

**“VISUAL HARVEST”:
Ambiguity in the U.S. Forestry Science at Home and in the
Tropic, 1890-1925**

History of Science Society, Annual Meeting, November 7-10, 2002. Milwaukee, WI.
USA.

Hannes Toivanen

School of History, Technology and Society
Georgia Institute of Technology
Atlanta, GA 30332-0345 USA
Tel. +1-404-874-2607
Email. Hannes.Toivanen@hts.gatech.edu

INTRODUCTION

The questions I am interested in is what was the relationship between forestry and American culture from late nineteenth century to early 1920's? It is an interesting question because during this period the professional identity of American forester was transformed from one of an engineer to a scientist.

After examining how the first generation of foresters employed technologies of representation to articulate their vision of how nature and industrial capitalism could be bridged. They were foremost system analysts that looked to carry out long-term and large-size projects. In contrast, the following generation looked to distance themselves from engineers, and to establish forestry as natural science. This resulted in visual culture that focused upon the biosphere.

Specifically, I am going to argue that the experience of the third Chief Forester, Henry Graves in the Philippines in 1905 triggered many of these changes, as he documented the frustration that followed American forester's entry in the tropical forest. Moreover, I will argue that this transformation from Forest Engineer to Forest Scientists suspended social visions from forestry.

FORESTRY AS ENGINEERING

Forestry was introduced to U.S. in the late nineteenth century as mere economic management of forests. Nevertheless, the men who responded to the demand by public, business and government to advance modern forestry in United States, committed themselves to something grander than simply take care of the trees.

The pioneering U.S. foresters believed to the expansion industrial capitalism, and hence lumbering, but sought to control the damage to the nature that shocked the voting people. The first U.S. Chief Forester Bernhard Fernow, and his famous successor Gifford Pinchot never failed to underscore that point. Forestry, as they presented it, mediated between private and public interests in a way that promised a win-win-situation. Both Fernow and Pinchot perceived the core of forestry as a special variant of scientific management that required long term planning of large size projects. They and people around them employed particular technologies of representation –statistics and maps- to demonstrate their claims about the American nature, and benefits of their approach.

Maps of North American forests compressed a vast amount of information into a practical format, and were products of ideals of engineering rationality that Fernow and Pinchot shared. Maps were the material technology of system analysis they advanced.

The character of forestry and forester was self-evident for Bernhard Fernow in 1898, when he left the Division of Forestry at Department of Agriculture to establish the first university school in forestry in U.S. It is very suggestive that his first graduate from the New York State College of Forestry, Ralph C. Bryant received in 1900 the degree of “Forest Engineer”. Nathan Rosenberg has documented a close parallel development in how European chemistry was transformed into Chemical Engineering at MIT.

The fountainhead of early American forestry, Bernhard Fernow was born and educated in forestry in Germany, and he emigrated to US in 1869. Here he accepted employment as engineer and worked mainly on mining and metallurgy. He joined in 1878 the American Institute of Mining Engineers, and became befriended with influential men who were concerned with the destruction of timber in mining districts. Abram Stevens Hewitt, iron manufacturer, chairman of

the Democratic Party's national committee, congressman, and later a mayor of New York, who helped to secure his nomination as the first Chief Forester in 1886.¹

The advent of Fernow's professional career in U.S., then, was characterized by an understanding of how engineering, politics, and industry could converge through forestry. Fernow was convinced that forests were as basic to national life as agriculture. This belief redirected his scientific interest from managing individual tracts of timber to model the national forests.

Around 1900, by rule all national statistics of forests and forest industries confirmed that forest industries were undergoing a rapid structural change. The location of the industry was shifting towards West, determined by the availability of new sources of timber. These statistics were problematic, however. Fernow acknowledged openly the shortcomings of forest statistics. The collection of statistics fell far behind of dominant ideals of accuracy, because the scattered locations, and unstandardized quality of forests, and the lack of funding, too.² Whatever the difficulties, by controlling the compilation of forestry statistics the foresters gained visibility in the national politics and economic life.³

[Picture 1. The Forest Wealth of Canada, 1908.]

As a means of system analysis, maps offered for Fernow another avenue of demonstrating the benefits of forestry. In 1908, he published an article in the *Forestry Quarterly* arguing that U.S. pulp and paper industry should integrate backwards to Canadian forests. Based on his fieldtrips, the article included sample of visual evidence: topographical models,

¹ Andrew D. Rodgers, *Bernhard Eduard Fernow. A Story of American Forestry*. Princeton: Princeton University Press 1951, 108-109.

