

Rapid Geospatial Assessment



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Utilizing Geographic Information Systems (GIS) to explore alternative motivations of Improvised Explosive Device (IED) use in Afghanistan.

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Experiences in Geospatial
Intelligence

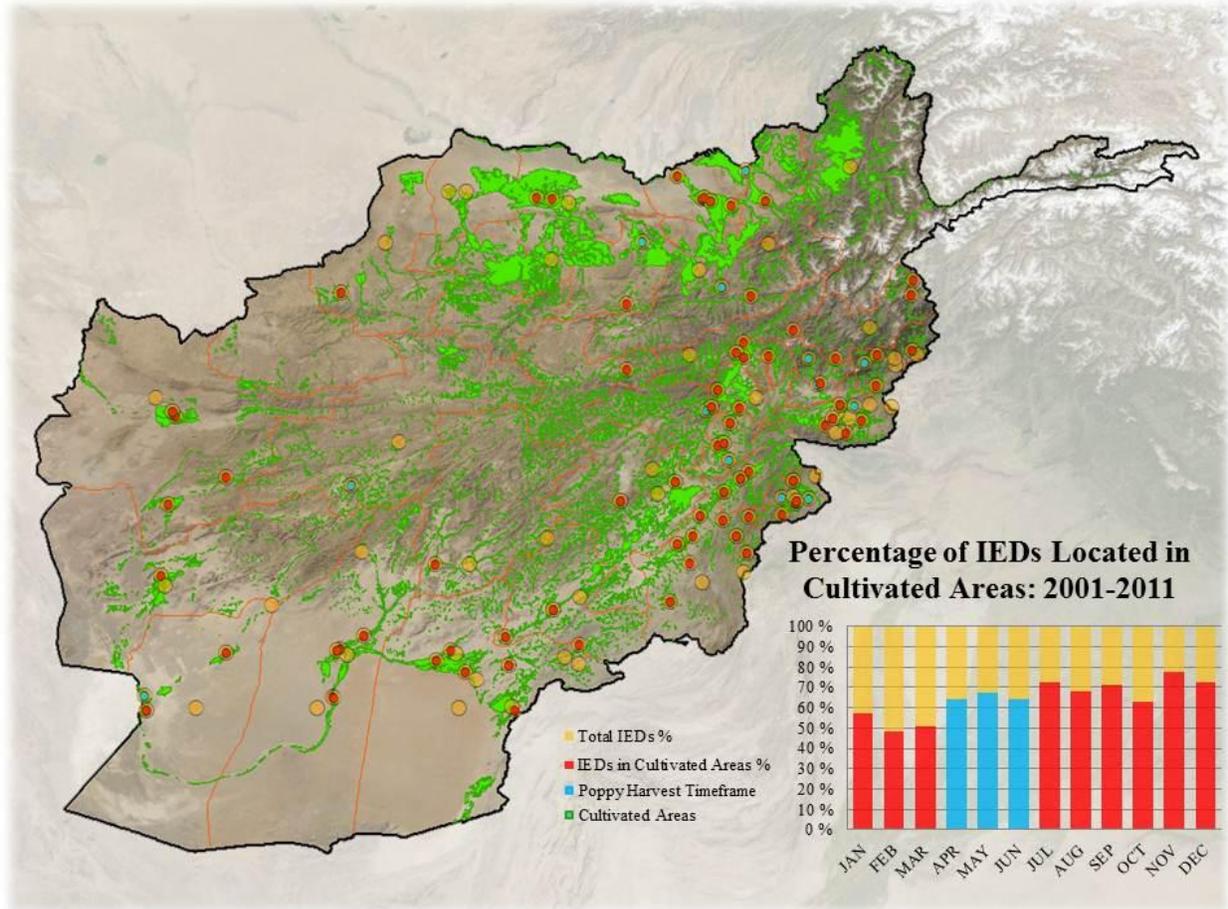
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I. Summary of Findings

Based solely upon open source terrorist event data, there is no statistical evidence to suggest that Afghans are using Improvised Explosive Devices (IEDs) as a defensive measure to protect their poppy harvest.



Map 1: Map of IED events in Afghanistan from 2001-2011.

II. Question for Inference

Are Afghans using IEDs as a defensive measure to protect their opium production and poppy harvest?

