditions and its small resource base. Eventually, however, the economic realities of a small country built on monoculture took their toll. Practical-minded legislators got their map, albeit rushed and not as grand as Pittier would have liked. Unconvinced of the need to put substantial sums into

79. An excellent introduction to the difficulties of selecting scientific research priorities in developed countries is Gabriel Drilhon, *Choosing Priorities in Science and Technology* (Paris: Organisation for Economic Cooperation and Development, 1991).

80. Instituto Panamericano de Geografía e Historia, *Los estudios sobre los recursos naturales en las Américas* (Mexico City: Instituto Panamericano de Geografía e Historia, 1953), 1:101, 105, 173, 237, 375; 2:11–12, 257; 3:16–17, 243, 353; 4a:17–18.

81. Pittier, *Informe . . . 1891*, anexo B; *Anales del Instituto Físico-Geográfico* 2 (1889):v; and *Anales del Instituto Físico-Geográfico* 2 (1889):xix.

82. Paul Standley believed that Costa Rica (as of the 1930s) had the best studied flora of any tropical American nation. See Standley, *Flora of Costa Rica*, 49–50. See also *Plants and Plant Science in Latin America*, edited by Frans Verdoorn (Waltham, Mass.: Chronica Botanica, 1945), 64.

scientific research during economic hard times, they finally drove Pittier to despair and resignation, effectively stalling a promising start for science in Costa Rica.

This start was almost entirely funded by the government and undertaken by foreign scientists. In a society with insignificant capital markets and small amounts of private capital available, the only private funding of scientific work came in the form of donations of materials (such as archaeological collections) or help in efforts to secure government funding. There was certainly no hope of access to private funds on the scale available in Europe or the United States at the turn of the century.

The role of foreign scientists in this enterprise also raises the issue of "scientific imperialism," which has been explored by a number of other studies of the history of science in the developing world.[83] Clearly, this case differs from the "scientific colonialism" that others have analyzed in formal colonies of the British, French, or German Empires. The scientists in Costa Rica (Pittier, most prominently) never acted as agents (consciously or unconsciously) of any country. At worst, they could be accused only of imposing "foreign values" and culture on Costa Ricans. Nevertheless, in a society that was nearly entirely of European origin (culturally and ethnically), the spread of science can hardly be viewed as a radical departure from "local culture."[84] In fact, the effort to diffuse science and scientific culture was only partially successful. Pittier and many of the other scientists left with the closing of the Instituto in 1904, but their efforts were not a complete failure.

The years 1887–1904 represented a period of exceptional activity in Costa Rican science, a level that would not be surpassed until the 1940s. For the first time, the country experienced native-born scientists at work (Zeledón and Alfaro, most prominently).[85] Foreign scientists produced some of the first serious scientific research and publications, and a fair

83. See in particular the works of Lewis Pyenson, *Cultural Imperialism and Exact Sciences: German Expansion Overseas, 1900–1930* (New York: Peter Lang, 1985); and *Civilizing Mission: Exact Sciences and French Overseas Expansion, 1830–1940* (Baltimore, Md.: Johns Hopkins University Press, 1993). See also *Scientific Colonialism: A Cross-Cultural Comparison*, edited by Nathan Reingold and Marc Rothenberg (Washington, D.C.: Smithsonian Institution Press, 1987); and *Imperialism and the Natural World*, edited by John M. MacKenzie (Manchester, Engl.: Manchester University Press, 1990).

84. In the early twentieth century, some Costa Rican intellectuals such as Carlos Gagini grew increasingly unhappy with U.S. imperialism in the region, but they never lost their admiration for European culture nor their desire to emulate it. On their anti-imperialist sentiments, see Richard V. Salisbury, *Anti-imperialism and International Competition in Central America, 1920–1929* (Wilmington, Del.: Scholarly Resources, 1989). For a discussion of foreign cultural influences, see *Héroes al gusto y libros de moda*, edited by Steven Palmer (San José: Porvenir, 1992).

