High-Resolution Satellite Imagery
and the Conflict in Eastern Burma

Summary Report

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promotes the human right to benefit from scientific progress (Article 15, ICESCR), and brings
human rights norms to the conduct of science.

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Executive Summary
In collaboration with several Burmese human rights groups, the AAAS Science and Human Rights Program conducted analyses of satellite imagery in 2007 and 2009 to corroborate reports of attacks on villages in Karen State, Shan State, and Thailand that were carried out by the ruling military junta. Within the areas of imagery analyzed in the 2007 analysis, the bulk of the sites (18) were removed villages or villages with removed structures, with other sites including military camps (4), possible forcibly relocated villages (2), and one refugee camp on the Thai border. A follow-up analysis conducted in 2009 found further evidence of destruction at 25 of the 49 locations examined.
I. Introduction

Since 2006, the AAAS Science and Human Rights Program (SHR), through its Geospatial Technologies and Human Rights project, has been compiling high-resolution satellite images to verify and corroborate reports of human rights violations against the civilian population in Karen State and other regions of Burma. AAAS SHR is working with the US Campaign for Burma, Amnesty International, Human Rights Education Institute of Burma, the Free Burma Rangers, the Karen Human Rights Group, and the Thailand Burma Border Consortium on this initiative. Primary funding comes from the Open Society Institute, with significant resources provided by the MacArthur Foundation as well.

In Burma, also known as Myanmar, the ruling military government, the State Peace and Development Council (SPDC), has waged a particularly active campaign of oppression against Karen State, located in the eastern part of Burma along the border with Thailand. In recent years, the SPDC has stepped up attacks by reportedly burning villages, raiding them for food, and burning agricultural fields during the dry season harvest. Thousands of Karen people have escaped as refugees over the Thai border, but tens of thousands more remain internally displaced in Burma, many often conscripted into forced labor acting as porters or human landmine detectors. The conflict is largely unreported in the general media and of low priority in most diplomatic circles. According to human rights organizations familiar with the conflict, this lack of international attention has allowed the ruling military government to carry out an unrestricted ethnic cleansing campaign.

II. Methods and Technologies

The U.S. Campaign for Burma assisted AAAS SHR in reaching out to organizations, such as the Free Burma Rangers, the Karen Human Rights Group, and the Thailand Burma Border Consortium, based in the region. These groups provided AAAS SHR with information concerning attacks on civilians in Karen State occurring from 2005 through the present, via email and through carefully documented publications accessible from their websites. Project staff reviewed these reports and compared them with a set of geospatial data and maps to identify specific villages and areas (Figure One). The attack locations were then compared with pre-existing high-resolution satellite imagery. Visual inspection of the imagery is the primary methodology in use, although more sophisticated methods are employed when necessary.
AAAS SHR has obtained and analyzed high-resolution commercial satellite imagery covering an area of 2,956 square kilometers, mostly of Karen State, with small areas of Shan State and Thailand also included. This imagery covers 1,931 square kilometers on the ground, and 2,085 square kilometers were purchased from the archives, while 871 square kilometers were new collections ordered by AAAS SHR over the last year. By obtaining before-and-after image sets, AAAS SHR visually documented sites where human rights violations involving housing and infrastructure destruction have taken place. By comparing the newer imagery with images collected several years ago, features such as villages and structures that have been removed in the intervening years are relatively easy to identify. Likewise, new construction such as military camps, are also relatively easy to identify. According to reporting, military camps have proliferated in the northern Karen State in recent years. These are relatively easily identified in images as many of the camps exhibit layers of fencing around them.