III. Grounding

A. Background

According to the Joint IED Defeat Organization (JIEDDO) website, “Improvised explosive devices – known worldwide as IEDs – are the weapon of choice of terrorists because they require limited skills to build and provide dramatic results

for very little investment of time, money and effort.” IEDs at their very basic are homemade bombs that have been fabricated to incapacitate persons or vehicles in a destructive and lethal manner. The number of IEDs has grown in use every year since the beginning of the war in Afghanistan.



Insurgents not only use IEDs to target coalition forces via roadside or vehicle borne bombs to kill and injure soldiers, they also use them to create distractions in order to facilitate other attacks. Department of Defense (DOD) efforts to counter the IED threat have not been effective enough to cut exposure to U.S. forces and their allies. After a decade of war and billions of dollars spent studying IEDs, they still account for the majority of coalition force casualties.

While the offensive push against the rising number of occupying forces is certainly a motivating factor, there could be other alternative motivations such as economic



disparity, lack of jobs, hunger or protection of livelihood.

Approximately 79% of Afghan citizens are dependent on agriculture for their livelihoods, which includes producing 90% of the world's opium. According to the NY Times,

“Counternarcotics officials say that much of the money from opium production and smuggling flows to insurgent groups.”

Currently, there is no clear understanding of alternative motivations that drive the use of IEDs. The chemistry process of opium refinement and the development of homemade explosives (HME) are very similar and it is not uncommon to raid a compound and find opium and HME side by side. This study aims to determine if there is an alternative motivation and defensive element to IEDs and whether or not the insurgency is using them as a screen for their opium production and poppy harvest.

B. Geospatial aspects

Afghanistan is a landlocked country located in Southern Asia. It is mainly bordered by Pakistan to the East and South and Iran to the West, but it also shares a border with Turkmenistan, Uzbekistan and Tajikistan in the North, and China in the far North-East. The country is divided into provinces, then districts, and then cities/towns. This assessment takes into account the locations of cultivated areas throughout Afghanistan and how they relate to both population centers and historical IED events.

Cultivation areas are usually located within 500 meters of a population center and are linked via roads, rivers, and streams. The latter represents irrigation methods and is the leading factor in where cultivation areas are located. IED events occur all over the country, but due to the nature of the open source data, events are geo-located to a more general population center.

A major geospatial aspect that is not taken into account in this assessment is the location of coalition forces. There is currently no appropriate open data source that lists forward operating base locations.

C. Key assumptions

For the scope of this study, it is assumed that all open source data is both factual and accurate. This assumption includes data sourced from the Worldwide Incident Tracking System (WITS), Global Terrorism Database (GTD), and TRITON security reports. It is assumed that all geospatial layers are spatially accurate, including boundary layers sourced from MapCruzin, Global Administration Areas, and USDA’s Geospatial Data Gateway. For the purpose of this study, it is also assumed that the conversion of text place names to geospatial coordinates has been completed accurately.

IV. Alternatives

If the Afghans are using IEDs as a defensive measure to protect their opium production and poppy harvest, then possibly:

- IEDs surrounding poppy cultivation areas will rise when labor is imported for harvesting
- IEDs will decrease during the harvest season when the population is diverted from warfare to cultivation
- IEDs will offensively target coalition forces located in harvest areas to eradicate crops

V. Evidence

A. Preexisting evidence

This assessment started by collecting preexisting evidence. Fortunately, there are a few open data sources that keep track of terrorist events across the globe. Textual records were exported from both the Worldwide Incident Tracking System (WITS) and University of Maryland's Global Terrorism Database (GTD). Equally as important to this study as the event data was the poppy cultivation data gleaned from the United Nations Office on Drugs and Crime (UNODC). While more general in nature, UNODC produced maps showing cultivation numbers by province/district and helped this assessment narrow down the poppy harvest season across Afghanistan. In addition to open data sources, administrative boundaries were freely available.

B. Derived evidence

Most of the evidence established in this assessment is derived. Both WITS and GTD provided terrorism events in a textual format, but these datasets had to be formatted and geocoded before the data could be further processed using preexisting evidence. The data was then paired down specific types of events and further separated out by both time (monthly) and location (within cultivated areas or not). This made it possible to compare the spatial statistics of certain types of events (IED events) against specific times (both harvest and non-harvest months).

