Monitoring Border Conflicts with Satellite Imagery: Cambodia and Thailand—2008-2011
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Introduction

The Temple complex of Preah Vihear is situated on the southern edge of the Khorat Plateau, in the Dangrek Mountains, near the border between Cambodia and Thailand. A hermitage was founded on the site during the 9th century. The complex was expanded over the course of the Khmer Empire and by the 11th century, it included a series of sanctuaries linked by paved paths and staircases.¹

In the late 19th and early 20th century, France and Siam signed several treaties establishing the boundary between Siam and French Indochina. In 1904, a joint commission began demarcating the border with instructions that in the Dangrek Mountains, the watershed line between the Nam Sen and Mekong river basins would serve as the boundary.² This would have placed Preah Vihear within Siam. However, the final pact, signed in 1907, placed Preah Vihear within French Indochina.

Siam once again asserted possession of Preah Vihear in 1934. In 1940, with France engaged in World War II, Thai troops occupied the Temple.³ After World War II, the territory was ceded back to France but was reoccupied by Thailand in 1953, following the French withdrawal from Cambodia.⁴ In response, Cambodia brought suit in the International Court of Justice (ICJ) in 1959. In 1962, the ICJ awarded Preah Vihear Temple to Cambodia, but left ownership of 4.6 km² of surrounding territory unresolved.⁵

In the following decades, international relations in the region were dominated by the rise of the Khmer Rouge and the subsequent war between Cambodia and Vietnam. On 7 January 1979, the Khmer Rouge were driven from Phnom Penh and took refuge in the Dangrek Mountains along the Thai border. As refugees fled Thailand, Preah Vihear became the site of one of the more infamous incidents of the war. On 8 June 1979, Thai soldiers bussed 45,000 Cambodian refugees to the Preah Vihear border crossing where they were forced at gunpoint down the steep, heavily mined mountain back into Cambodian territory. The incident became known by some in Cambodia as the Dangrek Genocide.⁶

The Khmer Rouge continued to wage a guerilla war against the Vietnamese backed government from strongholds along the Thai border. During this time, Khmer Rouge forces occupied the Temple at Preah Vihear. In the early 1990’s, mass defections to the newly elected government left Khmer Rouge forces drastically depleted and fractured by internal divisions.⁷ In 1992, Preah Vihear Temple was opened to tourists. However, the Thai provincial authorities provided entry

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³ Siam adopted the name Thailand in 1939 but re-adopted the name Siam between 1945 and 1949.
permits, facilities, and security. In 1993, the Temple was closed when the Khmer Rouge, operating from Thailand, reoccupied the site. The site remained closed until the Khmer Rouge surrendered in 1998.

Thai officials were intimately involved in managing the site as Preah Vihear was more accessible from Thailand than from Cambodia. On 11 June 2000, the two countries reached an agreement providing for joint management. Shortly after, public outcry in Cambodia over the agreement forced the ouster of the Cambodian Minister of Tourism and the agreement was annulled.

In October 2001, the government of Cambodia informed UNESCO of its intention to request that Preah Vihear be inscribed as a UNESCO World Heritage Site. In an article which discussed the request, Silverman notes that, “In nominating Preah Vihear to the World Heritage List, the Cambodian government was demonstrating its definitive victory over the Khmer Rouge, envisioning economic development through tourism at Preah Vihear, and continuing its project of nation-building.” The status of Preah Vihear is, therefore, intrinsically tied up with conceptions of Cambodian national identity.

In December 2001, however, the Thai army closed the border crossing due to sewage and sanitation issues at the nearby market. Cambodia responded by sending hundreds of troops to the area and accelerating the construction of an access road from the Cambodian side of the border. Efforts to demine the area were also accelerated in 2002.