² For Fernow's opinions on forestry statistics during his tenure as the Chief Forester, see Andrew D. Rodgers, *Bernhard Eduard Fernow. A Story of American Forestry*. Princeton: Princeton University Press 1951, 235.

³ For forestry statistics, see for example Bernard E. Fernow, Outlook of the Timber Supply in the United States. II. *Forestry Quarterly*, Vol. 1. No. 3. (April 1902), 87-93.

photographs, and very detailed maps of timber stands. Assessment of the economic viability of this backward integration framed the visual material. The most spectacular demonstration of Fernow's claims was a very large map folded inside the journal.⁴

The map provided an immense amount of detailed information by one glance: It showed the quality of stands, explored and unexplored areas, and how one could gain access to different stands. Fernow perceived forestry through economics, and emphasized the long-term profitability of forestry, a view crystallized in his influential textbook *Economics of Forestry*.⁵

On the level of style, the forest engineering of Fernow was the contrast to the other major contemporary alternative, the romanticizing preservationism of John Muir. Nevertheless, Fernow can not be interpreted as economic opportunist. He was driven by alternative Grand Vision of cohabitation of nature and society. Implicit in his idea of forestry was that preservationists were helpless in the face of industrial capitalism.

Foresters could and wanted to advance industrial and public interests because they conceived themselves as typical late nineteenth century engineers. That is, Fernow believed he had enough independence and social responsibility for not being corrupted by big business, and on the other hand he understood how to make money.⁶

The two first Chief Foresters were the visible embodiments of this attitude. By turning our attention to the third Chief Forester, Henry Graves, I want to introduce frictions, and ambiguity to our understanding of early twentieth century forestry.

⁴ Bernard E. Fernow, An Analysis of Canada's Timber Wealth. *Forestry Quarterly*, Vol 6. No. 4. December 1908, 337-353.

⁵ Bernhard E. Fernow, *Economics of Forestry*. New York 1902.

⁶ For this aspect of late nineteenth century engineering, see Edwin T. Layton, *The Revolt of Engineers. Social Responsibility and the American Engineering Profession*. Baltimore: The Johns Hopkins University Press 1986 (1971); David F. Noble, *America By Design. Science, Technology and the Rise of Corporate Capitalism*. New York:

FRUSTRATION IN THE TROPIC

When foresters arrived at the newly acquired American imperial properties of Cuba and Philippines in the early twentieth century, their experience of nature and culture was ambiguous. The entry in the tropical forest was followed by epistemological confusion. The jungle was anonymous for them. What could be demonstrated through maps and statistics, if one did not recognize the tree species and know what they were good for?

The Bureau of Forestry was established to the Philippines in April 1900 under the Captain George P. Ahern, a friend Fernow. The conditions were throughout discouraging for Americans. The huge tracts of land were unmapped, and the plants and trees were unknown for Americans.⁷ Ahern wrote to Fernow that forestry was difficult in the Philippines because the forests were so different from U.S., and no experimental knowledge existed of the uses of tree species.⁸

American foresters were disciplined to work in the North American and European forests, and they were simply not prepared to work in a jungle in 1900. In addition to the epistemological confusion, American suffered from cultural shock, too. A forester summarized Philippines to the readers of *Forestry Quarterly* 1912:

“It is no white man’s country.”⁹

Oxford University Press 1977; Bruce Sinclair, *A Centennial History of The American Society of Mechanical Engineers, 1880-1980*. Toronto: University of Toronto Press 1980.

⁷ M Barber, Assistant Adjutant General of Manila to Bernhard Fernow, 8/15/1900. Bernhard Fernow Papers, Collection #20/1/561, Box #1;

⁸ George P. Ahern to Bernhard Fernow, 9/7/1900, Bernhard Fernow Papers, Collection #20/1/561, Box #1.

⁹ W. D. Sterrett. The Philippine Bureau of Forestry, -Its Organization and Work. *Forestry Quarterly* Vol 10, No. 4, December 1912, 602-609.

Personal reactions to the heat, tropique and different looking people probably varied, but when American foresters got in contact with unknown tropical forests, they followed a standard reaction: Botanical work.