AAAS SHR used several types of imagery in this analysis, each with one meter or better spatial resolution. Most of the 'before' and 'after' images were obtained from the two major commercial satellite operators, GeoEye and DigitalGlobe. The 2007 analysis relied heavily on the OrbView-3 satellite from GeoEye, which has now been replaced by higher-resolution sensors. Another of GeoEye's satellites, Ikonos, is a multispectral (color) satellite with one meter panchromatic resolution. The QuickBird and WorldView satellites, both operated by DigitalGlobe, collect imagery with 60 centimeter and 50 centimeter spatial resolution, respectively. While QuickBird provides color imagery and is thus preferred for new image acquisitions, the black and white
imagery of WorldView provides slightly sharper resolution, and was relied upon heavily for post-attack data. Due to its lengthy time in orbit, Ikonos has collected the bulk of archival imagery for Burma, and for this reason, most ‘before’ imagery was produced by this spacecraft. The final imager used in this study, KOMPSAT-2, is a recently-launched South Korean satellite, whose imagery is resold through the SPOT Image (http://www.spot.com). KOMPSAT-2 provides one meter multispectral imagery. All the satellite imagery used by AAAS SHR to analyze Burma is available online using Google Earth. Project staff produced these visualization layers using the regionator code made available through Google. Staff used ERDAS Imagine, ENVI, and Global Mapper software to process images and GIS software ArcView throughout the process.

III. Results

A. 2007 Analysis

Reporting from the field provided specific locations and dates of more than 70 attacks in Karen State and surrounding areas in mid-to-late 2006 and early 2007. Of these, AAAS SHR positively located 31 of the reported attack sites. A set of information on many attack locations without specific dates over the last several years was also obtained, and used to corroborate other reporting and delineate likely conflict areas and time periods. Within the areas of imagery analyzed, 25 sites of interest are presented in this report. The bulk of these sites (18) are removed villages or villages with removed structures, with other sites including military camps (4), possible forcibly relocated villages (2), and one refugee camp on the Thai border. In addition, the possible forcibly relocated villages are only a small sample. When areas proximate to an identified military camp in Papun District were reviewed to corroborate reports of forced relocation, 31 new villages were located that appeared between the image acquisitions of 2000/2001 and late 2006.

Specifically, in Papun District reports indicated that 33 military camps were built in the area in 2006 and existing camps were enlarged and used as bases for military operations and internment camps for forced labor. AAAS SHR image analysis located nine settlement areas that had been visibly disturbed, abandoned, or destroyed. In addition, a military camp and an auxiliary military camp were also identified in that district. Reports on Toungoo District indicate increased military activity in 2006 and 2007, including military camp development, and dam and road construction. Three settlement areas that had been visibly disturbed, abandoned, or destroyed were identified, as well as two military camps. Signs of settlement destruction and abandoned agriculture sites were identified in the Dooplaya District. In Shan State, where relocation sites are reported, three areas where settlements or structures had been destroyed or damaged were identified. Since 1996, nine refugee camps have been established along the border of Thailand. AAAS SHR analysis of one of these camps, Mae La Oon, shows dramatic build-up of the camp between 2002 and 2005.

Imagery from the 2007 analysis can be viewed in Google Earth via this link: http://www.aaas.org/international/geotech/ge/burma/burma_results.kml
B. 2009 Analysis

The locations of reported attacks were compared with existing archives of commercial high-resolution satellite imagery, the extent of which has substantially increased since AAAS SHR’s 2007 analysis. In total, ninety-one attack locations were provided; eighty-five by the Thailand-Burma Border Consortium and six from the Free Burma Rangers. After a thorough review of the available satellite imagery, a total of twenty scenes were ordered, which permitted the examination of forty-nine of these sites both before and after the alleged violence. Of the forty-nine locations examined, twenty-five contained recognizable evidence of destruction within two kilometers of the provided coordinates. In the remainder, typically only jungle or undamaged structures were visible. While seemingly low, a success rate of fifty-one percent is in fact quite satisfactory, and it does not necessarily follow that the remaining reports were erroneous. In an area such as eastern Burma, vegetation canopy can easily render even a substantial settlement completely invisible from above, and the continued violence in the region may create a strong incentive for some residents to ensure that their homes remain undetectable. Reconstruction of similar-type structures in the same location also has the potential to confuse the efforts of space-based damage assessments, as the resolution afforded by the current generation of commercial imaging satellites is often insufficient to distinguish the structural differences that exist between individual dwellings.