Relations between the countries continued to deteriorate, and on 29 January 2003, a group of Cambodian students burned down the Thai Embassy in Phnom Penh. In response, the Thai military prepared F-16 fighter jets, commandos, and Special Forces for actions against Cambodia. A riot at the Cambodian Embassy in Bangkok was only subdued with an appeal from the Thai King. Tensions were diffused when Cambodia agreed to pay roughly 54 million dollars in compensation and begin a full investigation of the riots. The mayor of Phnom Penh was removed and the head of the Phnom Penh Military Police was reassigned. The riots also provided the Cambodian government with an excuse to crack down on anti-government activists, including the independent station Beehive Radio.

By 25 March 2004, relations had normalized to the point where Cambodia and Thailand signed a cooperation agreement for the protection of Preah Vihear. In 2007, the UNESCO World

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Heritage Committee announced its intention to inscribe Preah Vihear as a World Heritage Site at its next session in 2008. Leading up to the inscription date, the newly elected Thai Prime Minister Samak Sundaravej announced Thailand’s support for the inscription, with the explicit understanding that the status of the disputed area surrounding the Temple was still unresolved.15

These statements occurred within a fractious political environment in Thailand. Samak Sundaravej’s People’s Power Party (PPD) was considered a proxy for the regime of Thaksin Shinawatra that had been deposed in a 2006 coup. The opposition People’s Alliance for Democracy seized upon the Preah Vihear issue. On 7 July 2008, the Thai Central Administrative Court ruled that the entire cabinet had violated the national charter by not seeking parliamentary approval for the deal.16 On 10 July 2008, the Thai Foreign Minister, Noppadon Pattam, former lawyer for Thaksin, was forced to resign as a result of the ruling.17

On 15 July 2008, three Thai protesters were arrested after entering the Temple complex without authorization.18 Reports also indicated that Thai soldiers crossed the border19 and exchanged fire with Cambodian troops.20 Both sides responded by sending troops to the border and by October 2008, each side had over 1,000 soldiers present.21 In early October, two Cambodian troops were killed in a firefight while landmines injured several Thai troops. A similar incident occurred in April 2009 when a firefight broke out after a Thai soldier was injured by a landmine.22 Unconfirmed reports indicated that two Thai and two Cambodian soldiers were killed in this incident. Fighting again broke out in January 2010 and several soldiers were injured at multiple locations.23,24

These clashes shared several characteristic. Many clashes involved patrols encountering each other in contested territory. Injuries from landmines were also common. It is unclear if the landmines were placed after July 2008. Given the history of Khmer Rouge occupation in the area, it is possible that these mines were placed as early as the 1970s.

On 4 February 2011, the largest skirmish of the border dispute began. Over a three-day period, multiple clashes occurred, some involving tanks and artillery. Reports indicate that at least two Thai tanks were destroyed and 33 Thai soldiers were killed. It is unclear how many Cambodian casualties resulted from this skirmish. Fighting took place over a front stretching ten kilometers from Phu Makua Hill to the Village of Phrum Srol; several Thai civilians were among the casualties. A BM-21 missile attack was also reported near the village of Sao Ton Chai in Thailand.

New skirmishes occurred on 15 and 16 February though casualties were limited. At a meeting in Jakarta on 22 February 2011, Thailand and Cambodia agreed to a cease-fire and allowed Indonesian observers to enter the area. In April 2011, Thailand admitted to using cluster munitions during the February clashes. Throughout April and May, multiple clashes occurred at Preah Vihear and other locations along the border. On 28 April 2011, the two sides agreed to a cease-fire though fighting continued the following day. After several more days of clashes, Thailand and Cambodia agreed to final terms to allow Indonesian observers to monitor the border.

On 28 April, Cambodia filed a request with the ICJ asking for a clearer interpretation of its 1962 ruling. Pending a response, in July 2011, Cambodia requested that the ICJ order Thai troops from the disputed area. On 18 July, the ICJ ordered troops from both countries out of the Temple area, effectively creating a demilitarized zone around the Temple. Furthermore, the ICJ ordered that both sides abide by the terms of their agreement to allow Indonesian observers into the area.

