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Frame DS1050-1006DF129: March 20, 1969

One hundred miles above the earth in the vacuum of space, a top-secret US spy satellite, launched two days earlier from California and traveling 17,000 miles per hour in a circumpolar orbit with two 1,000-mm cameras arranged in a stereo-panoramic array, snapped the image in Figure 1. This single frame, shot on March 20, 1969, represents the pinnacle of American photographic and space technology in the 1960s. The US top-secret CORONA program produced thousands of film-based images such as this one in the 1960s before satellites in the 1970s with multispectral scanners delivered digital scans and made the technology obsolete. The CORONA images, now accessible to the public via the National Archives and the US Geological Survey (USGS), present tremendous opportunities to support environmental history research. However, their visual complexity as space images presents technical and methodological challenges. Each image, including this one, is the artifact of a complex network of human organizations and new, often top-secret technologies including hundreds of satellites, a global network of ground-based tracking stations, and reentry vehicles, captured in midair, that transported the exposed film back down to Earth.

The technical and methodological challenges involved in interpreting images such as DS1050-1006DF129 stem from essentially two visual problems, one residing in the photo and the other in the eye of the viewer. With a resolution of approximately six feet on the ground and an areal coverage of about a thousand square miles, the images contain an overwhelming amount of information. They were unparalleled in

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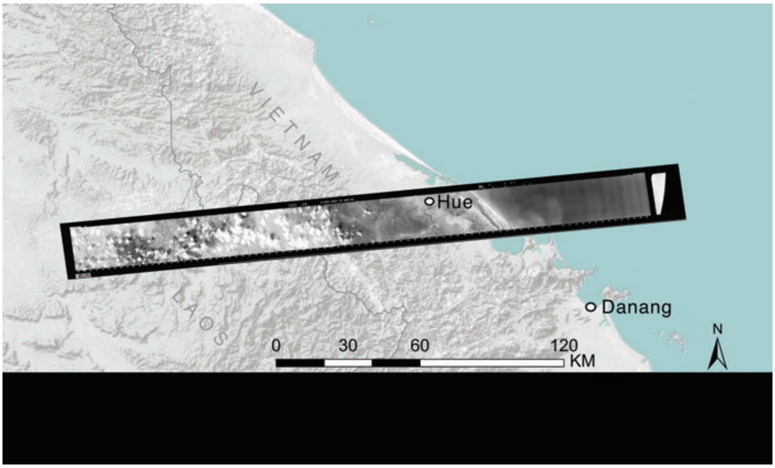

Figure 1: Frame DS1050-1006DF129 overlaying terrain map. Source: Author.

commercial (nonclassified) satellite imagery until the 1990s, and only in the past ten years has such imagery been available to scholars at little to no cost. In digital terms, the resolution of DS1050-1006DF129 is approximately 1.5 meters per pixel, and the entire eight-bit image file is almost a gigabyte in size.

While the complexity of each photo and its myriad details present technical difficulties, the general absence of any figurative, textual, or cartographic guides presents the primary methodological challenge for viewers. Reading an image such as DS1050-1006DF129 requires the viewer to know this landscape through archival research, site visits, and the study of maps or other photos. Without interpretive cues (such as the underlying reference map and labels in Figure 1), the raw image presents a detailed, yet anonymous, black-and-white view of Earth. Seeing just the image without any other interpretive information, one might experience the patterns of clouds, mountains, and ocean ripples as some form of abstract sublime. For instance, while many works of aerial and space photography, such as Yann Arthus-Bertrand's *Earth from Space* (Abrams, 2013), explore this abstraction, photographer Edward Burtinsky approaches this *disembodying tendency* in air photos (see accompanying Field Notes Essay) more critically. Many of Burtinsky's images juxtapose aesthetically beautiful shots of landscapes with obviously problematic features from burning oil platforms to the signs that toxic runoff is the source of the beautiful colors.[1]

How can researchers and others derive meaning from images such as DS1050-1006DF129 without ignoring troubled natures contained within? The answer, I think, lies in a more reflective and critical interpretive practice. For example, one could trace a decade-long visual survey of the Cold War by exploring the evolving sequence of the thousands of

CORONA photographic subjects chosen by the US intelligence community. By reading against the grain, in a sense, one could draw inferences about changing American strategic interests at home and around the world. Mission 1050-1, for example, captured several dozen shots over Vietnam, Laos, and Cambodia including DS1050-1006DF129. A quick survey of other sites pictured on the same day, March 20, 1969, include images of Vladivostok, Siberia, West Africa, and Cuba.