Imagery from the 2009 analysis can be viewed in Google Earth via this link: http://shr.aaas.org/geotech/burma/GE/2009_Burma_Analysis.kmz

IV. Challenges

The process of precisely locating attacks based on reporting from human rights groups in the region is relatively laborious and difficult given the necessary translations and transliterations between local languages into the Latin (English) alphabet, as well as the general paucity of highly detailed maps and geospatial data for the region. In some cases, coordinate information was communicated directly by the sources in the region, greatly easing the process.

Using commercial imagery for conflict assessment in Burma faces numerous challenges. Burma is a mountainous, heavily vegetated region with frequent cloud cover. Such physiographic and climate characteristics, exacerbated further during monsoon season from mid-June to September, can combine to simply block observation satellites. The small feature size of the objects in question in Karen State, specifically homes and small farms often built along treelines or beneath canopy, can sometimes be a challenge to identify. Few archived high-resolution images of Karen State are available, making before and after comparisons more difficult.

The military tactics in use likewise hinder detection of their effects via commercial satellite imagery. Reports from Karen State indicate that villages are most often abandoned, not destroyed, with residents driven out. Identifying an abandoned village can be more difficult than identifying a razed village. Similarly, other reporting indicates mortar fire is common in the area. Scattered mortar fire, however, will have relatively small impact areas that may not be visible for
long in the very dynamic ecology of the region. Lastly, much reporting indicates that the majority of attacks in Karen State are interpersonal in nature, often the killing of one or a few people, or rape and/or assault on a similar scale. Satellite imagery is not appropriate for analyzing such attacks.

V. Conclusion

Based on reports from human rights groups, AAAS SHR surveyed satellite imagery of Karen State, Shan State and Thailand to assess damage to communities affected by the Burmese government's military campaign. Removed structures were apparent in 18 of the sites, while military camps and a refugee camp were also found. A second analysis conducted in 2009 found evidence of destruction at 25 locations, which largely corroborates reports from the Thailand-Burma Border Consortium and the Free Burma Rangers.

VI. Further Resources

- Google Earth layers of the imagery used in this study can be found here:
  - 2007 Analysis
  - 2009 Analysis
- AAAS SHR partner organizations include:
  - US Campaign for Burma
  - Amnesty International
  - Human Rights Education Institute of Burma
  - Free Burma Rangers
  - Karen Human Rights Group
  - Thailand Burma Border Consortium
- For an extensive report and on-the-ground pictures from the attacks on the Karen people in Burma, see the Karen Human Rights Group and reports on BurmaNet News.
- For more on the forced labor and displacement of civilians, see the Human Rights Watch report, "They Came and Destroyed Our Village Again: The Plight of Internally Displaced Persons in Karen State" (June 2005).
Papun District Image Analysis

Overview

Papun District, like Thandaung District to its north, has been a perennial conflict zone for years. Due to its proximity to the Thai border, it is the source of many of the refugees who occupy camps in Thailand, upon whose testimony the Thailand Burma Border Consortium relies to reconstruct events within that country.

AAAS SHR surveyed areas in Papun District in 2007 and again in 2009. The first analysis relied upon coordinates received from the field identifying a specific set of villages burned on and around April 22, 2007. Reports indicated that 33 military camps were built in the area in 2006 and existing camps were enlarged and used as bases for military operations and internment. Attacks in this area are documented in Karen Human Rights Group reports as well as by the Free Burma Rangers, and supported by information from Thailand Burma Border Consortium.

Images from 2000, 2006, and 2007, covering a portion of Papun District, were compared with one another to derive results. Imagery analysis located nine settlement areas that had been visibly disturbed, burnt, or destroyed (see Images 1 - 4 and Images 7 - 11). A military camp and an auxiliary military camp were also identified in the study area (Images 5 and 6). Analysis of 93 sq. km. surrounding the military camps indicated 31 possible sites of forced relocation, indicated by the appearance of new villages and groups of structures between imagery collected in 2000-2001 and a new satellite image acquired in late 2006. Samples of these 31 sites are presented in Images 12 - 13. Figure Two summarizes these locations.