On 11 November 2013, the ICJ ruled “that Cambodia had sovereignty over the whole territory of the promontory of Preah Vihear.” As a result, Thailand was ordered to withdraw any military

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26 Cambodian. “At least 2 Thai tanks were destroyed and 33 Thai soldiers were killed.” 4 February 2011. http://www.cambodian.info/atleast-2-thai-tank-were-destroyed-and-33-thai-soldiers-were-killed/1721/ accessed on 27 February 2015.
and police forces from the Temple. However, the status of Phu Makua hill, located northwest of the Temple, was left unresolved.\(^{37}\)

**Data and Methods**

The border conflict between Cambodia and Thailand largely occurred within the immediate vicinity of Preah Vihear Temple (Figure 1). Troop levels were relatively low, with no reports indicating that the total number of soldiers was ever greater than 2,000. In addition, no reports indicated that large numbers of troops were redeployed towards the borders of either country. As a result, analysis of the conflict was entirely focused on the area around Preah Vihear. No imagery was acquired of supporting Cambodian or Thai military installations and no imagery was acquired of other areas of the border where small skirmishes were reported.

*Figure 1: Preah Vihear Temple and the surrounding area*

Imagery was acquired of three locations near the Temple (Figure 1). The first location, Preah Vihear West, includes the Temple, the Cambodian countryside immediately south of the Temple, and Phu Makua Hill. This location encompasses most of the 4.6 km$^2$ under dispute. Nine images were acquired at this site (Table 1). Nine images were also acquired at the Preah Vihear East location. This site includes the hill immediately to the east of the Temple and more of the Cambodian countryside (Table 2). The final location, Phrum Srol, includes the nearby Thai villages of Phrum Srol and Sao Ton Chai, which were reportedly damaged during the fighting in February 2011. Seven images were acquired at this location (Table 3). Due to image availability, not every image of each site includes the entire site.

One image, from 1 March 2011, covers all three sites along with the area between them. This image was acquired first and used to delineate the three sites of interest. In addition, a Digital Terrain Model (DTM), created with Thailand’s official topographic maps, was also acquired. The DTM was used to orthorectify all the imagery, a process which removes distortion in the imagery that can arise from topographic variation. This process allowed for higher quality analysis given the extreme changes in elevation.

With the exception of the February 2011 skirmish, clashes between the two sides were characterized by short firefights between small patrols. The 11 February skirmishes were, therefore, of particular interest for this project. As a result, multiple images were acquired from that time period.

### Table 1: Imagery of Preah Vihear West

<table>
<thead>
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<th>Image Date</th>
<th>Sensor</th>
<th>Image ID</th>
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<tr>
<td>Preah Vihear West</td>
<td>24 April 2009</td>
<td>Quickbird-2</td>
<td>10100100097FC000</td>
</tr>
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<td>Preah Vihear West</td>
<td>26 October 2009</td>
<td>Quickbird-2</td>
<td>101001000A819800</td>
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<td>Preah Vihear West</td>
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<td>Preah Vihear West</td>
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<tr>
<td>Preah Vihear West</td>
<td>1 March 2011</td>
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<td>Preah Vihear West</td>
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Table 2: Imagery of Preah Vihear East

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Table 3: Imagery of Phrum Srol

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<th>Image Date</th>
<th>Sensor</th>
<th>Image ID</th>
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<td>1 March 2011</td>
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<td>1030010009160B00</td>
</tr>
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Results

The observations that resulted from image analysis can be broadly grouped into four categories: 1) numerous instances of road building and improvement were observed; 2) structures in the Preah Vihear Temple’s immediate area were both removed and constructed; 3) changes were observed in two Cambodian villages; and 4) potential military camps were observed in Thailand. These observations will be discussed in the following section. Figure 2 shows their locations.
Over the course of the conflict, both Cambodia and Thailand constructed new roads and improved existing roads in the area around Preah Vihear Temple. Prior to the conflict, most tourists accessed the Temple from Thailand. A paved road led from the village of Phrum Srol and terminated less than 400 meters from the Temple’s northernmost point. Prior to the conflict, there were two routes to the Temple from Cambodia. The first was via a narrow dirt road that ascended the promontory and terminated approximate 200 meters west of the Temple. An ancient staircase also descended from the Temple to the east. On 22 July 2008, the base of the staircase could be reached via a narrow dirt track.