To interpret features *within* a single frame, one has to draw on other sources of environmental and historical information—texts, maps, other air photos, and site visits. Just one image, once interpreted, can present many new insights. My fascination with this image comes from what it tells us about environmental and historical dimensions of the Vietnam War. For all the books, films, and photographs describing this war, we know relatively little about it in ecological or spatial terms. My process of gathering knowledge from sources other than this photo has involved extensive travel to the area, research involving records from local village and state archives, collecting scans of maps and other air photos, and the study of American and French military records.

The reading of DS1050-1006DF129 that follows is organized into two parts, the first an interpretive reading of elements in the photograph followed by an extended reading that compares elements in the photograph with elements at the same location in a near-present satellite image. This second, a comparative interpretation of DS1050-1006DF129, considers it within a historical geographic information system (hGIS). Such systems, which are typically used to manage geographically and historically referenced information, exist in digital form on a software platform featuring a geo-database. A growing cohort of geographers and historians has successfully used hGIS to support such research.[2] This increasingly easy-to-use technology has led many historians, along with geographers and others, to consider a spatial turn in their analyses. Examined in such an hGIS space, DS1050-1006DF129 contributes to an extended, more dynamic study of a changing landscape deeply altered by war. The hGIS I have constructed for this essay runs on a free public and web-based platform from Harvard called WorldMap and is available at http://worldmap.harvard.edu/maps/DS1050-1006DF129.

READING DS1050-1006DF129

A zoomed-in detail from the eastern half of DS1050-1006DF129 shows some general geographic facts of the Vietnam War. The approximately east-west orientation of the image captures one of the essential spatial features of the conflict—its east-west and lowland-highland orientation. American and allied South Vietnamese forces occupied lowland coastal areas and cities such as Huế, a former imperial capital on the Perfume River whose city walls and moat appear in this image as a square in the upper-right corner. The hilly areas depicted in the middle of Figure 2 and further west were the main strongholds of the National Liberation Front and the North Vietnamese People's Army. Further west into Laos were the major footpaths and trails used by North Vietnamese soldiers carrying supplies into the south. This east-west and lowlands-highlands orientation was not only important to the Vietnam War but also to most wars in Vietnam's history. Intervening hills dividing upland and lowland functioned as a border zone or, in war, a no-man's land dividing groups during many conflicts. James Scott's *The Art of Not Being Governed: An Anarchist History of Upland Southeast Asia* (Yale University Press, 2009) explores this pre-1940 tension between lowlanders and highlanders in the region, arguing that upland areas served as a refuge for those fleeing lowland state control. However, the hills also served as a refuge for lowlanders like the ethnic Việts fleeing from seaborne invasions.

Using the hilly area as a center of focus, the evidence of dense lines of bomb craters and lighter gray defoliated areas suggests that the worst ecological destruction of the war was centered here. Whitish areas along the eastern edge of the hills on the right side of this image show the outlines of one large US army base, Camp Eagle. A white line snaking westward from Camp Eagle across the Perfume River along the photograph's bottom indicates the reach of American trucks from the base to smaller fire support bases and staging grounds in the hills. Fire support bases provided artillery support or regroupment areas for forward offensives into the mountains. To the west of the hills, patterns of bomb craters and defoliation intensified closer to the Lao border.

Zooming in closer to the hill region of the image, one derives a clearer sense of the scale of bombing in these areas (Figure 3). Each of the whitish dots in these rows represents a single bomb crater with an approximate diameter of 20 to 40 meters. The tight linear nature of the craters suggests that these bombs were dropped in aerial runs by

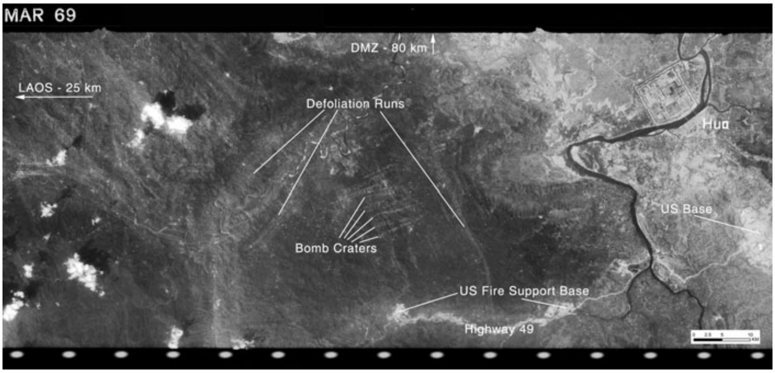

Figure 2: Midsection of DS1050-1006DF129 showing Huế and hills to the west. Source: Author.