Images 1 - 4 and 10 - 11 correspond with the reported attacks around March through May of 2006, and the area believed to be the site of the village burnings in April 2007 is presented in Images 7 - 9. Of special interest, reporting concerning the April 2007 attacks identified a number of villages that had been burned by the military in the northern Papun District area. Given the report of burning, which produces recognizable scarring on the land surface, a new image of the areas was ordered, though no before imagery of some areas was available. Despite the fact that the monsoon clouds had moved in for the season, in mid-June the clouds cleared briefly one morning and an image was successfully collected for the area.
AAAS SHR revisited Papun in 2009 after reports that the district ranked second only to Thandaung District in intensity of conflict during 2007-2008. Imagery from 2006 and 2009 was analyzed by AAAS SHR and shown to largely corroborate these reports, revealing the destruction of entire villages, as well as isolated dwellings in the forest. In some cases, one settlement would appear to grow at the expense of others - a pattern that could be consistent with reports of forced relocation collected by humanitarian workers familiar with the situation on the ground. *Images 14 - 17* are from the 2009 analysis of Papun.
The top image depicts a settlement adjacent to rice paddies in 2000. The after image from December 2006 shows the same area of land with all structures removed. Note: a similarly sized settlement appeared 1 km north in the interim. This area was reported attacked in April 2006. (Lat: 18.41 N  Long: 97.26 E)
The top image shows a 6-structure settlement in 2000; all structures are removed from the 2006 image (bottom). This area was reported attacked in April 2006. (Lat: 18.42 N Long: 97.26 E)
The top image shows 5+ structures along a densely-wooded ridge in 2000. All structures are removed in the corresponding 2006 image. This area was reported attacked in April 2006. (Lat: 18.39 N  Long: 97.24 E)
The top image depicts a settlement of 6-10 structures in 2000. The majority of structures are removed in the 2006 image; significant forest growth is also seen. This area was reported attacked in April 2006. (Lat: 18.36 N Long: 97.24 E)
This particular camp was identified from a report disseminated by the Free Burma Rangers that reported a major expansion of the camp in 2006. Bamboo fencing was erected around the camp, visible in the after image above. (Lat: 18.42 N  Long: 97.23 E)
This image is of a suspected military camp developed between November 2000 and the date of this image, December 13, 2006. This is likely a satellite camp, lying about a kilometer from the larger military camp depicted in Image 5. (Lat: 18.42 N  Long: 97.23 E)
The settlement in the image pair above has experienced the removal of at least 3 structures. This corresponds with reported attacks in the area in April of 2007. (Lat: 18.56 N  Long: 97.06 E)
The settlement in the image pair above shows burn scars for about 12 – 14 structures. This corresponds with reported attacks in the area on April 22, 2007. (Lat: 18.54 N  Long: 97.05 E)
Two burn scars can be seen in the image ‘after’ above between two standing structures, corresponding with reported attacks in April 2007. This corresponds with reported attacks in the area on April 22, 2007. (Lat: 18.54 N  Long: 97.06 E)
The top image shows 2 - 5 small structures in November 2000, with those structures removed by the December, 2006 image. This location is 4.1 kilometers from the military camp shown in Image 5 (Lat: 18.43 N  Long: 97.25 E)
The top image shows a small cluster of huts and a path in 2000, with the after image showing those features removed by late 2006. This location is 2.5 kilometers from the military camp shown in Image 5 (Lat: 18.43 N  Long: 97.24 E).
The two villages indicated by the red arrows in this image appeared between February 2001 and the date of the above image acquisition, December 13, 2006. Reporting indicates numerous instances of forced relocations to this area, which lies 3.7 kilometers from the military camp shown in Image 5. In Papun District, analysis of 93 sq. km. surrounding the military camp indicated 31 possible sites of forced relocation, indicated by the appearance of new villages and groups of structures between imagery collected in 2000 - 2001 and a new satellite image acquired in late 2006. (Lat: 18.42 N  Long: 97.26 E)
The four areas of housing marked by the red arrows in this image appeared between November 2000 and the date of the image acquisition, December 13, 2006. Reporting indicates numerous instances of forced relocations to this area, which lies 5.6 kilometers from the military shown in Image 5. In Papun District, analysis of 93 sq. km. surrounding the military camp indicated 31 possible sites of forced relocation, indicated by the appearance of new villages and groups of structures between imagery collected in 2000 - 2001 and a new satellite image acquired in late 2006. (Lat: 18.41 N  Long: 97.29 E)
Papun District Sites: 2009 Analysis