During the conflict, Cambodia constructed several new roads, and improved the existing dirt road to improve access to the Temple. Between 13 November 2008 and 24 April 2009, 850 meters of the dirt track were widened and graded to improve access to the eastern staircase (Figure 3).
Between 13 November 2008 (A) and 24 April 2009 (B), 850 meters of trail leading towards the east Temple stairs were widened. Images DigitalGlobe | Analysis AAAS. Coordinates 14.3918 S, 104.698 E.

Improvements to the western road also were made over the course of the conflict. By 26 October 2009, two new bridges were under construction in the southern segment of the road leading to the Temple (Figure 4).

Construction began on two bridges (red arrows) between 24 April 2009 (A) and 26 October 2009 (B). Images DigitalGlobe | Analysis AAAS. Coordinates 14.3858 S, 104.666 E.
By 13 November 2010, trees had been cleared to both widen the road and create new switchbacks. Construction crews appear to be present in this image as well (Figure 5).

Figure 5: Trees cleared to improve the road leading to the Temple

Between 26 October 2009 (A) and 13 November 2010 (B), trees had been cleared to make way for improvements on the road leading up to the Temple. A construction crew (red arrow) was also observed. Images DigitalGlobe | Analysis AAAS. Coordinates 14.3858 S, 104.666 E.

Some progress was made between 13 November 2010 and 10 February 2011 as cleared segments appear to have been graded (Figure 6). No construction crews were visible in this image and no more progress was observed in either the 22 February 2011 or 1 March 2011 images. By 22 February 2012, the road appeared to be mostly complete. The finished portion of the road extended to within 1,000 meters of the Temple. Guardrails and new bridges were also observed (Figure 7).
The newly cleared land had been graded between 13 November 2010 (A) and 10 February 2011 (B). Images DigitalGlobe | Analysis AAAS. Coordinates 14.3858 S, 104.666 E.

By 22 February 2012 (B), guardrails (red arrows) and a new bridge (green arrows) had been added to the road. Images DigitalGlobe | Analysis AAAS. Coordinates 14.3858 S, 104.666 E.

In addition to these projects directly improving access to the Temple, Cambodia also constructed 3 km of paved road running east to west, southeast of the Temple. This new road bypasses a narrow, dirt road and reduces, by 1.3km, the distance needed to travel between the town of Sra Emm, located to the southeast, and the Temple. Construction of this road began
between 24 April 2009 and 26 October 2009 and was completed by 13 November 2010 (Figure 8).

*Figure 8: Construction of a new road near the Temple*

Between 24 April 2009 (A) and 26 October 2009 (B), land was cleared (green arrow) to begin construction on a new road to bypass the existing narrow road (red arrow). By 13 November 2010, the new road had been paved. Images DigitalGlobe | Analysis AAAS. Coordinates 14.3773 S, 104.691 E.

Both Cambodia and Thailand also built roads into the contested areas along the border, particularly Phu Makua Hill. Phu Makua Hill is situated to the west of Preah Vihear and provides a commanding view of the Temple. By 13 November 2008, Cambodia had begun construction on a road leading west along the south face of the hill. This road had been expanded both north and west by 24 April 2009. By that time, a second road had also been built, north of the original and running roughly parallel to it. By 26 October 2009, the first road was extended north and third road leading south from Thailand was observed. By 13 November 2010, the original road
was extended even further north and Thailand had constructed a road providing access to the hill from the north (Figure 9).

