

Tehran After the Revolution

Mapping Tehran's Development Post-1979

False Color Images of Tehran in 1980, 1987, 1999, and 2013

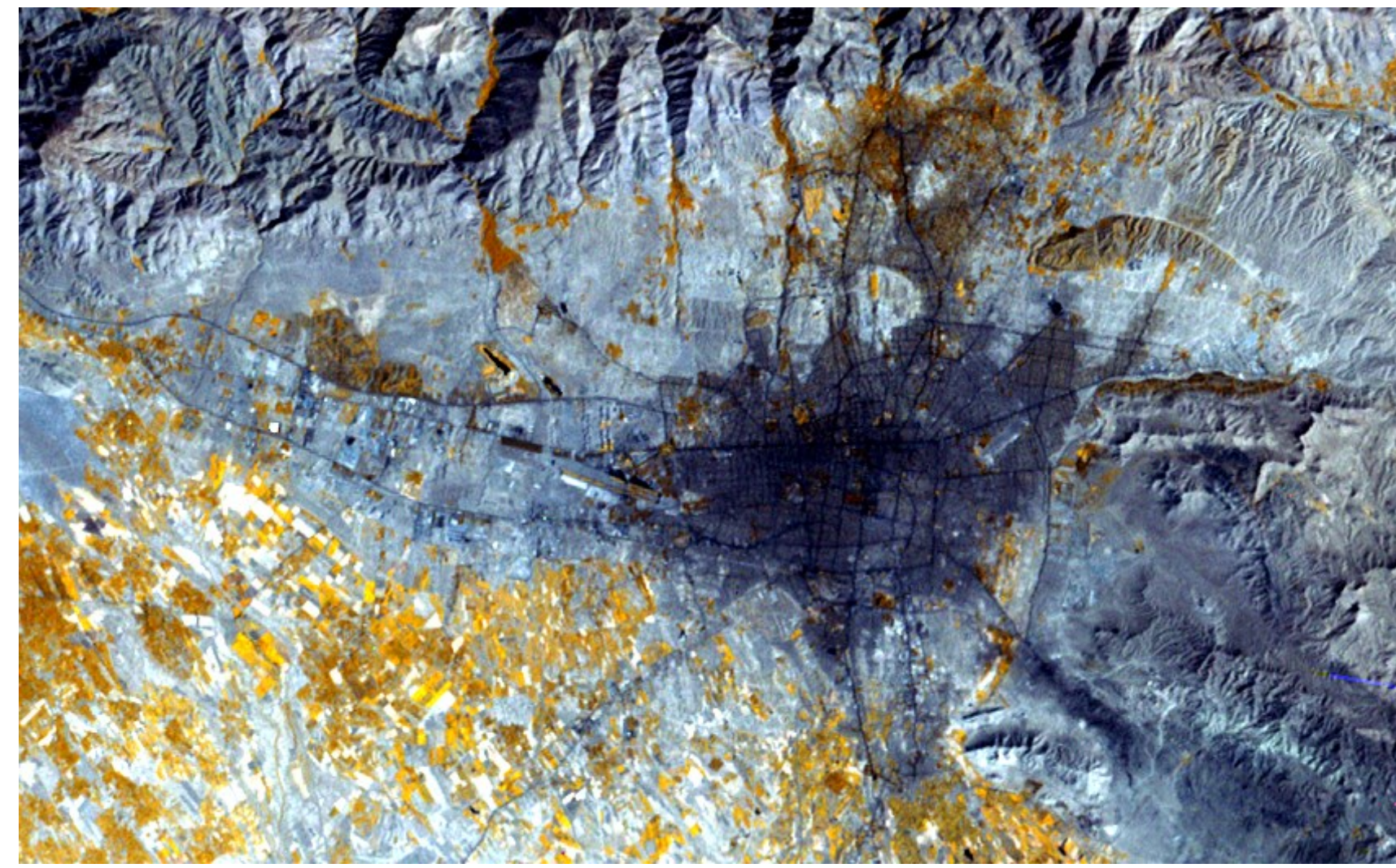


Figure 1. False color image (7,6,5) of Tehran taken by LandSat 3 in 1980

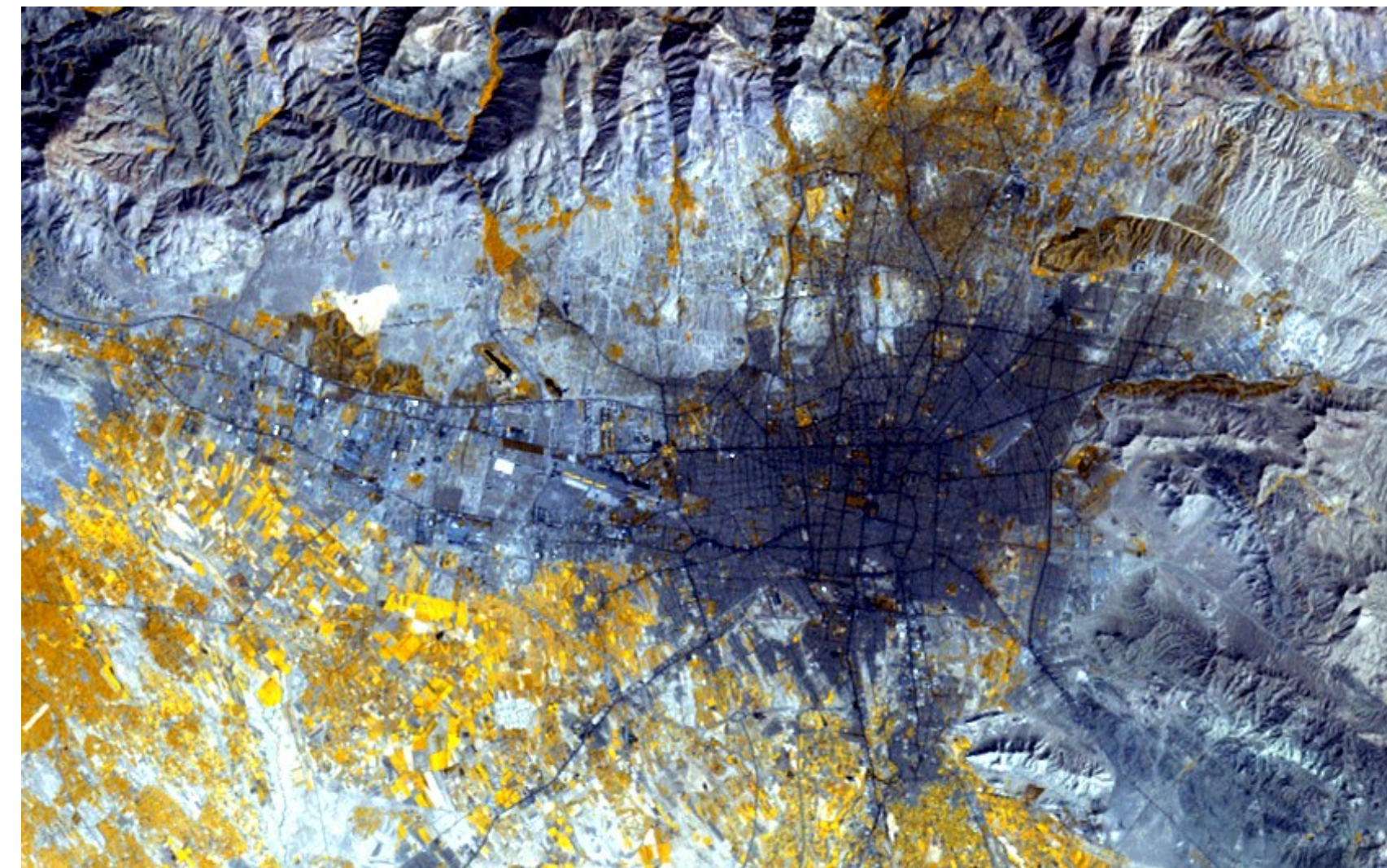


Figure 2. False color image (4,3,2) of Tehran taken by LandSat 5 in 1987

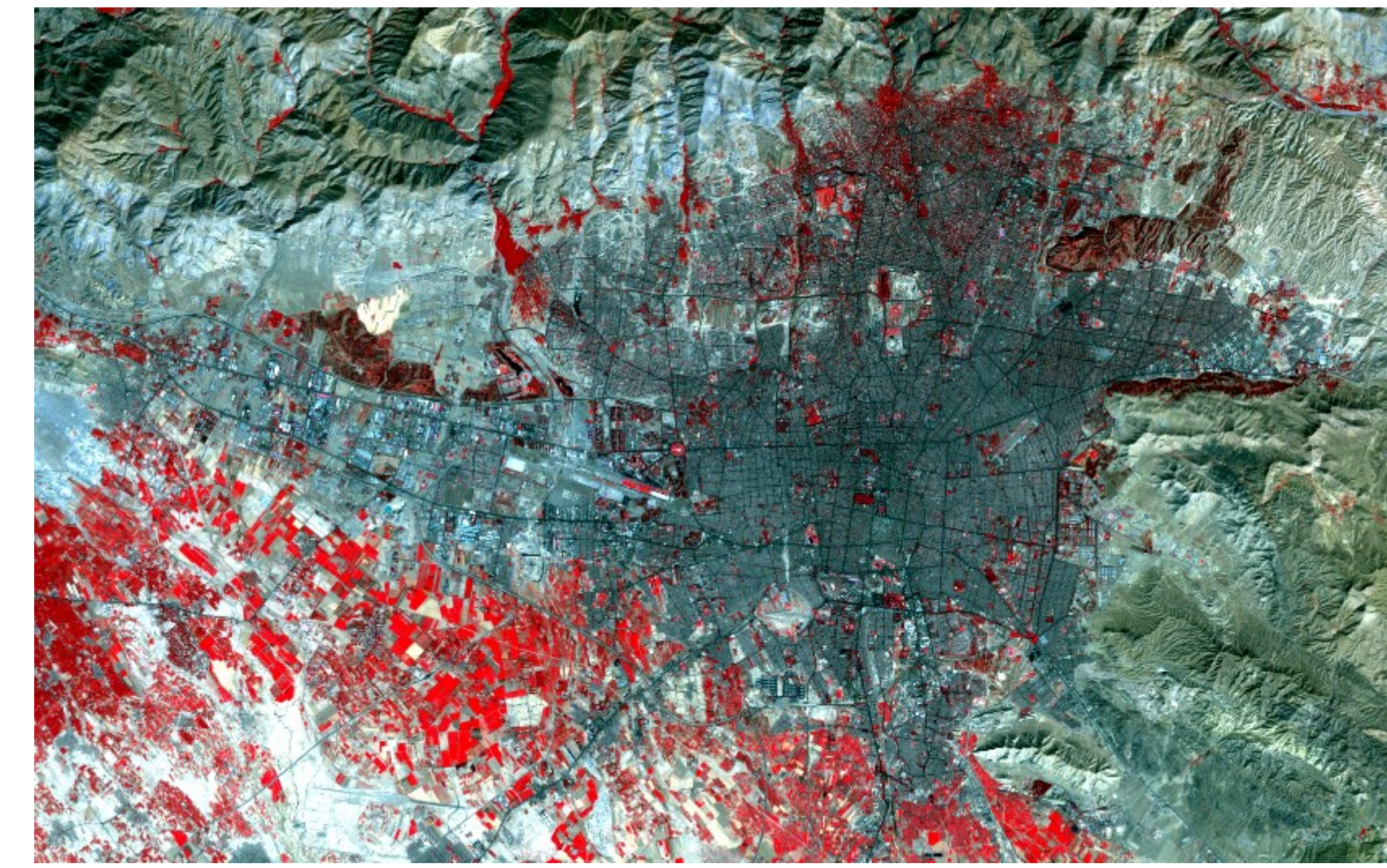


Figure 3. False color image (4,3,2) of Tehran taken by LandSat 7 in 1999

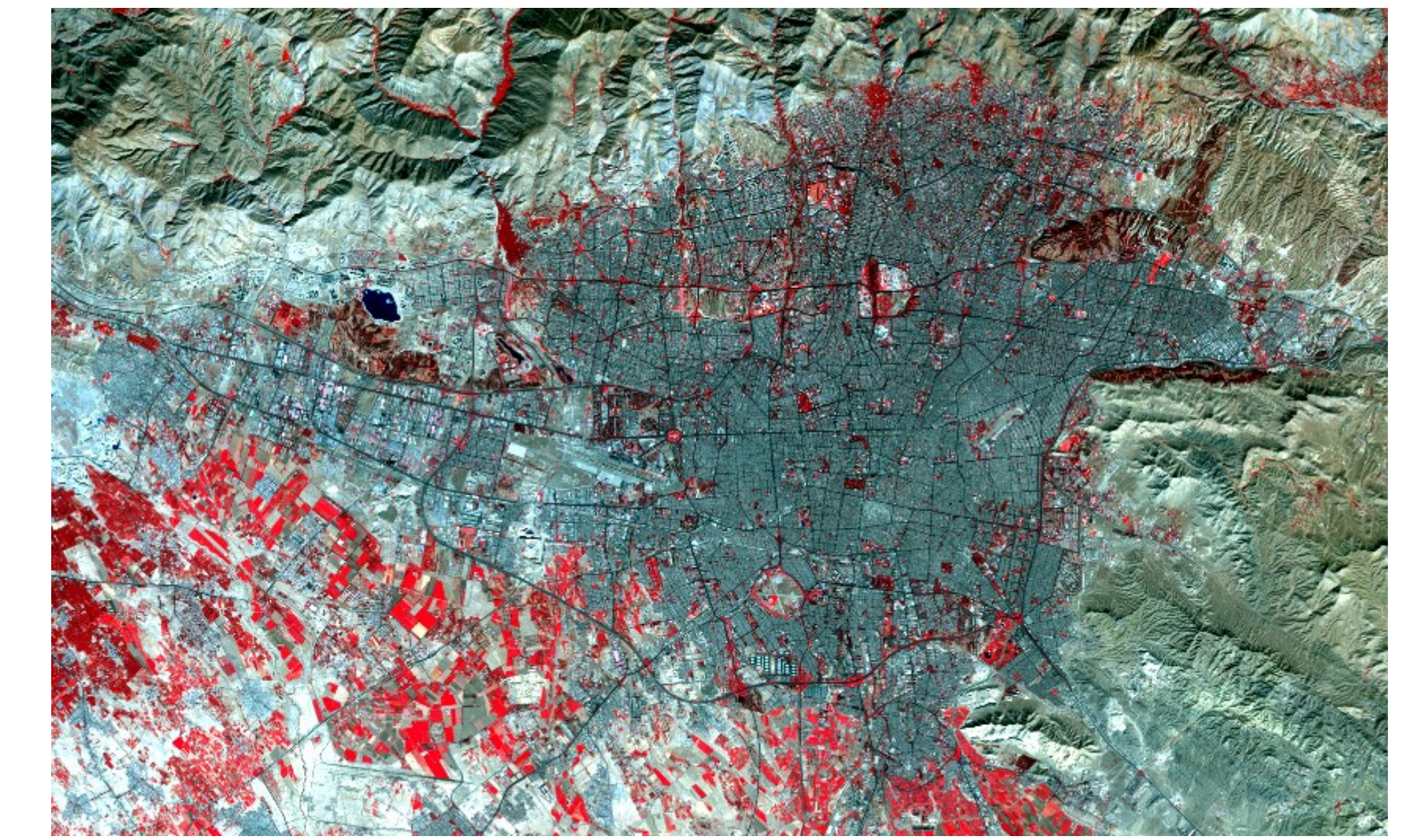


Figure 4. False color image (5,4,3) of Tehran taken by LandSat 8 in 2013

Background

The Iranian Islamic Revolution of 1979 was a major event not only in Iran, but across the world. A modern secular government had been replaced by a theocratic republic, causing political leaders to reassess their theories of modernization. While the immediate aftermath of the revolution was chaotic, the government has since been relatively stable with the Islamic