Legend
- Destruction Observed
- Karen Districts

Thailand
A village of ten dwellings is present in this location at the end of 2006 (top). By 2009, all have been destroyed, with one new structure erected in the interim. Additionally, the small orchard located in the south of the earlier image has been abandoned. Image was obtained based on reporting by the TBBC. (Lat: 18.42, Lon: 97.13)
A village consisting of fourteen structures occupies this location in 2006 (top). By the beginning of 2009, all save one have been destroyed. As the remains of the razed dwellings are clearly visible, their destruction was likely recent. Image was obtained based on reporting by the TBBC. (Lat: 18.49, Lon: 97.14)
A village of twelve dwellings (top) is visible in 2006. All but two have been destroyed by early 2009. As in Image 15, the visible remains of the razed dwellings are evidence of the structures’ relatively recent destruction. Image was obtained based on reporting by the TBBC. (Lat: 18.45, Lon: 97.14)
At top, in 2006 a small village of nine structures is present. All have been removed by February of 2009, and the surrounding land has been clear-cut. Many new structures appeared in a village to the northwest during the same interval, a fact which could represent evidence of forced relocation. Image was obtained based on reporting by the TBBC. (Lat: 18.43, Lon: 97.19)
Toungoo District Image Analysis

Overview
AAAS SHR conducted two analyses of the Toungoo District based on reports of attacks on villages and forced displacement occurring between 2006 and 2009. The first analysis, conducted in 2007, concerned reports that southern Toungoo District had been the site of increased military activity in 2006 and continuing into 2007, including military camp development, and dam and road construction. Attacks corresponding with these developments were widely reported by the Karen Human Rights Group (KHRG) and corroborated by reporting from the Free Burma Rangers (FBR) and the Thailand Burma Border Consortium (TBBC).

A number of villages were reported as having been burned and bombarded with mortar fire. Other villages had simply been abandoned, likely due to military harassment. In particular, military activity was concentrated along the east-west road from the Pegu Division in the west to Karenni State in the east, running through the larger-sized settlement Bawgali Gyi, and the southeast running road from Bawgali Gyi to BuSahKee and Papun District. Several dam construction projects in the area also drove attacks as reported by FBR and KHRG.

Archival images from May and March 2004 were compared with a new collection from February 2006. Image analysis located three settlement areas that had been visibly disturbed, abandoned, or destroyed (Images 14 - 16) and also identified military camps (Images 17 - 19). These sites are summarized in the map to the right.