*Figure 9: Construction of roads on Phu Makua Hill*

Between 22 July 2008 (A) and 13 November 2008 (B), a new road leading west was constructed on the south face of Phu Makua Hill. By 24 April 2009 (C), the road was extended north and a second road, parallel to the first, was constructed. Images DigitalGlobe | Analysis AAAS. Coordinates 14.4039 S, 104.654 E.
Figure 9 (continued): Construction of roads on Phu Makua Hill

By 26 October 2009 (A), the first road was extended further north and a third road leading south from Thailand was observed. By 13 November 2010 (B), the road from Thailand had been extended south. Images DigitalGlobe | Analysis AAAS. Coordinates 14.4039 S, 104.654 E.

Cambodia improved a third road running towards the border east of the Temple. On 22 July 2008, this road was a narrow dirt track connecting several scattered structures. By 13 November 2010, the road had been substantially widened and construction had begun on multiple bridges (Figure 10). The road had been graded by 10 February 2011 but no additional construction was observed on 22 February 2011 or 1 March 2011. By 22 February 2012, however, most of the road was paved and ten new bridges were observed.
The road was widened and construction had begun on bridges (red arrows) between 24 April 2009 (A) and 13 November 2010 (B). No progress was observed on 1 March 2011 (C), but the bridges were complete by 22 February 2012 (D). Images DigitalGlobe | Analysis AAAS. Coordinates 14.402 S, 104.71E.
**Temple Structures**

Though reports indicated that troops were stationed near the Temple itself throughout the conflict, no obvious military equipment was observed on the Temple’s promontory during the hostilities. However, a count of all structures was undertaken to assess the effect of the conflict on the immediate Temple environs (Table 4).

**Table 4: Structures removed and added to the area around the Temple**

<table>
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<th>Image Date</th>
<th>Structures Added</th>
<th>Structures Removed</th>
<th>Total Structures</th>
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<td>NA</td>
<td>86</td>
</tr>
<tr>
<td>13 November 2008</td>
<td>8</td>
<td>6</td>
<td>88</td>
</tr>
<tr>
<td>24 April 2009</td>
<td>82</td>
<td>27</td>
<td>143</td>
</tr>
<tr>
<td>26 October 2009</td>
<td>28</td>
<td>18</td>
<td>153</td>
</tr>
<tr>
<td>13 November 2010</td>
<td>76</td>
<td>16</td>
<td>213</td>
</tr>
<tr>
<td>10 February 2011</td>
<td>0</td>
<td>84</td>
<td>129</td>
</tr>
<tr>
<td>22 February 2011</td>
<td>0</td>
<td>0</td>
<td>129</td>
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<td>122</td>
</tr>
<tr>
<td>22 February 2012</td>
<td>47</td>
<td>20</td>
<td>149</td>
</tr>
</tbody>
</table>

The structure count revealed that structures were added and removed at different rates throughout the conflict. For instance, only one new structure was added between 13 November 2010 and 1 March 2011, while 92 structures were removed in the same interval. This time period coincided with the most intense fighting of the conflict.

There were two periods of large-scale structure construction and one major demolition prior to the fighting in February 2011. The major demolition event occurred between 13 November 2008 and 24 April 2009, when the majority of structures were removed from a market situated north of the Temple (Figure 11). The 82 structures added to the Temple area during this time period were dispersed throughout the site (Figure 12).
Figure 11: Structures removed from the market north of Preah Vihear Temple

Multiple structures were removed from the Temple market place (red box) between 13 November 2008 (A) and 24 April 2009 (B). Images DigitalGlobe | Analysis AAAS. Coordinates 14.3984 S, 104.681 E.

Figure 12: New and removed structures on 24 April 2009

On 24 April 2009, the removed structures (red dots) were concentrated in the Temple market area, while the new structures (purple dots) were dispersed throughout the Temple site. Images DigitalGlobe | Analysis AAAS. Coordinates 14.3956 S, 104.679 E.
Of the 76 structures added between 26 October 2009 and 13 November 2010, many were concentrated around the market area (Figure 13).

**Figure 13: New and removed structures on 23 November 2010**

On 13 November 2010, the removed structures (red dots) were dispersed throughout the Temple site while new structures (purple dots) were somewhat concentrated near the market area. Images DigitalGlobe | Analysis AAAS. Coordinates 14.3956 S, 104.679 E.

