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Breaking Organic: Tracking the Rise of Ephedra-Based Meth in Afghanistan

Introduction:

In fall of this year the US bombed multiple structures in Western Afghanistan said to be methamphetamine processing labs (Mansfield). Multiple sources are reporting that use of the psychoactive stimulant has rapidly increased in recent years, and especially since 2013 (Mansfield, Power, Economist). Part of this rise is attributed to a diffusion of refinement process knowledge from Iran to Afghanistan (Mansfield). Whereas meth labs in poor/rural Afghanistan were previously throttled by the scarcity of expensive precursors or cold medicine, the few pill-bottle-strewn drug labs of the past have been replaced by countless compounds with mounds of drying plants and trenches of soaking leaves (Mansfield). The new cottage industry fueling this expansion is the harvesting of the ephedra plant, and its use in the manufacture of meth and meth precursors, and everyone from rural hillbillies to spring break college students are in on the action (Mansfield).

A picture containing text, map

Description automatically generated

Provinces with harvesting or processing

In the early 2000s the US Food and Drug Administration banned the sale of herbal ephedra after a decade of it being sold over the counter as the main ingredient in dietary supplements and trucker speed. The adverse health effects induced by the plant, without processing is enough to have killed many, but, through processing the plant, it can become methamphetamine—one of the most fatal and addictive substances ever discovered (NIH).

Methods:

Ephedra is a genus of 40 plants that grow in high altitudes on every continent except Australia. The plants are extremophiles, thriving in coarse, nutrient poor soil on steep, dry, cold slopes, but despite being so hardy they are remarkably hard to cultivate. To survive, all types of ephedra require all day direct sun, well-drained soil, cold but not freezing temperatures, are slow growing, and are not self-pollinating.

This project documents my efforts to identify sites of ephedra cultivation based on changes in NDVI and fresh erosion deposited on alluvial fans near plant clusters with Landsat-8 imagery. I hypothesized that between 2013 and 2019 there would be a significant and visible decline in biomass and a significant increase in erosion in the selected areas, due to an assumption that the plants would have difficulty re-growing and that their absence (as well as harvesting) would increase erosion.

My research identified three varieties of ephedra from photos featured in recent reporting, all misidentified as “Oman” or “Ma Huang,”

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Low Altitude | High Altitude | Size |
| Equisetina | 800m MSL | 3000m MSL | .5-1 m grass |
| Pachycladia | 1800m MSL | 5000m MSL | 1-3 m shrub |
| Sinica | 700m MSL | 1600m MSL | .5-2 m shrub |

See Slide 8-11

Because of the range of altitudes and the unanimity of reporting *that ideal cultivation is above 2500m MSL*, I produced the following map to identify possible ephedra habitat,

A close up of a map

Description automatically generated

To find South-facing slopes I initially experimented with terrain aspect data (slide 13) but, later found the ArcMap 3D Scene ‘World Elevation 3D/World Terrain 3D’ map to be perfect (slide 14). I began by looking at areas of ideal altitude, near western villages/cities recently bombed and thought to have been the first to adopt the process. I settled on one near Farmakan in Herat Province and one near Farah in Farah Province. For simplicity sake, both were under 40 sqkm and in the same path/row.

A close up of a rug

Description automatically generated

Study Areas and Last Frost

My next challenge was to refine date ranges in order to search for harvesting data. The image above is from April 2013 and shows snow on the terrain near the selected areas. I take the presence of snow to mean that it would be too cold for harvesting. *On another note, the extent of the snow down-slope can also be used to distinguish north and south facing slope and windward and leeward sides of the mountains.* Apropos of weather that is too cold for harvesting, I considered weather that would be too hot for harvesting. Based on weather data, by July temperatures in the valley can reach 120 degrees F and would still be in the 90 in our study areas, and temperatures stay prohibitively hot until October (shortly before first frost).

I settled on the following months: April, May, June, and October for 2013 and 2019, and I began the data processing by downloading, unzipping, clipping the data to the study areas, and enhancing their picture by adjusting brightness, contrast, and gamma (Slides 18-19). Next, I used the NDVI raster tool on each of the clipped images (Slides 20-22) and used the ISO Unsupervised Classification Analysis tool (with boundary clean and majority filter) to symbolize and quantify both erosion and biomass (Slides 23-24).

Results:

My results indicate an increase in biomass in the study areas as well as an increase in erosion in both study areas between 2013 and 2019, and a significant and consistent decline in biomass between April and October of both years. The results are not quantified due to irregularities in the Farah classification throwing off the totals of the combined Study Areas feature class (my mistake). Still, a visual comparison of NDVI and classified Farmakan maps is enough to reject my hypothesis that biomass would decline.

There are a few possible explanations for this, 1. There was more rainfall in 2019 than 2013 and net plant health was improved (despite ephedra harvesting), 2. The 30m spatial resolution of Landsat-8 is insufficient to differentiate ephedra from other plants, 3. The ephedra is being harvested sustainably and regrows annually, 4. Ephedra is not being harvested in the selected study areas.

More Questions/Discussion:

Based on reporting, the price of meth and the ephedra plant has dropped considerably (2/3rds) in the last year (Mansfield). The author speculates that this may be due to a drop of Iranian demand due to government interdiction efforts or economic troubles or a drop in the quality of the product. It may also be that supply of the plant has ballooned due to a bonanza of new harvesters branching out into new harvest areas.

My gut tells me that the price decline is mostly a problem of oversupply, that the average product is less pure as a result of less potent (but more vigorous) varieties of the plant making up a larger share of the harvest/ a relative scarcity (particularly in areas with large-scale refinement labs) for more potent varieties, and, possibly, as a result of successful coalition interdiction efforts (bombing labs).

With higher resolution imagery I could better pinpoint plant habitat and processing structures using the same NDVI and classification methods. The answer to this puzzle would hint at the resilience of the ephedra economy in the country, the prospects of increased drug use/ trafficking. With better country data I could determine if this new market is a threat to domestic or regional stability, and to what extent terrorists, tribes, or criminals are profiting from the trade.

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