In 2008, the Free Burma Rangers and the Thailand Burma Border Consortium again identified Toungoo as a hotbed of attacks and forced displacement. This prompted AAAS SHR to conduct another survey of the district in 2009. Images from 2004, 2006, and 2009, each covering a portion of Toungoo district, were compared with one another to derive results. Analysis identified fourteen settlement areas that exhibited a sharp decrease in the number of structures visible in imagery taken after the reported attack. The fraction of structures destroyed exceeded half in nearly all cases, and in a substantial percentage of cases the settlement ceased to exist entirely. The destroyed villages in images one through five were all located within six kilometers of one-another. Those in images six through fourteen, while located twenty five kilometers from the first group, were similarly proximate. The nearly simultaneous disappearance of so many settlements over such a wide geographic region is suspicious, to say the least. In some cases, agricultural activity nearby these settlements shows signs of having been abandoned, a phenomenon that is also supported by field reports. Images 20 - 29 are taken from the 2009 analysis.
The before image depicts a small settlement with all structures removed from the area. The identified area corresponds with FBR reported December 2006 village attacks at and near the village of Kwey Kee (Lat: 18.79 N  Long: 96.76 E)
The top image shows 8-10 small structures in March 2004, with the after image showing those structures removed by late February, 2007. (Lat: 18.86 N  Long: 96.89 E)
The before image depicts a mid-size settlement of approx. 25 structures; in the 2007 image at least 3-5 of those structures are no longer present. (Lat: 18.82 N Long: 96.71 E)
The top image shows a military camp near a large settlement in 2005. Expanded layers of fencing should be noted in the 2007 image, along with the presence of small structures within the boundaries. These could be tents or military vehicles or both. (Lat: 18.86 N Long: 96.71 E)
In the 2007 image a possible military camp can be seen adjacent to the settlement; it was built up during the three-year gap between image acquisitions. A close-up of the camp is found in Image 19. (Lat: 18.95 N Long: 96.82 E)
This image from February, 2007 shows a close-up of the possible military camp, seen in Image 18. Layers of fencing can be seen in the upper-left corner.
The top image depicts a small settlement consisting of about ten structures in March of 2004. The bottom image shows the same location in early 2009. Nearly all structures in the original settlement have disappeared; only a single building - possibly damaged - remains. Image was obtained based on reporting by the TBBCC. (Lat: 19.11, Lon: 96.82)
Above, a small settlement consisting of about eleven structures is visible in March of 2004. Nothing remains by early 2009, and the clearing is beginning to be overgrown with vegetation. Image was obtained based on reporting by the TBBC. (Lat: 19.05, Lon: 96.83)
A village of about seventeen structures is present in March of 2004. Only three are visible in February 2009, and the agricultural field that was present appears to have been abandoned. Image was obtained based on reporting by the TBBC. (Lat: 19.11, Lon: 96.83)
Fourteen structures are visible in March of 2004 (above). Only three are present in February 2009. Image was obtained based on reporting by the TBBC. (Lat: 19.09, Lon: 96.84)
In March of 2004 (above), this village consists of fifteen buildings. Only one is present in February 2009. Image was obtained based on reporting by the TBBC. (Lat: 19.11, Lon: 96.85)
In October of 2006 (above), a village of substantial size is present at these coordinates. By early 2009, all but two structures have been destroyed. Image was obtained based on reporting by the FBR. (Lat: 19.04, Lon: 96.88)
In 2006, a small village is present in a clearing in the jungle. Three years later, nearly the entire community has been removed, with two structures left standing. Image obtained based on reporting by the FBR. (Lat: 19.03, Lon: 96.89)
In 2006, over a dozen buildings make up this village. By February of 2009, only four of the original structures remain, some of which may show signs of damage. (Lat: 19.03 Lon: 96.91)
Of the twenty five structures present in this village in the fall of 2006, only two remain by early 2009. (Lat: 19.01, Lon: 96.88)
In November of 2006, this village contains seven structures. Approximately two years later, the settlement has disappeared. Image was obtained based on reporting by the TBBC. (Lat: 18.78, Lon: 96.79)
**Dooplaya District Image Analysis**

**Overview**

Dooplaya District is in southern Karen State and has experienced conflict for many years, with the military government and its allies taking firm control of the region after a major offensive in 1997. Reporting from FBR and KHRG (see Table One) indicates that attacks continue to this day, corroborated by reporting from TBBC. Village attacks, forced displacement, destruction of agriculture, and forced labor have been the main tactics in use in the area.