**Cambodian Villages**

The acquired images contained parts of two small Cambodian villages situated on the plain south of the Temple. The village of Angkrong, located at the base of the road leading up to the Temple remained largely unchanged through the first portion of the conflict. There were no major construction or demolition events between 22 July 2008 and 26 October 2009. By 13 November 2010, however, almost all structures in the village had been removed. Between 13 November 2010 and 1 March 2011, no other changes were observed. However, by 22 February 2012, a large area of land had been cleared and paved, possibly for a parking lot for tourists (Figure 14).
Multiple structures (red arrows) were removed between 26 October 2009 (A) and 13 November 2010 (B). No changes were observed on 1 March 2011 (C), but a large area of land was cleared by 22 February 2012 (D). Images DigitalGlobe | Analysis AAAS. Coordinates 14.3798 S, 104.662 E.

Portions of a second village, situated southeast of the Temple, were also contained within the imagery. Between 13 November 2008 and 24 April 2009, a small number of structures were added to this village and two narrow roads were constructed running both north and east of the village. By 13 November 2010, these roads had been widened and more structures were added. The number of structures remained stable through 1 March 2011, but many had been removed by 22 February 2012 (Figure 15).
Between 13 November 2008 (A) and 24 April 2009 (B), two new roads were created (red arrows) and a small number of structures were added (green arrows). By 13 November 2010, the roads had been widened (red arrows) and new structures were added (green arrows). By 22 February 2012 (D), many of the structures had been removed (purple arrows). Images DigitalGlobe | Analysis AAAS. Coordinates 14.3717 S, 104.721 E.

**Potential Military Camps**

A number of small encampments were constructed in the area around the Temple throughout the conflict. These encampments often included a small number of structures arranged in a circular fashion. For some of these camps, further construction indicated that they were civilian
in nature. Though no obvious military equipment was observed, the location and layout of other camps suggest they could have been military in nature.

Two camps in particular, both in Thailand, were likely military. The first was situated seven kilometers northeast of Preah Vihear Temple. It was first observed on 13 November 2010 and it remained in place through 22 February 2012. It includes multiple structures arranged in a small circle and surrounded by a fence. No other settlements with this layout were observed. This fact, combined with the defensive nature of its layout, strongly suggests this was a military camp (Figure 16).

*Figure 16: Construction of a potential military camp*

Between 24 April 2009 (A) and 13 November 2010 (B), a circular camp was constructed in Thailand. The camp remained through 22 February 2012 (C). Images DigitalGlobe | Analysis AAAS. Coordinates 14.4232 S, 104.737 E.
A second camp was observed east of the village of Phrum Srol on 8 November 2009 and was still present in the 7 February 2012 image. This camp included multiple structures, three of which are enclosed in earthen berms. These three structures appear to have been destroyed by 10 February 2011, but were rebuilt by 7 February 2012. The remaining structures in the compound were arranged in a compact fashion, in contrast to other compounds in the area. The earthen berm and orderly layout suggest that this camp was military in nature (Figure 17).

Figure 17: Potential military camp near Phrum Srol

A potential camp was constructed near Phrum Srol between 13 November 2008 (A) and 8 November 2009 (B). Three earthen berms protect structures (red arrows). The camp was present on 10 February 2011, but the three structures had been removed (red arrows). By 7 February 2012, the structures had been rebuilt (red arrows).

Images DigitalGlobe | Analysis AAAS. Coordinates 14.3717 S, 104.721 E.
Discussion

Road Building

Multiple roads were constructed and improved in the area around Preah Vihear Temple over the course of the conflict. Cambodia improved access to the Temple by widening the main road leading up to the Temple’s promontory. This included the creation of new switchbacks and the construction of new bridges. The road leading to the eastern staircase was also expanded. A third road, east of the Temple and leading north to the border with Thailand, was also improved. The road was widened and ten new bridges were constructed.