85. Alfaro published many works in archaeology, ethnology, and biology. He also published a novel. For a sample of his work that lists his publications, see Anastasio Alfaro, *Investigaciones científicas* (San José: Trejos Hermanos, 1935).

number chose to take up permanent residence (Biolley, for example). They provided continuity with this period of florescence and the revival of research after 1940, in continuing their own work and in training Costa Ricans. For the first time, scientific research was institutionalized and turned into more than the scattered writings of occasional travelers.[86]

With the departure of Pittier, however, Costa Rican science lost much of its impetus. After serious earthquakes shook the central valley in 1924, the government resurrected the Instituto, but it did little more than seismological work, disappearing again in 1936.[87] The impact of World War I and the Great Depression on the Costa Rican coffee economy made it difficult for the government to provide funds for scientific research. Several assistants and students of Pittier, Tonduz, and Biolley carried on their work in the decades after 1904.[88] Ricardo Fernández Peralta, to take one example, received his first scientific lessons in the observatory. After the Instituto Geográfico Nacional was created in the 1940s, Fernández became its director.[89] The greatest flaw of the Instituto was its inability to pass on scientific training to more than a handful of Costa Ricans. In the absence of scientific institutions and universities, the training of the next generation of scientists was left almost entirely to the individual initiative of scientists like Biolley or Clodomiro Picado.

This small but abortive beginning of modern science in tiny Costa Rica raises some large questions and issues for students of the history of science in Latin America. First, this case demonstrates vividly the problems of creating and nurturing modern science as an intellectual or research enterprise in developing nations. Even in the biggest economies of Latin American today (Brazil, Mexico, and Argentina), scientific research and scientific institutions often live and die by their ability to stress applied rather than basic science. This tendency has long skewed the development of science in Latin America. Although science has always been

86. The brightest star of Costa Rican science in the years after the demise of the IFG was Clodomiro Picado Twight. After studying at the Pasteur Institute in Paris, Picado returned to Costa Rica in 1913 and eventually set up a laboratory at the Hospital San Juan de Dios in San José. A Lamarckian biologist, Picado published more than a hundred scientific papers on tropical medicine, microbiology, ecology, and herpetology before his death in 1944. Picado worked largely on his own, however, and left no lasting institutional legacy. See M. Picado Ch., *Vida y obra del Doctor Clodomiro Picado* (San José: Editorial Costa Rica, 1964). For a list of his scientific publications, see Clodomiro Picado Twight, *Serpientes venenosas de Costa Rica*, 2d ed. (San José: Editorial Universidad de Costa Rica, 1976), esp. 231–41.

87. *Gaceta*, no. 100, 10 May 1924, p. 474; Elisa Pittier F., *El Instituto Físico-Geográfico*, Ph.D. diss., Universidad de Costa Rica, 1942; and Karl Sapper, *Viajes a varias partes de la República de Costa Rica, 1899 y 1924* (San José: Imprenta Universal, 1942), 129.

88. One of these was José Fidel Tristán, who recounted his experiences in *Baratijas de antaño* (San José: Editorial Costa Rica, 1966).

89. Interview with Ricardo Fernández Peralta, San José, Costa Rica, 6 Feb. 1974. His father, Ricardo Fernández Guardia, was one of Costa Rica's most distinguished historians.

constrained by the limitations of economic development in Europe, the United States, and Japan, strong industrial economies that have produced sustained economic growth have opened up a range of possibilities for scientific development that have become available only in the most developed economies of Latin America in the last generation. The small agro-exporting economies of Costa Rica and its Central American neighbors face much steeper economic obstacles to scientific development than the developed nations. They also confront much greater obstacles than the larger Latin American countries.

Second, the case of the IFG raises fundamental questions about the development of modern science that are too often ignored by historians of science in developed countries. Must developing nations follow similar paths in creating modern scientific research as those forged in the North Atlantic world? In the developed nations, science emerged alongside economic expansion and industrialization, and on many fronts simultaneously. The historic convergence of universities, industries, and government—the combination of private and public capital—that took shape in the late nineteenth and early twentieth centuries has been a fundamental feature of science in the North Atlantic world, arguably the fundamental feature in this century. Can Latin American countries afford to follow the same path—even if they choose to—given the economic imperatives constraining weaker and less-developed economies? Can a path or paths to modern scientific research in Latin America be built on the needs and concerns of Latin American societies? In short, what will the development of science "on the periphery" look like? These are all questions of the first order for science in Latin America but also for the future of Latin American societies. It is my hope that this study of the Instituto Físico-Geográfico Nacional de Costa Rica will help stimulate further discussion of these immense questions.

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