Archival images from January, 2000 were compared with archival images from November, 2006. Much of the area analyzed was devoid of any large settlements visible in the though much agriculture was present throughout. The following image pairs present areas of possible settlement destruction, and associated agricultural abandonment.

While a variety of factors may account for removal of the structures and crops in the intervening time period, reporting does indicate both the destruction of villages and agricultural sites, and creation of new agricultural areas, with forced labor, as part of attacks across the region.
Image 20: Agriculture Abandonment and Structure Removal

Before Image: 22-Jan-2000

(© 2007 GeoEye)

After Image: 18-Nov-2006

(© 2007 GeoEye)

The before image above depicts a cluster of structures and a nearby possible palm oil plot that are not present in the after image. (Lat: 15.70 N Long: 98.35 E)
A cluster of approximately 4 structures in the before image are no longer present in the after image. This corresponds with attacks reported to have occurred in the area between mid-2005 and mid-2006.

(Lat: 15.73 N  Long: 98.32 E)
Image 22: Agricultural Abandonment and Structure Removal

Before Image: 22-Jan-2000

After Image: 18-Nov-2006

An additional site of possible structure removal and agricultural abandonment (Lat: 15.71N  Long: 98.32E)
**Shan State Image Analysis**

**Overview**
The ethnic conflicts that disrupt civilian life in Karen and Karenni States (also known as Kayah State) spill over into southern Shan State. The relations between the military government and their allies and resistance groups in the region is complex with the recent history marked by ceasefire agreements, the subsequent breakdown of the agreements, and intervening human rights abuses that occur. Village attacks and forced relocations have been a recurrent theme in 2005 and 2006 according to KHRG and FBR reporting. Specific locations of village attacks analyzed with satellite imagery were obtained from TBBC.

An archival image from January, 2000 was compared with newly collected image from February, 2007. Within the imagery that was purchased, three areas were identified where settlements or structures had been removed or apparently damaged.
The before image above depicts an approximate 24-structure settlement. The corresponding after image from 2007 shows all structures either completely destroyed or severely damaged. The damage corresponds with attacks in the area reported as having occurred between mid-2005 and mid-2006. (Lat: 19.94 N  Long: 97.51 E)
Image 24: Removed Structures

Before Image: 14-Jan-2000

After Image: 01-Feb-2007

Image pair above depicts approximately 17 structures that have been removed in the 2007 image, corresponding with reported attacks against villages in the area occurring sometime between mid-2005 and mid-2006. (Lat: 19.98 N Long: 97.52 E)
The 2000 image above depicts a settlement of approximately 43 structures. In the after image an estimated 23 structures are removed, destroyed, or damaged. (Lat: 19.95 N Long: 97.5 E)
**Shwegyin District Image Analysis**

**Overview**
In February of 2009, the Thailand Burma Border Consortium provided AAAS SHR with a shapefile containing the coordinates of nearly one hundred sites that its reporters believe may have been attacked between August of 2007 and July of 2008. While most of these reports concerned Karen state and other areas nearer to the border with Thailand, nearly a dozen also concerned Shwegyin district, located in southern Pegu state near the Karen border. These reports were lent further legitimacy by information furnished by the Free Burma Rangers, who had been operating on the ground in the area, and reported that the village of Kaw La Sein had been attacked on March 8, 2008.

AAAS SHR acquired contemporary as well as archival imagery of the areas reported by both groups, each of which revealed evidence that could corroborate their claims of attacks and displacement. The coordinates provided by the Free Burma Rangers were very accurate, and revealed the total destruction of what had once appeared to be a small fishing village. The TBBC coordinates were more ambiguous, however there was at least one instance where a settlement appeared to have been abandoned.
The top image depicts the village of Kaw La Sein at the end of 2003. The bottom image depicts the same location in February of 2009. The footpaths are the only sign that a settlement once existed; all structures in the original settlement have been removed. According to the Free Burma Rangers, this site was attacked on the eighth of March, 2008. (Lat: 17.82, Lon: 97.03)
Myawadi State Image Analysis