Three other new Cambodian roads were observed near the Temple. Three kilometers of paved road were constructed southeast of the Temple. This new road bypasses a narrow, dirt road and improves access to the area from the town of Srah Emm. Two smaller, dirt roads were constructed in the area around Phu Makua Hill. The first follows the base of the hill east to west before turning north. The second road traverses the southern face of the hill and approaches the summit via two switchbacks. This road terminates in close proximity to the contested portion of the hill. In addition, Thailand constructed one road leading south that also terminates near the contested portion of the hill.

The construction of roads, particularly on the Cambodian side of the border, demonstrates the importance of the Temple to conceptions of Cambodian statehood. By constructing several new roads and improving others, Cambodia was tangibly asserting control of its border region. Improving access to the Temple from Cambodia also demonstrates Cambodia’s commitment to developing Preah Vihear as an international tourist destination.

Temple Structures

The number of structures present on the Temple promontory changed throughout the conflict. There were two periods of time when large numbers of structures were removed. The first occurred between 13 November 2008 and 24 April 2009, when a nearby market was demolished. The second occurred between 13 November 2010 and 10 February 2011, when 84 structures were removed.

There were also three periods of time when large numbers of structures were added. Eighty-two structures were added between 13 November 2008 and 24 April 2009. Between 26 October 2009 and 12 November 2010 an additional 76 structures were added. Finally, 47 structures were added between 1 March 2011 and 22 February 2012.

The first observed loss of structures was likely the result of a series of events that occurred on 3 April 2009. Thai rockets reportedly struck the market area and Thai soldiers stopped residents
from extinguishing the resulting fires. Residents of the village who lost their homes were then moved to a temporary camp 10km away. The new structures observed in this same time period were scattered throughout the promontory. It is possible that these were constructed by residents who chose not to be relocated or that the structures were used as part of the subsequent investigation of the incident.

Construction of a new market began in July 2009, and given the location of the structures, may account for the new structures that were observed between 26 October 2009 and 13 November 2010. The next major event was the removal of 84 structures between 13 November 2010 and 10 February 2011. This time period coincided with the heaviest fighting of the conflict, which may have contributed to the loss of structures. The new structures constructed before 22 February 2012 may have been a result of rebuilding efforts following the February 2011 fighting.

**Cambodian Villages**

Almost all of the structures of the village of Angkrong were removed between 26 October 2009 and 13 November 2010. The circumstances behind this removal are unclear. No craters or other signs of fighting were observed in the village during this period. In addition, the village does not lie within the Temple’s view-shed as mapped in the UNESCO application.

The addition and subsequent removal of structures to a settlement east of Angkrong is similarly unexplained. Multiple structures were added between 24 April 2009 and 13 November 2010. By 22 February 2012, they had been removed. It is possible that civilians displaced from either the Temple promontory or the village of Angkrong created these new structures at the second village, but it is also plausible that the structures were built as part of the other, unrelated, infrastructure improvements.

**Potential Military Camps**

Though each side deployed approximately 1,000 troops to the area during the conflict, only two potential military camps were observed, both in Thailand. Though no obvious military equipment was observed at either camp, their layouts suggested that they were military in nature. Tree coverage in the area may have obscured smaller camps or military positions. Reports indicated that Cambodia stationed troops at the Temple itself. It is possible that some of the new structures observed on the promontory actually housed military personnel.

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Conclusions

Analysis of imagery of the Preah Vihear Temple area was conducted in order to determine what phenomena could be observed that would indicate escalating tensions along the border. Twenty-images of the area, totaling 860 km², were acquired. Particular attention was paid to the period of time leading up to and immediately following the February 2011 skirmishes.

The analysis revealed few changes in the period leading up to the February 2011 skirmishes that would indicate the skirmish was imminent. Only a small number of troops were deployed to the area by either side, making it difficult to monitor military encampments. The dense forest canopy of the area also hindered the detection of military equipment. Furthermore, reports indicate that most skirmishes were the result of random events, such as patrols encountering each other or the explosion of a landmine. Due to these facts, remote sensing provided little information concerning the possibility of the outbreak of violence.