Republic being guided by Ayatollah Khomeini until his death in 1989. Khomeini's death saw a general liberalization of Iran and an increase in foreign investment, a trend that was temporarily reversed by the election of Mahmoud Ahmadinejad in 2005.

While a detailed analysis of development trends in Iran is an interdisciplinary task, the goal of this project is to determine how Tehran has grown and changed since the Islamic Revolution of 1979, with a particular focus on the changes in agricultural and urban development. Ultimately, this project aims to see if the development trends in the decade after the revolution have continued to the modern day.

Methods

To determine the development of Tehran post-1979, Regions of Interest (ROIs) would be created in one image for basic types of ground cover, then used to classify three other images. Images were selected from late September and Early October of 1980, 1987, 1999, and 2013. The Spectral Angle Mapper method of classification was selected because of its ability to import the average wavelength of ROIs created on other images, allowing the same classes to be applied to multiple images. This created a problem where only images of a similar band number could be analyzed, with only the Landsat 3 and Landsat 5 images being suitable. As a result the 1999 Landsat 7 image was not classified, while the 2013 Landsat 8 image was classified to create an impression of general trends. When selecting ROIs for the 1980 image it was found that band 4 had a major scanline error, making the selection of ROIs using all 4 bands impossible. Because of this, ROIs were selected on the 1987 image and then applied to the 1980 image. This process allowed general classes to be discerned on the 1980 image despite the error. Large areas of contiguous unclassified pixels in the classified 1980 image represent areas that were significantly different from any classes in the 1987 image, thus indicating that the area underwent a large amount of change between 1980 and 1987.