The way American foresters mobilized botany is best described as retreat rather than application. Botany offered a safe haven from epistemological crisis the tropic created. When foresters relied on botany, they gave up their identity as engineers

When Fernow examined the economic potential of the forest region of Sierra Maestra in Cuba in 1905, the virgin tropical forest amazed Fernow. It was unknown for white man; neither botanist nor naturalist had examined it. He exclaimed to the readers of *Forestry Quarterly*:

“To talk about forestry in these conditions is like putting a dress in a camp.”¹⁰

Although the image invoked by Fernow lends itself to multiple gendered readings, it calls attention in dramatic way to persistent gender associations with forestry and lumbering - readings that include such more recent examples as the famous Monty Python joke about Canadian Lumber Jacks. The gendered ridicule demonstrated how ill suited the engineering-like approach that Fernow embodied was in the tropic. Confusion is best cured with determined action, and to this end the classical botanical work offered the means. Fernow took to classify and provide English definitions of Cuban trees, while his botanical assistant studied the vegetation.¹¹ The easiness with Fernow rejected forestry and embraced botany in Cuba suggests

¹⁰ Bernard E. Fernow, The High Sierra Maestra. I. A Survey in the Tropics. *Forestry Quarterly*, Vol 4. No. 4. December 1906, 239-258.

¹¹ Bernard E. Fernow, The High Sierra Maestra. II. Botanical Notes on the Sierra Maestra. *Forestry Quarterly*, Vol 4. No. 4. December 1906, 259-269; Norman Taylor, The High Sierra Maestra. III. Botanical Notes on the Vegetation of the High Maestra. *Forestry Quarterly*, Vol 4. No. 4. December 1906, 270-272.

that he perceived the relationship between forestry and botany unproblematic. This observation deserves our attention, because the Henry Graves attached great importance to this attitude.

In 1905 the chief forester of U.S., Gifford Pinchot, sent his personal friend and student, Henry S. Graves to examine in confidentiality the operations of the Forest Bureau in Philippines. Graves produced a very sharp critique of the Bureau. Graves argued that both work, and thought at the Bureau were unfit for the task the jungle and imperialist needs presented.

His analysis of the Bureau suggests that the solution lie in the way Bureau's employees looked at and comprehended Philippine forest. The report is an important document of the early stage of ideas that over the next decades became to control American forestry schools at universities, when Henry Graves chaired the graduate school in forestry at Yale and succeeded Pinchot as the third Chief Forester. Graves aspired to define forestry as a natural science, and to distance it from engineering.

Upon his arrival, Graves was shocked to learn that the Bureau prioritized silvicultural work at the cost of mapping forests. This transformed the forester into botanist, and for Graves that was even worse than being an engineer. He argued that a forester making the maps could gather an immense amount information, which an engineer could not.¹²

But it was botany that troubled Graves. The Bureau was organized from the beginning around wrong principles, he argued. The most important function of the Bureau, the Experiment Station, had been built after the model borrowed from Java with the result that “there is now in the forest reserve a botanical station.”¹³

¹² Henry S. Graves, *Confidential Report on The Condition of The Philippine Forest Service*. 1905. Submitted to Gifford Pinchot, Forester of U.S. Department of Agriculture, Washington, D. C. Henry Solon Graves Papers, MS 249. Box #36. Folder #404. Yale University, Sterling Memorial Library.

¹³ Henry S. Graves, *Confidential Report on The Condition of The Philippine Forest Service*. 1905. Submitted to Gifford Pinchot, Forester of U.S. Department of Agriculture, Washington, D. C. Henry Solon Graves Papers, MS 249. Box #36. Folder #404.

Four experiment stations had been established in the Philippine reserve at different elevations. Graves considered the work done largely a failure, and ridiculed it. Graves produced in his confidential report a caricature of botanist that was epistemologically confused, and helpless to advance commercial interests.

At the experimentation stations, the people of Forest Bureau mechanically followed the botanical model, without trying to understand what they were doing and why. Graves wrote:

“The Bureau seems to be satisfied provided they can get a very large amount of identified material into the nurseries.”¹⁴

The stations could simply not produce any silvicultural information, because there was no person who knew what to do with these plants. Finally, Graves summarized his aversion by exclaiming that the Bureau was spending its money on botany, not forestry.¹⁵

Henry Graves realized that Forest-Engineers depended upon botanists in the tropic. Graves looked to do away with botanists by redirecting the system analysis of forestry from national planning to biosphere. Forestry, he reasoned, should include critical parts of botany.

The problem was the way a botanist looked at forest. A botanist had endless appetite for new species, and inherent interest in small vegetation. Forestry required that one prioritized large

¹⁴ Henry S. Graves, *Confidential Report on The Condition of The Philippine Forest Service*. 1905. Submitted to Gifford Pinchot, Forester of U.S. Department of Agriculture, Washington, D. C. Henry Solon Graves Papers, MS 249. Box #36. Folder #404.

