Forest density mapping for semi-arid forests using Sentinel 2 and reference data extracted from Google and Bing imagery

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Introduction

Zagros Mountains in western Iran provides multiple ecosystem services. In semi-arid forests, comprehensive information on forest density gives a clear picture of the status of the forests. Forest density is an important parameter to identify declining forest areas from the satellite data as too sparse canopy cover may lead to a weak signal that may get lost in the signal-to-noise ratio of the satellite datasets. Accurate mapping of forest variables from satellite imagery over arid and semi-arid regions still remains a challenge. Therefore in this study, the forest density of the complete Zagros area in Iran will be estimated.

Research questions

1) Where are the forested areas across the Zagros region? 2) What is the corresponding density of the forests?

Methodology

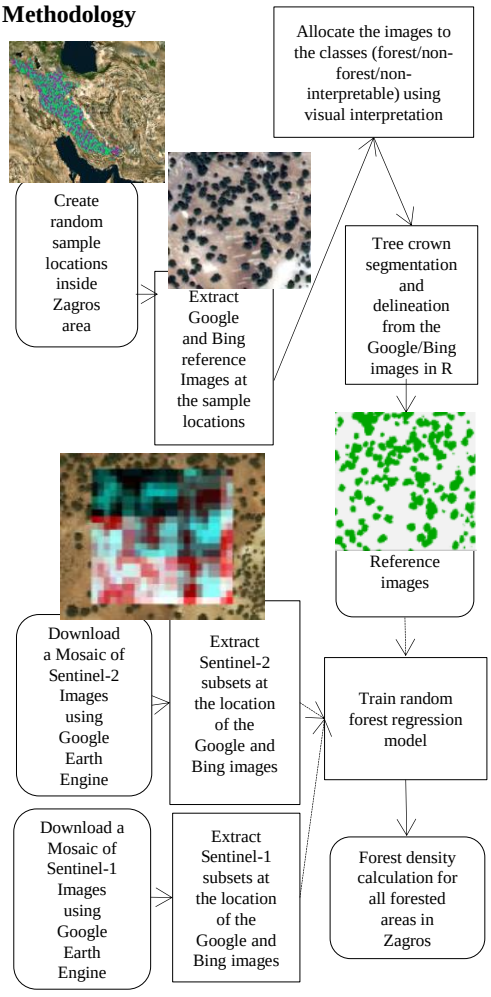
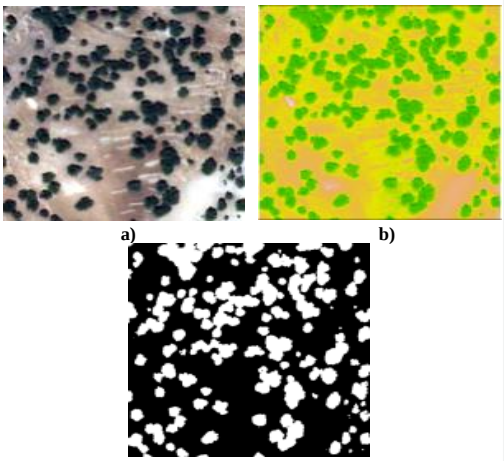


Fig1) Methodology

Preliminary Results

We developed a simple threshold-based function that delineates the trees from the Google/Bing images.



a) **b)**

c)

Fig2) A sample outputs of the tree crown segmentation approach on a Google image of the Zagros area (a: shows the original image in RGB, b: shows the blue channel in DN values, c: shows the final binary values)

Our first results using a Random Forest Model showed stable relationships between the reference datasets and the Sentinel-2 based estimates of forest density (variance of approximately 70%). Further research will be directed to refine our workflow by including Sentinel-1 SAR imagery. This will finally lead to creating a map of forest density for the entire Zagros forest area.

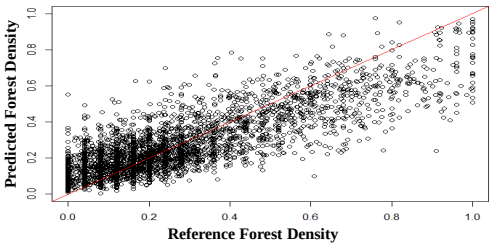


Fig 3) 1st result of Random Forest Model

Conclusions

The work-flow is potentially also applicable to other arid and semi-arid forest areas and can contribute to improve currently available global forest cover products, which often perform poorly across semi-arid areas covered by sparse forests.

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