Essays of a Peripheral Mind

A Chronic Lack of Focus

By K. M. Havstad

On 5 May 1906, George R. Lawrence pioneered a new application of aerial photography. He used a camera suspended from an aerial kite floating 2,000 feet above San Francisco to capture an image of that city in ruins 17 days after the historic 18 April earthquake and subsequent city-wide fires (Photo 1). Though aerial photography from tethered and hot-air balloons, kites, and dirigibles had been used infrequently in Europe during the late 19th century, George Lawrence's 1906 image might be the first known record of aerial photography for landscape and disaster assessment. Even today, this pioneering aerial perspective conveys a powerful, focused image of the devastation triggered by this earthquake.

On 13 January 2010, the New York Times website provided satellite-based images and aerial photographs of the horrors of the devastation of Port-au-Prince, Haiti, as a result of the earthquake of the previous day (Photo 2). In many ways, the New York Times images were disturbingly similar to those of San Francisco provided by George Lawrence nearly 104 years earlier. The extent and physical impacts of the destruction following these two events were horribly evident, and the obvious human tolls were conveyed starkly. The 2010 images, though, contained and linked to layers of information that far exceeded the solitary image produced by George Lawrence. In one web-based interactive format, one could move a cursor over a photograph and view a comparison of images taken before and after the earthquake. The development of these remote imagery technologies over the past 100 years has been crucial to our increased capacities to respond to natural disasters such as the Haiti earthquake. These technological developments had their roots in early 20th-century warfare and agriculture.

In 1909 Wilbur Wright used a camera aboard his biplane in a demonstration flight near Rome to capture the first airplane-based photographs (see Grover Heiman's 1972 book, *Aerial Photography*, Macmillan Publishers, for an early history of aerial mapping). A few years later, the British Royal Flying Corps took a series of overlapping photographs from a dirigible, and the keystone technique for using overlapping aerial photographs for photo interpretation was developed. World War I provided the impetus for combining these two technologies of aerial photography and interpretation when there were numerous instances of aerial photography, providing military forces with strategic advantages. By the end of WWI, defense programs in many developed countries had nearly universally understood the military advantages of aerial photography–based reconnaissance. For example, the US Air Service, with thousands of aircraft by the early 1920s and thousands more on order for delivery, included an aerial photographic research and development program in order to aggressively advance a suite of technologies associated with aerial photography and photographic interpretations.

Photo 1. San Francisco in ruins, May 5, 1906. George R. Lawrence photograph; Library of Congress photograph archives # LC-DIG-ppmsca-07824 (digital file from original photograph).

Photo 2. Aerial photograph of an area within Port-au-Prince, Haiti, provided by the American Red Cross and published in the New York Times on 13 January 2010, one day after a 7.1 earthquake devastated regions of Haiti.

Peace-time applications advanced in the 1930s, in part in response to President Roosevelt's New Deal programs in the United States. One solution to the dismal economic plight of American farmers during the Great Depression for both raising farm income and stabilizing commodity prices was to reduce commodity supplies. New Deal programs were implemented with farmer incentives for voluntary acreage planting reductions of certain commodities. To be effective, programs of this nature required nearly national-scale surveillance and verification methods. The newly formed Agricultural Adjustment Administration employed aerial photography techniques to provide the needed large-scale verifications (see M. Monnomier's 2002 article in *Photogrammetric Engineering and Remote Sensing* 68:1257–1261, for an account of this early history). In a few short years, aerial photography provided the verifications required by these crop reduction programs. By 1938 published reports on photo interpretation methodologies provided needed technical guidance and assessment to further advance this technology. By 1947, a majority of the United States had been aerially photographed, and the quality of this early and subsequent imagery has been valued in 21st century analyses (see Photo 3 for an example of this utility).