VI. Analysis

After completing the assessment, the best alternative is that IEDs will offensively target coalition forces located in harvest areas to eradicate crops. In other words, IEDs are occurring because of the presence of coalition forces, regardless of where those forces reside.

VII. Conclusions

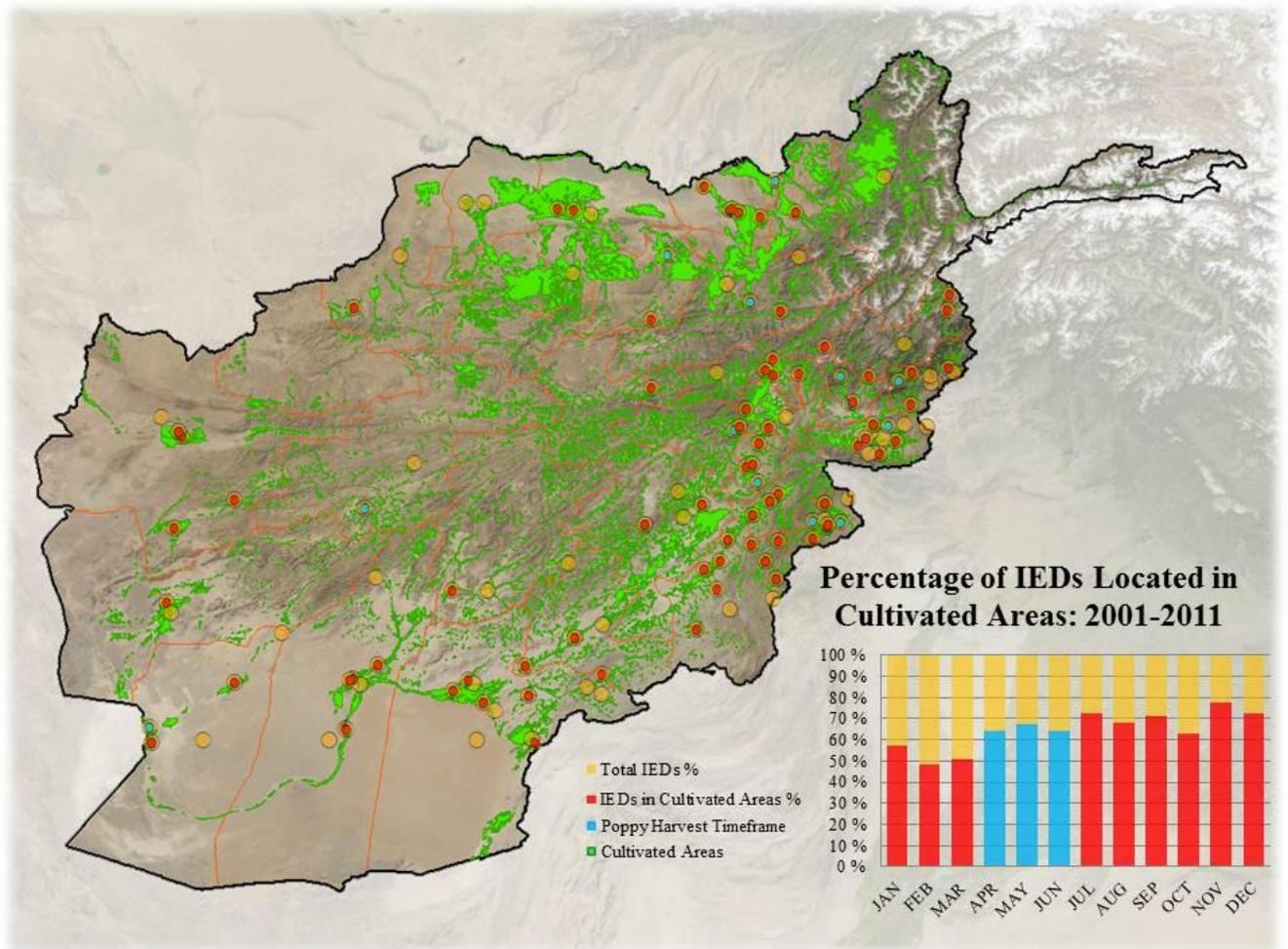
There is no evidence to support the hypothesis that Afghans are using IEDs as a defensive measure to protect their opium production and poppy harvest. Statistically speaking, the percentage of IEDs occurring within cultivation areas during the harvest months is not higher than IEDs occurring within cultivation areas during non-harvest months. These results can be directly related to the quality of the open source data available.