Results

Despite the rather poor quality of the classified 1980 image, it was still possible to make general conclusions about the growth trends of Tehran between 1980 and 1987. Interestingly, the areas that indicated major change had occurred did not appear to have been urbanized in the 1987 image, but in the 2013 image these regions had been fully covered by urban ground cover. This might indicate that areas that were beginning to be cleared or changed slightly between 1980 and 1987 were areas that continued to be the focus of development after this period.

The general trend of Tehran's growth from 1980 to 1987 was to the west, north, and northwest. This development was likely largely impacted and limited by the close presence of mountainous terrain. The classified 2013 image clearly shows that Tehran has grown right up to the edge of the mountains. While there has been some development to the south, the land is still heavily used for agricultural purposes. Given the information in the three classified images, it could be predicted that Tehran will primarily continue to grow to the west, as growth in other directions is largely limited by mountains.

Conclusion

Given the time constraints and multiple issues that arose while working with very old satellite imagery, the project cannot be declared a complete disappointment. It can be generally concluded that Tehran has expanded to the west, northwest, and northeast since 1980, following a generally consistent pattern. The more useful result of the project was documenting how to utilize different remote sensing techniques in slightly unorthodox ways to overcome technical limitations without changing the ultimate research goals of the project. As new problems arose, new solutions were crafted, all without compromising the ultimate goal of the project, even if the results were more limited than originally planned.