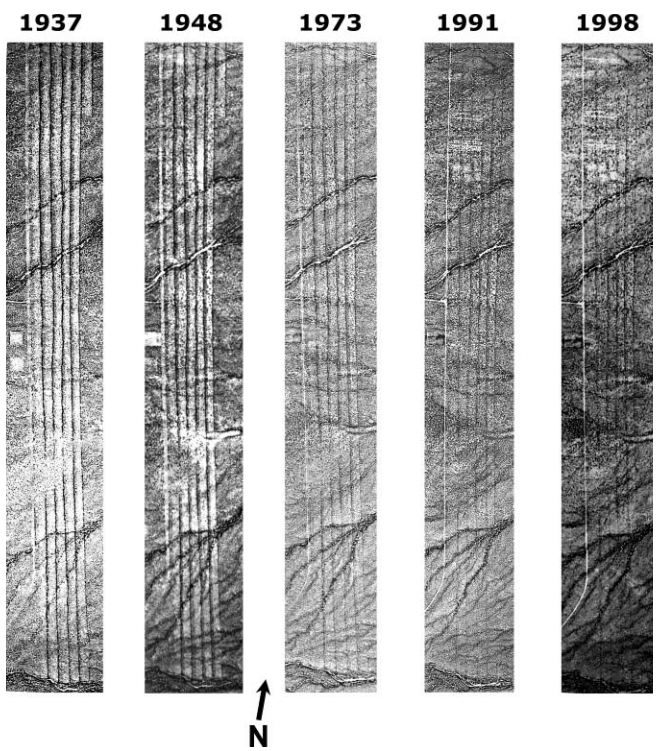

Photo 3. Temporal sequence over a 61-year period of alternating grubbed (shrubs physically removed at the ground surface level) and ungrubbed strips in a predominantly degraded creosote bush area in southern New Mexico where original grubbing was performed in 1936. Aerial photos were taken from flights in 1937, 1948, 1973, 1991, and 1998. (From Rango et al. 2003. The utility of historical aerial photographs for detecting and judging the effectiveness of rangeland remediation treatments. *Environmental Practice* 5:107–118.)

It is significant to note that the post-WWI Air Service fledgling aerial photography program in 1920 was headed by the 29-year-old George W. Goddard. It took the pioneering efforts of Goddard and his colleagues over the next six decades to produce critical technologies for defense and space exploration from this coordinated, national-level program. Notable among these achievements were the technologies that led to detection of missiles capable of carrying nuclear warheads on ships bound for Cuba in 1962 and the capture of images of Mars relayed by the Viking space craft in the late 1970s and early 1980s. Without their pioneering efforts, especially during times when resources and budgets were severely limited for this program, we would not have had the advances and subsequent essential benefits of those advances.

Today, aerial photographic interpretation is a ubiquitous element of many natural resource research and management programs. Although it is not a descriptive metric, it is indicative of the broad set of activities in this field; during the decade of 2000–2009 there were over 450 journal articles specifically on photo interpretation techniques with application, in varying degrees, to natural resource management. Yet, these activities are characteristic of an eclectic effort with little organization or national vision, much like the broader field of natural resource science and management. We have an impressive array of activities in the science and management of our natural resources, but little overall focus. For example, we have not yet developed any coherent structure in which to house and use gathered information that we have collected over decades, including (but certainly not limited to) aerial photographs, which should scientifically guide and evaluate our management activities. We have employed our modern technologies to provide acute disaster assessments, as well as civilian program assessments such as how many acres may be in a program. We have limited capacities to judge the ecological effectiveness of our management programs. However, we are now in a position to apply recent technological advancements in soil surveys, landscape ecology, and data storage, management, and analyses, to more fully apply these technologies to management of our natural resources. Yet, we lack a collective vision of how to develop and use these technologies for management. Only one aspect of this void is that we have tens of millions of photographic images of the bulk of our natural resource management activities in the United States since WWII that are being used intermittently. We have yet to collectively pioneer a focused use of any of these resources and technologies. In fact, it is nearly impossible to access and use information, such as these photographs, in any comprehensive, transparent, logical, or meaningful fashion in support of management of our nation's natural resources.

We will continue to collect a variety of data in different manners, and store it, in different places, and for different reasons. We will continue to be able to use these technologies and data to focus on acute events, such as disaster assessments. However, these data are doomed to a fate of irrelevance, if not simply nonuse, for our chronic management needs. It is not that technologies will solve our problems, but a collective focused vision that employs technologies to create a framework for evidence-based land management is desperately needed. Without this focus we will be increasingly unresponsive to management demands, especially as we face growing fiscal austerity. It is possible that an existing federal program such as the US Department of Agriculture's Conservation Effects Assessment Project could be that vision, but visionaries are needed to provide that focus. It also is possible that the Bureau of Land Management's new efforts in regional and landscape level geospatial assessment could be the unifying vision, but that will require selection of contractors who understand that this is not about verification, surveillance, detection, or assessment of acute events. They will have to understand that this is about how you create a framework to use evidence, not conjecture or hearsay, as a basis for resource management, to tap the evidence that we have collected for decades, to structure a basis for new evidence, to involve scientists and managers in its interpretations, and to place that evidence within a transparent, accessible, ecologically-based framework. This will require commitment to a pioneering effort based on using that evidence.

The slogan George R. Lawrence used for his company over 100 years ago was "The Hitherto Impossible in Photography is our Specialty." We need to focus and commit to a similar slogan that substitutes "rangeland management" for the word "photography."

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