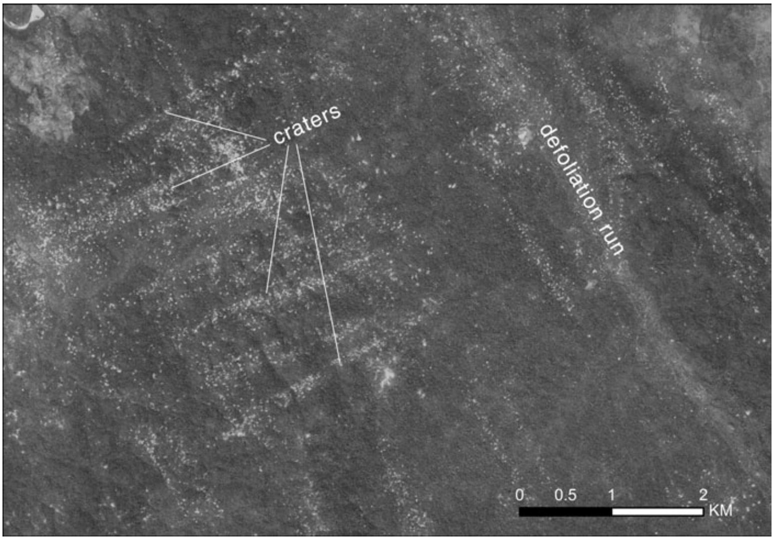

Figure 3: Section of DS1050-1006DF129 showing craters and defoliation. Source: Author.

large aircraft such as the B52. Similar patterns of craters can be found far west of the Vietnam border, suggesting that the intensity of American bombing spread not only in Vietnam but also to neighboring Laos and Cambodia.

A closer view of the lowland areas at the bottom of the photograph in Figure 4 reveals the stark juxtaposition of American bases housing approximately ten thousand US troops each and historic Vietnamese villages. The white areas in the image detail sandy soils and bare earth stripped clear of vegetation by machines or herbicides. Looking carefully within the whitish areas, one can just make out the faint gray rectangles and lines of many hundreds of buildings covering two major American bases, Camp Eagle and Phu Bai Air Combat Base. These base cities were sandwiched among densely populated long-established villages. In this image, the vermiculated pattern of white-and-black squares next to the bases shows the outlines of hedgerows, mostly bamboo, surrounding individual homes and yards within these villages. This interface of base and village highlights one important geographic facet of the war: American bases were situated in between or even on top of Vietnamese villages and towns. In interviews with villagers in Giạ Lê Village, several who lived there during the war describe episodes of bulldozing, aerial spraying of defoliants in 1968–69, and frequent use of guns and artillery to guard the newly mined base perimeter.

Besides war-related damage, DS1050-1006DF129 also shows important dimensions of village life in central Vietnam. Villages such as Giạ Lê and Phú Bài stretched across a declining cross section of hills in the west to homes on the plain and finally rice paddies in reclaimed tidal

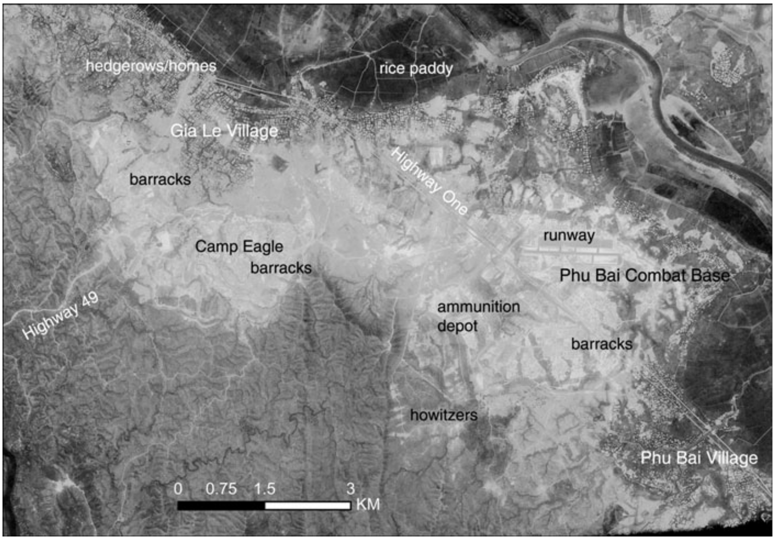

Figure 4: Detail of base areas in DS1050-1006DF129. Source: Author.