GTD provided ~53,000 total terrorist events from 1990-2011. Of those events, only 2556 were located within Afghanistan and only 1505 were able to be geocoded. Finally, only 799 of those events were IED related. The open source quantity of events is orders of magnitude smaller than real world IED event numbers.

In addition to a smaller sample size, the events were only spatially accurate to the city/town level. This means that all events will be located at a population center. It would be impossible to associate events with specific areas of cultivation or even roadways.

Despite all the shortcomings of the data, it's interesting to note that the majority of IED events were within cultivated areas, regardless of whether or not it was harvest season. Also, there is a lack of spatial clustering of IED events in cultivation areas in the North, where Afghanistan is bordered by allies, but there is clustering in the East, where Afghanistan is bordered by Pakistan.

VIII. Appendix A: Maps, Graphics, and Methodology for Derived Evidence



Map 1: Map of IED events in Afghanistan from 2001-2011.



Map 2: Afghanistan as it relates spatially to the World.



Map 3: Country of Afghanistan with province boundary lines.

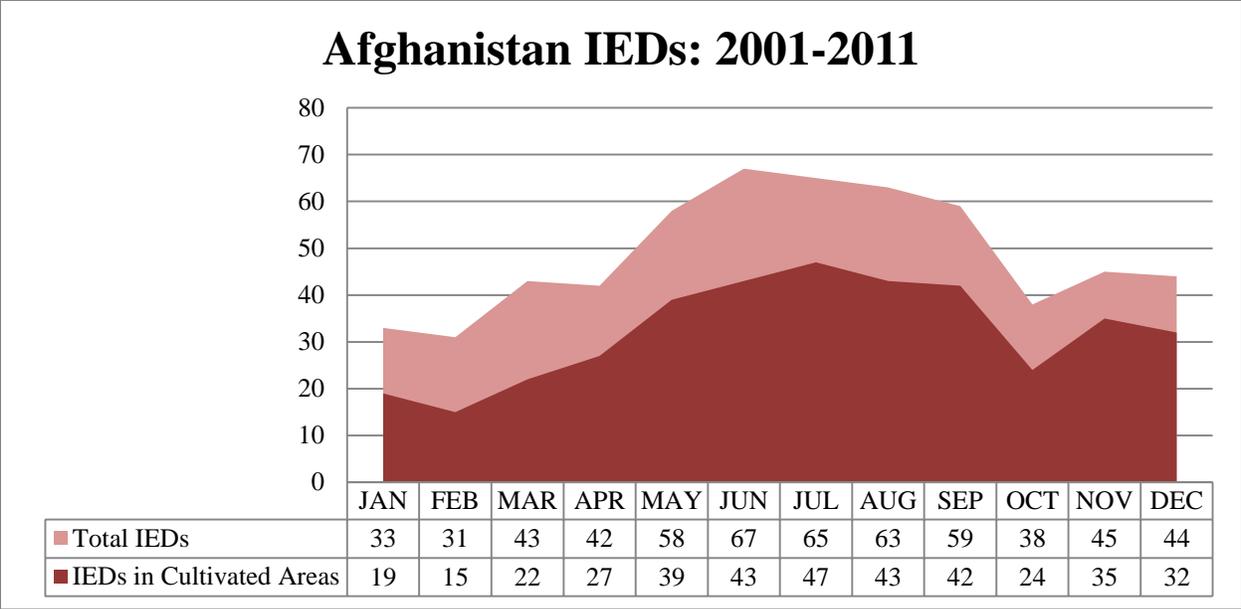


Figure 1: Total IEDs vs. IEDs in Cultivated Areas

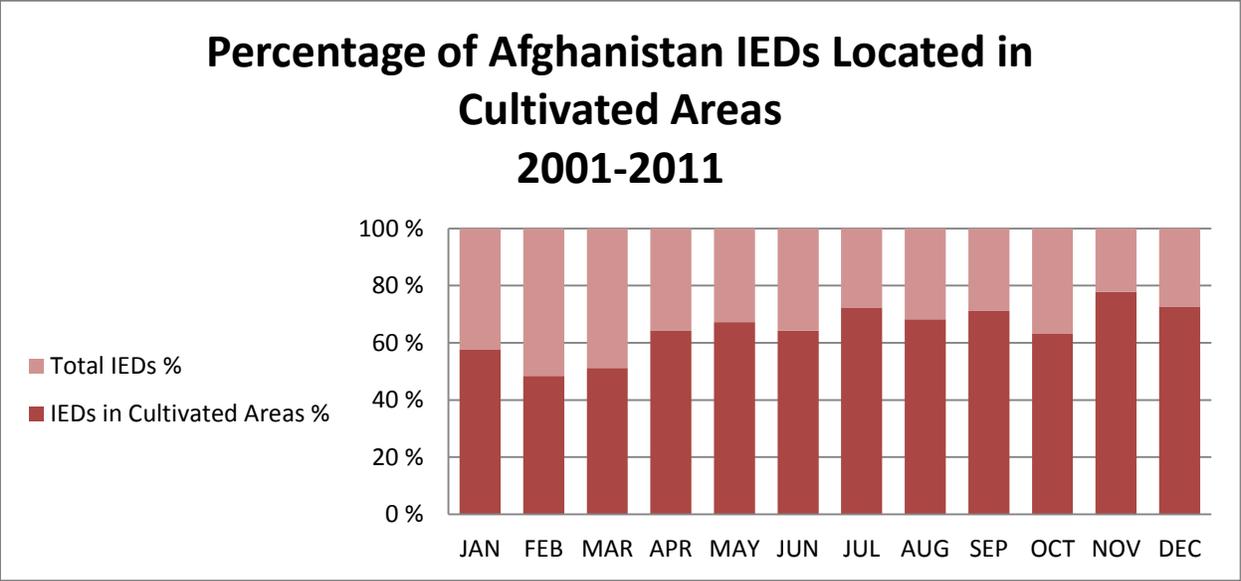


Figure 2: Total IEDs % vs. IEDs in Cultivated Areas %

Many methods were employed to derive evidence for use in this assessment. First and foremost was preparing the data. In order to study the data temporally, dates and times had to be concatenated from several columns of data (year/month/day) or extracted from non-time related columns (record ID). Second, the data needed to be paired down to just the data within the area of study, Afghanistan. This was accomplished by selecting the data in Excel that listed 'AFG' for its country. Another data selection was performed on Type of Event being 'Bombing/Explosions'. Finally, the remaining data records were geocoded using an in-house