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Data from USGS

Classified Images of Tehran in 1980, 1987, and 2013

Class Color	Ground Cover
Dark Red	Dense Urban
Red	Sparse Urban
Blue	Arboreal Foliage
Cyan	Agricultural Fields
Light Green	Open Ground
Yellow	Flat Open Ground (LandSat 8 Only)
Green	Water (LandSat 8 Only)
Black	Unclassified Pixels

— Ten Kilometers

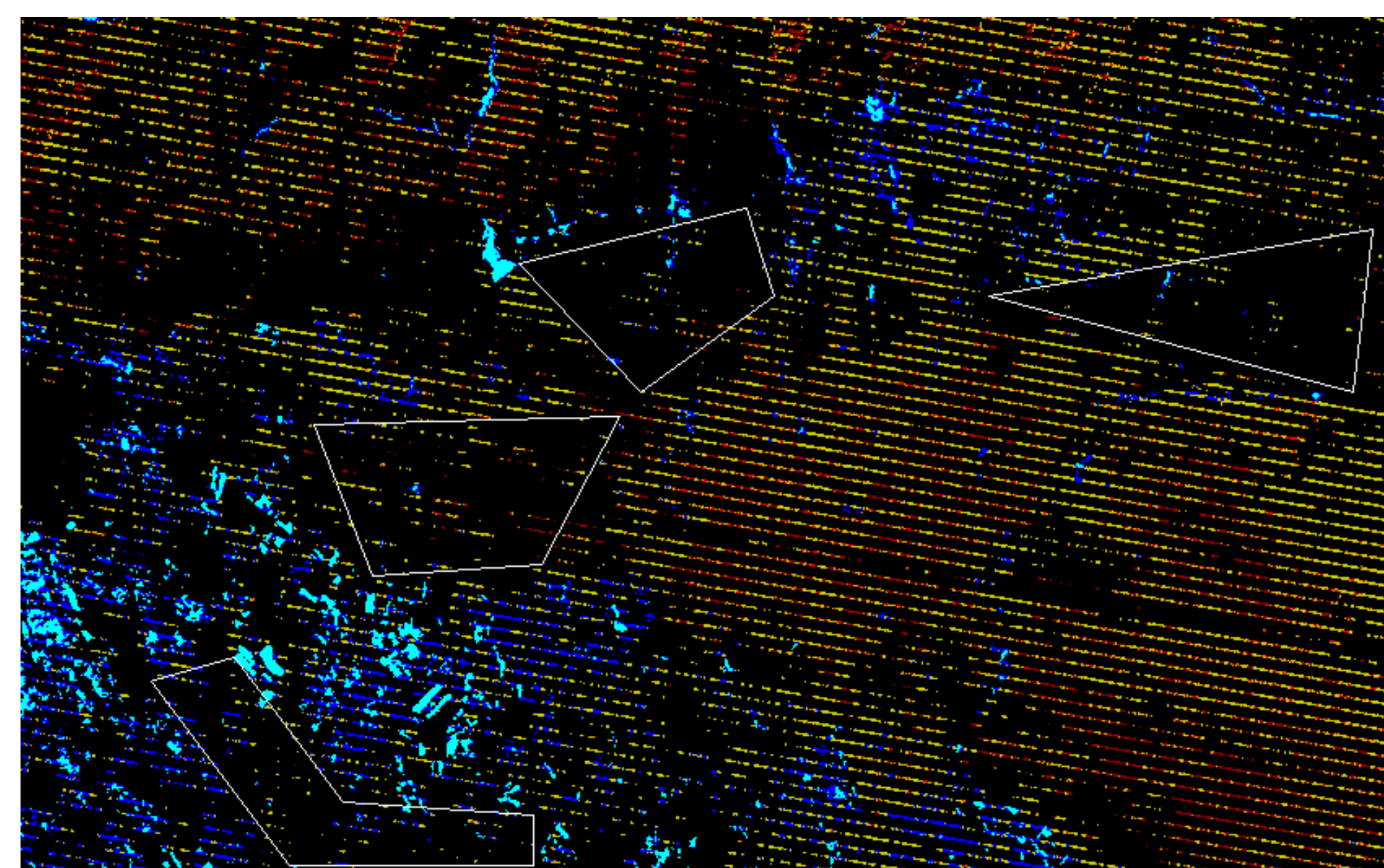


Figure 5. Classified image of Tehran in 1980 with classes from the LandSat 5 image. Marked regions had very high levels of change 1980-1987