flats—here shown as dark gray. Each village was divided into an upper (Thượng) and lower (Hạ) domain. In village life, families routinely moved up to the hills to gather wood or grow dry upland crops. They maintained ancestral tombs here as well because land in the village and near the paddy was too precious. The highway, pictured as a diagonal white line, served as the primary conduit for trade and travel beyond the village. Homes thus occupied an important social and ecological nexus between hills and estuary and along the road.

Military base construction in the 1960s radically transformed village life by preventing access to the uplands and by bulldozing or defoliating the upland fields. Thus hundreds of circular-shaped tombs, woods, and former vegetable fields were absorbed within the militarized perimeter of these American camps. US Marines, using Giạ Lê as a landing area before the army, called it Landing Zone Tombstone for the eerie graves made all the more stark by defoliation. As the army base expanded here after the Tet Offensive in 1968, it took over more of the village, absorbing more tombs and fields within perimeters of razor wire, watchtowers, minefields, and exploding *fougasse* canisters.

EXTENDED READINGS

Over the last decade, improvements in geographic information system software and the increased availability of web-based instant satellite imagery through services such as Google Earth present researchers with new possibilities for comparing historic maps or air photos with contemporary imagery and other historic data. By juxtaposing a historic map or photograph over contemporary imagery, one can at the very least observe basic changes in land use as well as evidence for the persistence of older features from past eras. Figure 5 shows a screenshot of DS1050-1006DF129 displayed in WorldMap over base imagery layer supplied by Google Terrain. Contemporary satellite images, like historic ones, require the viewer to rely on other knowledge to interpret them; however, the availability of various "hybrid" sources of imagery such as this make the task much easier.

Returning again to the cutaway of bomb craters discussed earlier, reading it in an historical GIS permits the viewer to analyze the image against other sources of geographic data. In Figure 6, derived from the WorldMap GIS, I have displayed the same zoomed-in portion of DS1050-1006DF129 depicting bomb craters with an additional overlying data source: a map of bombing points (here colored green). The bombing points map is derived from a different public map source, namely the US Department of Defense's data of aerial bombing sorties from 1965 to 1975 in Vietnam, Laos, and Cambodia. Comparing these two historical sources, one a georeferenced space image and the other a geo-database showing points linked to detailed information (data, bomb type, pounds, aircraft, etc.), one can perform a more sophisticated reading of DS1050-1006DF129.

One can readily observe, for instance, that there are many more bomb craters in the image than the points displayed in green from the bombing database. This extended reading of DS1050-1006DF129 raises important questions, especially about the completeness of the bombing data. For example, the individual green points of bomb drops only describe initial drop coordinates for a planeload of bombs.

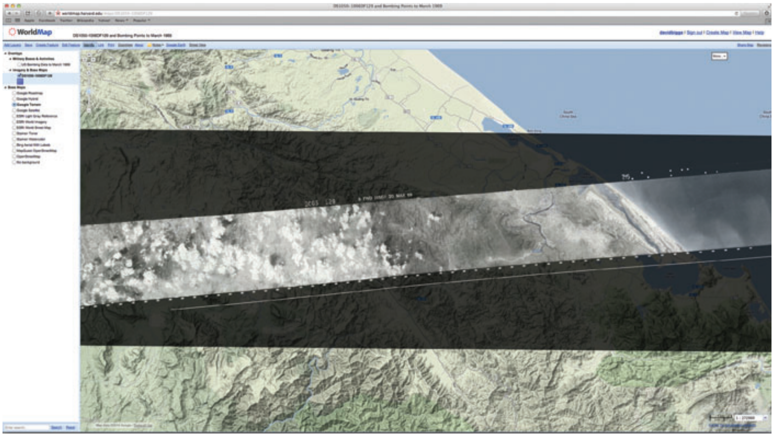

Figure 5: Screenshot of DS1050-1006DF129 in WorldMap. Source: Author.

Figure 6: Zoomed-in section of DS1050-1006DF129 showing bomb craters with overlaying layer of US bombing coordinate data. Source: Author.