¹⁵ Henry S. Graves, *Confidential Report on The Condition of The Philippine Forest Service*. 1905. Submitted to Gifford Pinchot, Forester of U.S. Department of Agriculture, Washington, D. C. Henry Solon Graves Papers, MS 249. Box #36. Folder #404.

and merchantable trees, Graves argued. That should be part of forestry, and the small shrubs and vines could be left for botanists, he wrote.¹⁶

Some ten years later, when Graves had left the chair of Yale School of Forestry to succeed Pinchot as the Chief Forester, he had accomplished a position from which he could crystallize the tension between botany and forestry to the readers of *Science*:

“Forestry may be called tree sociology and occupies among natural sciences the same position as sociology among humanistic sciences. Sociology may be based upon the physiological functions of a man as a biological individual. A physician, however, is not a sociologist, and social phenomena can be understood and interpreted only in the light of sociological knowledge. So also with Forestry. Forestry depends upon the anatomy and physiology of plants, but is not applied anatomy and physiology of plants”¹⁷

By then, however, Graves and his colleagues had done away with the need for botanists in the field expeditions to the tropical forests.

THE TROPIC DOMESTICATED

In US Graves launched the teaching of Tropical Forestry at Yale in the early teens, and eventually established a distinct department with three professors in 1916. The majority of this research and teaching can be summarized as an attempt to create a sound epistemological foundation for tropical forestry. The other leg of this program was work on sustained yield

¹⁶ Henry S. Graves, *Confidential Report on The Condition of The Philippine Forest Service*. 1905. Submitted to Gifford Pinchot, Forester of U.S. Department of Agriculture, Washington, D. C. Henry Solon Graves Papers, MS 249.. Box #36. Folder #404.

¹⁷ Henry S. Graves, The Place of Forestry Among Natural Sciences. *Science*, January 22, 1915, 117-127.

management, a subject not discussed here, but which also established a new scientific foundation of forestry. In short, the new forestry focused upon biosphere instead of national planning.

Samuel J. Record assumed the responsibility of the program. Record had authored a textbook on the identification and uses of North American Tree species, and looked now to accomplish the same in the tropic. This work would specifically meet Graves' frustration in the Philippines, and did botanist unnecessary in the field expeditions into tropical forests.

The accomplishments of Yale group are very suggestive. Within few decades the school housed a carefully catalogued collection of over 35,000 tropical tree species, over 10,000 microscopic slides of the structural characteristics of tropical woods, launched in 1925 the journal *Tropical Forestry*, and prepared an encyclopedia of scientific and vernacular names of tropical trees and woods. In short, tropical forestry had been established, and Yale School of Forestry was the international authority on the subject.¹⁸

The establishment of tropical forestry followed from Graves' experiences in tropic, especially in Philippines. Graves perceived his intellectual program to go beyond tropical forestry, however. Tropical forestry served as a vehicle of constructing new, a more scientific forestry that focused upon biosphere.¹⁹

When Graves promoted the scientific measurement and testing, and control of the field as new core methods in forestry, he always contrasted "A New Era of Forestry" with that of Fernow

¹⁸ Henry S. Graves to Frederick Paul Keppel, 3/7/1937. School of Forestry & Environmental Studies. Records of the Dean, Henry S. Graves, 1900-1946. Ru 40, #1982-A-010, Box #11. Folder #157 Yale University, Sterling Memorial Library.; Memo *Tropical Forestry*, 1911 and undated memo, *Tropical Forestry*. (Probably around 1910), H. N. *Report on Tropical Forestry Work*, 12/17/1917. School of Forestry & Environmental Studies. Records of the Dean, Henry S. Graves, 1900-1946. Ru 40, #1982-A-010, Box #15. Folder#214; *An Outline of the Work in Tropical Forestry From September 1916 to January 1920*. School of Forestry & Environmental Studies. Records of the Dean, Henry S. Graves, 1900-1946. Ru 40, #1982-A-010, Box #15. Folder #216.

¹⁹ Henry S. Graves, *Some Reflections Regarding the Profession of Forestry*. Sent to the Idaho Forester 12/20/1928. Henry Solon Graves Papers, MS 249, Box#14. Folder #175.

and Pinchot.²⁰ Without no doubt Graves and his colleagues succeeded in establishing a more scientific forester that held the engineer at arm's length. However, in so doing they did away with the social responsibility embedded in the Forest-Engineer.

²⁰ Henry S. Graves, *State of Research in Forestry*. Article for National Research Council, 1921. Henry Solon Graves Papers, MS 249, Box#14. Folder #175.