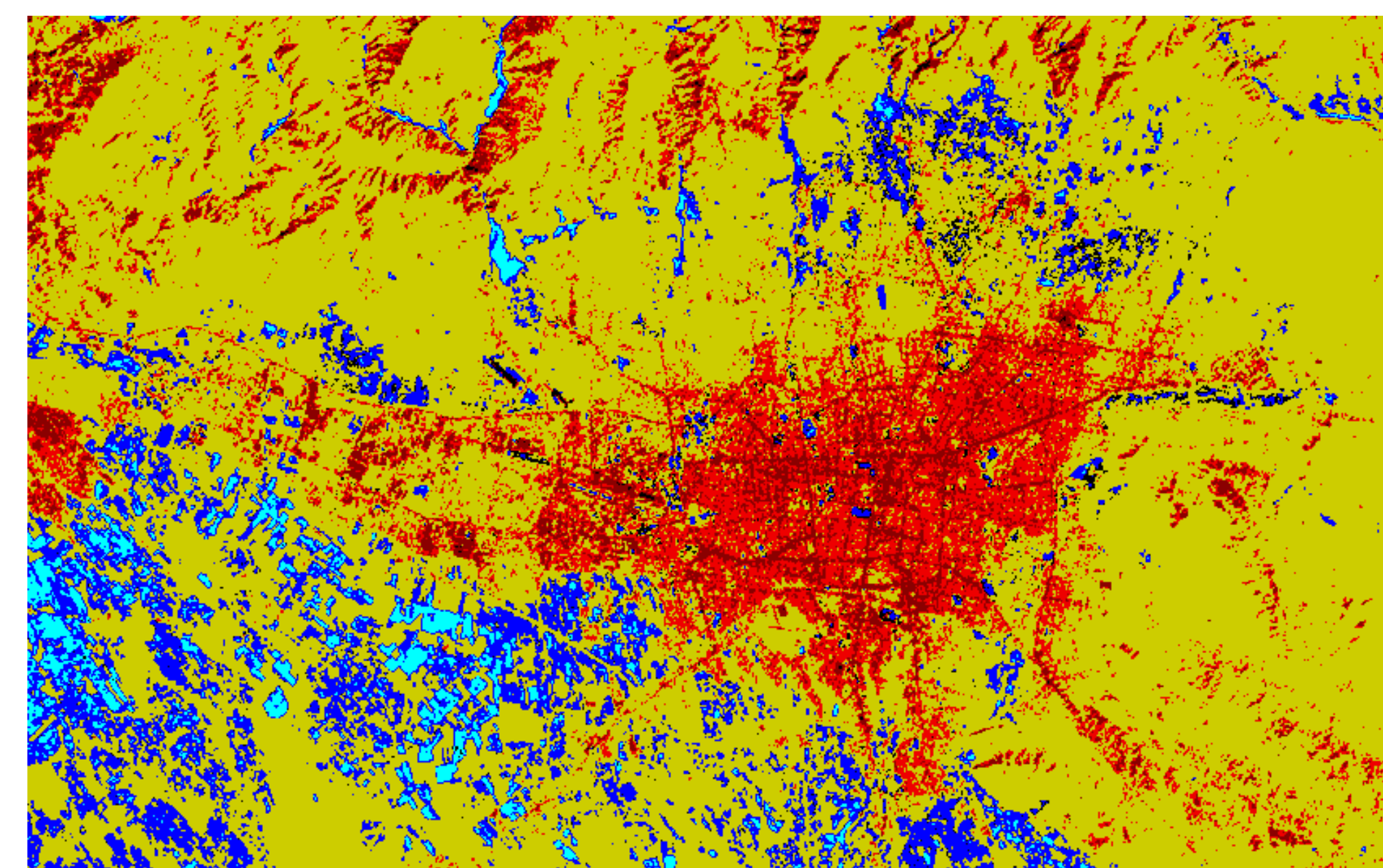


Figure 6. Classified image of Tehran in 1987 with 5 distinct classes

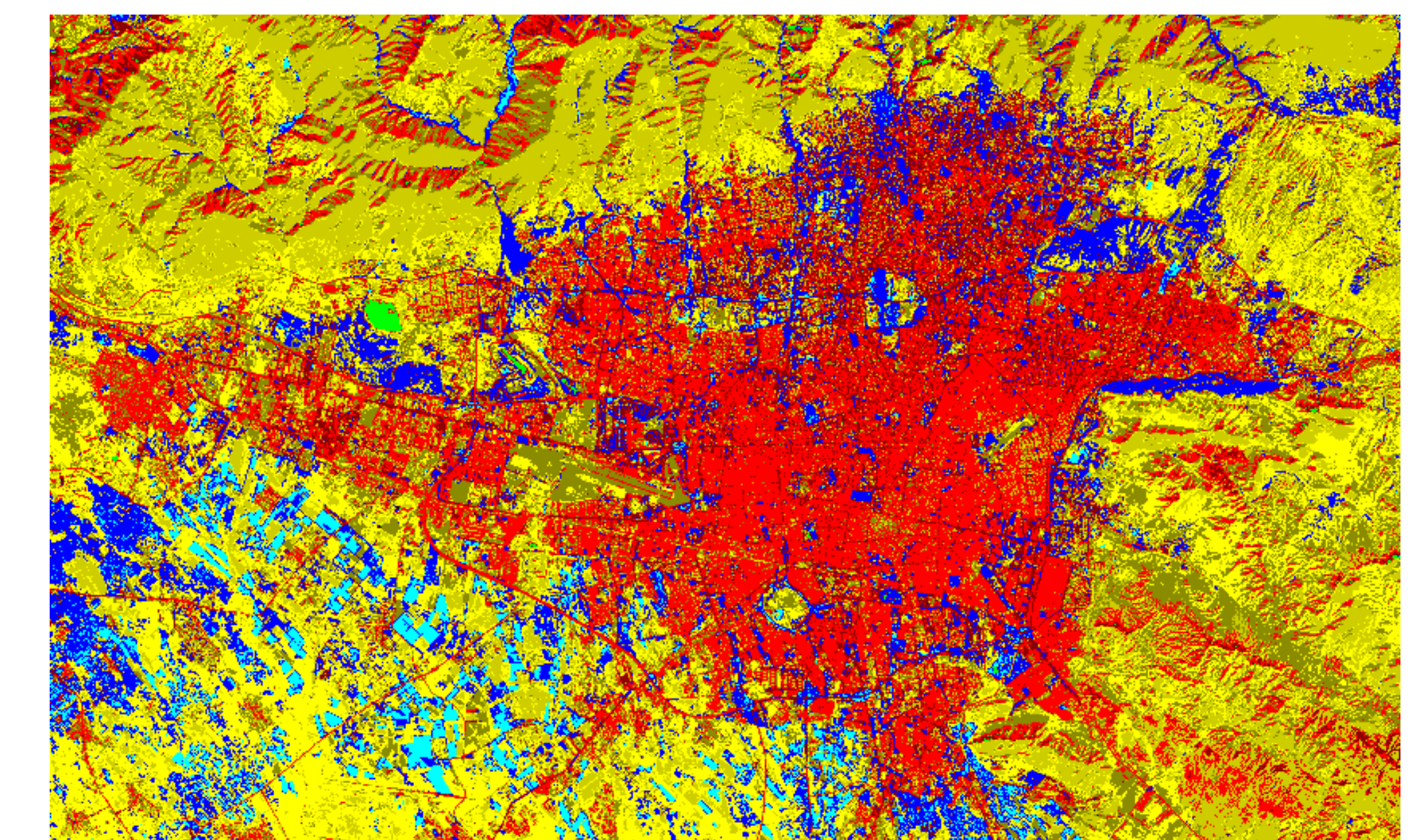


Figure 7. Classified image of Tehran in 2013 with 7 classes chosen to thematically correspond to the LandSat 5 image