The visual bomb crater information in the image, however, shows what might be the dispersed patterns of bomb sorties after impact. Additionally, the density of bomb craters apparent in DS1050-1006DF129 suggests other possibilities: perhaps many aerial bombing raids went unrecorded or the craters shown were not the result of aerial bombing but perhaps ground-based artillery. Since the bombing data was developed by the US Department of Defense to aid in demining and cleanup of unexploded ordnance, problems of incompleteness are highly important here. Historical space photographs such as DS1050-1006DF129 could serve as guides for more complete cleanups of unexploded ordnance.

Finally, comparing a historical image such as DS1050-1006DF129 (left) with a contemporary image such as this satellite image from Google Maps (right) (Figure 7) suggests other questions regarding the nature and causes of land use change after the Vietnam War. Transitions noted in the two photos show postwar uses of the war-torn landscape. The proliferation of ponds in this area, for instance, suggests the persistence of some larger bomb craters; as rainwater pooled in these craters, people who resettled in these areas often used them for aquaculture. The whitish line running diagonally through the new image suggests

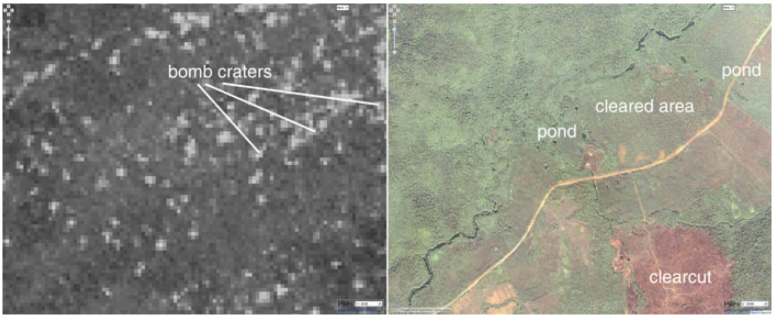

Figure 7: Comparison of cratered area in 1969 and 2013. Images courtesy of WorldMap, Google Map, and GeoEye. Source: Author.

a newly constructed dirt road running alongside a creek. Grid-like lines fanning out on either side of the road suggest planted crops such as coffee; however, they also suggest neat lines of earth that have been upturned following an ordnance clearance operation. Finally, the area noted as clearcut should be especially familiar to people from the Pacific Northwest. Since the late 1990s, the government of Vietnam has decentralized its control over forests, selling parcels typically planted in fast-growing trees such as acacia.

CONCLUSION

Reading images such as DS1050-1006DF129 is not easy. However, barriers to accessing them and interpreting them have significantly diminished in the past decade. The entire collection of CORONA images is available for download or order courtesy of USGS's interactive website Earth Explorer.[3] Professional GIS software such as ESRI's ArcGIS is expensive, but academic discounts are available, and there is a growing open-source GIS initiative to develop free tools for manipulating geographic information.[4] For displaying and sharing maps and geographic information, Harvard's WorldMap offers a free open-source solution; Google Earth Pro provides a more robust commercial platform.[5]

While it is becoming increasingly possible for many tech-savvy historians to access historical imagery such as DS1050-1006DF129 and develop hGIS projects, the interpretive challenges have yet to be extensively addressed in published literature. We must still grapple critically with historical maps and images in some of the same ways we approach other sources. What do they show and what do they hide? How might reliance on this type of source support certain kinds of bias or silences? As with any other historical source, critique and interpretation depends on a variety of sources. Nevertheless, the use of aerial photography and space imagery such as DS1050-1006DF129 opens up possibilities for new kinds of stories, perhaps even new spaces.

Notes

1. See Edward Burtinsky's "Water" series at http://www.edwardburtynsky.com/site_contents/Photographs/Water.html.
2. Anne Kelly Knowles, ed., " Historical GIS: The Spatial Turn in Social Science History," special issue, *Social Science History* 24, no. 3 (Fall 2000).
3. See Earth Explorer at http://earthexplorer.usgs.gov. USGS's summary of the CORONA images can be found at https://lta.cr.usgs.gov/declass_1.
4. For ESRI's information on academic licenses, see http://www.esri.com/industries/university/academic_programs/sitelic. Quantum GIS is an example of an open-source free GIS platform. See http://www.qgis.org/en/site/.
5. For WorldMap, see http://worldmap.harvard.edu; for Google Earth Pro, see http://www.google.com/enterprise/mapsearth/products/earthpro.html.