Overview

Myawadi district is located in southeastern Karen state, and according to reports by the FBR and TBBC, contains numerous areas that have been subjected to recent violence. Imagery obtained by AAAS SHR over this area dates from 2002, 2003, 2008, and 2009. Careful analysis of this imagery has resulted in the identification of thirty seven potential indicators of violent conflict, though in many cases they are more subtle in this region than elsewhere in Karen state. The most dramatic result was observed in a village of unknown name located approximately ten kilometers southwest of the Thai border. Although the settlement appeared superficially intact in post-attack imagery, none of the structures which were identified in earlier images appeared to have survived; all the structures were of recent construction. The removal of these earlier structures was difficult to discern without careful comparison of “before” and “after” imagery, due to the visual confusion introduced by the more recent buildings. It is possible that the structures present in the more recent images represent the reconstruction of the village following its destruction in an earlier incident.
At top, in late 2002 a village consisting of thirteen structures is present. Although a similar number of structures are present in contemporary imagery, none of the dwellings extant in 2002 (indicated by red dots) appear to have survived. This phenomenon may be evidence of reconstruction following an earlier attack. Image was obtained based on reporting by the TBBC. (Lat: 16.58, Lon: 98.45)
According to the Free Burma Rangers, in October of 2008 the town of Paw Bu Lah Hta was attacked by paramilitaries allied with the SPDC. Although the resolution of the available imagery renders a more detailed assessment of the damage difficult, it is nevertheless apparent that at least three structures (indicated by arrows) have disappeared from the town during a period which includes the alleged attack. Image was obtained based on reporting by FBR. (Lat: 16.58, Lon: 98.45)
Thailand Image Analysis

Overview
In addition to looking at areas in Burma that experienced human rights violations, AAAS SHR examined the expansion of refugee camps in Thailand near the Burmese border in 2006 and again in 2009. As of 2006, the Thailand Burma Border Consortium (TBBC) estimated that 154,000 refugees had crossed the border into Thailand. Nine camps had been established along the border extending from Karenni State in the north to Tenasserim Division in the South from 1996 to 2006. AAAS SHR obtained imagery of one particular camp - Mae La Oon, adjacent to Karen State in Thailand's Mae Hong Son province - that was built in 2004 and was home to 15,345 refugees in March 2006.

Imagery covering the area of Mae La Oon was acquired from GeoEye dating to 14-Nov-2002. This imagery was compared with a high-resolution QuickBird image from 2005. The comparison of images between 2002 and 2005 showed a dramatic build-up of the refugee camp. As seen below, hundreds of structures ranging in size and cluster density are built along the slopes leading up from the river, a tributary of the lower Salween River.

Due to the potential for the creation of new refugees by the ongoing humanitarian situation in Burma, AAAS SHR decided to revisit Mae La Oon in 2009 in an attempt to gauge whether any further expansion had taken place. As illustrated below, the results of this effort were mixed, with a moderate contraction of the camp’s central region largely offset by substantial new construction in its western areas. The southeastern sector of the camp, once densely populated, appears to have been completely abandoned, though this too is more than compensated for by growth elsewhere. Overall, the area of the camp appears to have increased by approximately 2.5% - a far less dramatic expansion than that which was observed between 2002 and 2005, but which may nevertheless indicate a slow but steady influx of new inhabitants from across the border.
The images above depict the Mae La Oon refugee camp in Thailand, transitioning from a few structures in 2002 to hundreds in 2005 (Lat: 17.79 N Long: 97.78 E)
Image 2: Close-ups of Mae La Oon Refugee Camp


Two image sets of areas within Mae La Oon refugee camp. In each image pair significant build-up can be seen between the 2002 and 2005 images.
The above images depict the evolution of Mae La Oon refugee camp, Thailand (outlined in red) over the span of approximately four years. Although substantial shifts in the placement of dwellings and shelters have taken place, the total area of the camp has increased only marginally in the intervening years. (Lat: 17.79, Lon: 97.78)