tool called Oxygen, which is a tool in the Event Horizon product suite, and converted from an Excel file to an ArcGIS compatible shapefile. The reason for eliminating data before geocoding is simple, the geocoding process must cross check textual locations against a large geodatabase and this is extremely time intensive. Data preparation easily took as long as data manipulation.

Once the data was in a useable format, it could be manipulated and displayed spatiotemporally for the presence of patterns. For this assessment that meant clipping and separating the IED event data that occurred outside of and within cultivated areas. Next, those datasets were divided by monthly timeframes. This means that all IED events that occurred in January, regardless of what year, were grouped together. This allowed monthly patterns throughout the past decade to bear out.

Finally, the derived evidence data was summarized and graphed in Excel. Comparing the data against preexisting evidence provided the conclusions made in this assessment.

IX. Appendix B: Annotated Bibliography

1. World Incident Tracking System. Web. 25 Oct. 2011. <http://wits.nctc.gov>.

This is a resource for open source IED data and provides information in the life and intellectual spaces.

2. Free Afghanistan ArcGIS Shapefile Map Layers. Web. 25 Oct. 2011.

<http://www.mapcruzin.com/free-afghanistan-arcgis-maps-shapefiles.htm>.

This is a resource for Afghanistan shapefiles, including layers representing cultivated areas, rivers, etc. and provides information in the life space.

3. Free Afghanistan Maps. Web. 25 Oct. 2011. <http://www.mapcruzin.com/free-afghanistan-maps.htm>.

This is a resource for Afghanistan map files, including layers representing political boundaries and administrative divisions. Provides information in the life space.

4. Free War in Afghanistan Maps. Web. 25 Oct. 2011. <http://www.mapcruzin.com/free-war-in-afghanistan-maps.htm>.

This is a resource for Afghanistan maps made by Department of Defense and represents Operation Enduring Freedom. Provides information in the life and intellectual spaces.

5. Free Afghanistan Settlements ArcGIS Shapefile Map Layers. Web. 25 Oct. 2011.

<http://www.mapcruzin.com/free-afghanistan-settlements-arcgis-maps-shapefiles.htm>.

This is a resource for older, possibly out of date, Afghanistan settlement maps. Provides information in the physical and intellectual spaces.

6. Global Administrative Areas. Web. 25 Oct. 2011. <http://www.gadm.org/>.
GADM is a spatial database of the location of the world's administrative areas (or administrative boundaries). Provides information in the life and physical spaces.
7. USDA:NRCS:Geospatial Data Gateway. Web. 25 Oct. 2011.
<http://datagateway.nrcs.usda.gov/>.
The Geospatial Data Gateway (GDG) is the One Stop Source for environmental and natural resources data. Provides information in the life and physical spaces.
8. IED Attacks in Afghanistan 2004-2009. Web. 25 Oct. 2011.
<http://www.youtube.com/watch?v=uCK8oSFFpgc>.
This resource provides a time lapse of IED events in order to see the spatial distribution. Provides information in the physical and intellectual spaces.
9. Infographics Shed Light on IED Strategy in Afghanistan. Web. 25 Oct. 2011.
<http://www.fastcompany.com/1609512/infographics-shed-light-on-ied-strategy-in-afghanistan>.
Researcher and former Army officer Alec Barker has created this resource of IED heat maps that illustrate how the Afghan fight is evolving. Provides information in the physical and intellectual spaces.
10. Improvised Explosive Devices In Southern Afghanistan and Western Pakistan, 2002-2009. Web. 25 Oct. 2011.
http://www.newamerica.net/publications/policy/improvised_explosive_devices.
This study presents, analyzes, and assesses data about the use of IEDs by Taliban or Taliban-affiliated Islamist extremists in the provinces of Kandahar, Helmand, Nimroz, and Balochistan from 2002 to mid-2009. Provides information in the physical, life and intellectual spaces.
11. Global Terrorism Database (GTD). Web. 25 Oct. 2011. <http://www.start.umd.edu/gtd/>.
The Global Terrorism Database (GTD) is an open-source database including information on terrorist events around the world from 1970 through 2010. Provides information in the life and physical spaces.
12. HMS Inc. - Intelligence-Led Solutions, Operational Assurance. Web. 25 Oct. 2011.
<http://www.hmsna.com/>.
The TRITON database is the largest open source IED and terrorism database of its kind in the world. Provides information in the life space.
13. JIEDDO Information Resources. Web. 25 Oct. 2011.
<https://www.jieddo.dod.mil/resources.aspx>.

This resource is intended to provide easy access to information on JIEDDO's capability gaps, emerging critical initiatives, new developments, studies, reports and items of interest to aid in the effort of defeating IEDs. Provides information in the life, physical and intellectual spaces.

14. Spatial Statistics Resources. Web. 25 Oct. 2011.

<http://blogs.esri.com/Dev/blogs/geoprocessing/archive/2010/07/13/Spatial-Statistics-Resources.aspx>.

This is a resource about using and understanding Spatial Statistics. Provides information in the intellectual space.

15. Scott, Lauren. "Answering Why Questions." ESRI ArcUser Magazine. Spring 2009. Web. 25 Oct. 2011. <http://www.esri.com/news/arcuser/0309/files/why.pdf>

This resource serves as an introduction to using regression analysis with spatial data. Provides information in the physical and intellectual spaces.

16. "Afghanistan Opium Survey 2011 Summary Findings." United Nations Office on Drug and Crimes. Oct. 2001. Web. 25 Oct. 2011. http://www.unodc.org/documents/crop-monitoring/Afghanistan/Executive_Summary_2011_web.pdf .

This resource provides data on poppy/opium production in Afghanistan. Provides information in the life, physical and intellectual spaces.