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Sentinel-2 derivatives are rewriting land-cover history

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Abstract

The terms, land-use, land-cover and change detection, gained their full meanings and came to researches' attentions after NASA's first Landsat, the Earth Resource Technology Satellite, was launched in July 1972, started monitoring the Earth and collecting data. Successional namesake satellites have continued Earth monitoring missions, even today. They have later been challenged by SPOT and IRS missions, being also continued by France's and India's respected institutions. Famous CORINE land cover maps which have been released by Copernicus Land Monitoring Service for five periods since 1990 primarily used the imagery captured by these missions. In the last coverage of 2018, though, a new imagery amassed by a completely new mission called Sentinel-2, has taken over the task only to be complemented by Landsat-8 for gap filling across the Europe. 10 m multispectral imagery has surpassed expectations in all arenas and has helped in the formation of new global land-cover datasets. This study aimed to present three new such global datasets, Dynamic World by World Research Institute, Google; World Cover by ESA and Land Use/Land Cover Time-series coverages by ESRI, their specifications and field verification results.

Introduction

Land use/land cover maps have mostly been transformed to frequently updated, considerably reliable global datasets displaying the changes occurring in ecosystems, habitats, regions, etc. Monitoring the biodiversity, the health of natural resources, carbon cycle and sequestration, favorable or adverse effects of human endeavors on natural any anthropogenic processes, the effects of shifting climate on agricultural production and natural forest loss/gain can effectively be performed utilizing such maps [1-3].

The concept has always been on the spotlight [4], however the satellite image qualities that have been used to construct such datasets have mostly been configured for specific tasks, so not very many discernable classes were present in earlier such datasets [5-7].

ESA's launch of Sentinel-2A in June, 2015 has started a new era in global land-cover monitoring. With the inclusion of Sentinel 2B in March 2017, the tandem satellites quickly amassed enough data for Google World Research Institute's Dynamic World datasets produced using deep learning [8], European Space Agency's World Cover datasets produced using machine learning [9], and ESRI's Land Cover datasets produced again using deep learning methodologies [10-11].

Material and Method

Three global land-cover datasets were acquired from their respective portals [12-14]. Area of interest was determined as a rectangle plot within downtown Kastamonu; 33.791 and 33.771 Eastern Latitudes, 41.417 and 41.401 Northern Longitudes. 2021 coverages from each dataset was visually compared to the corresponding year's hi-resolution Google Earth imagery.

Results

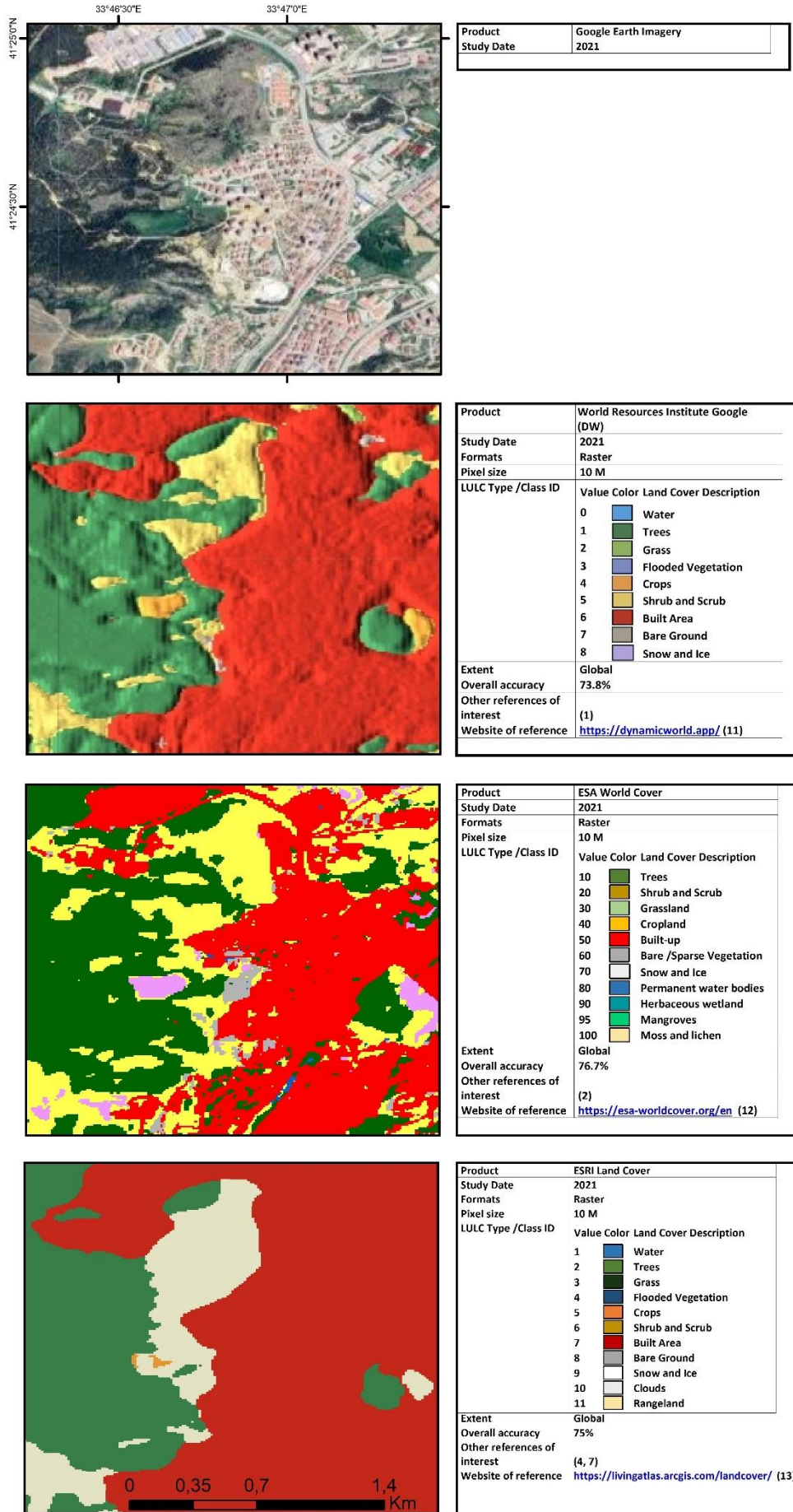


Figure 1. Google earth, Dynamic world, ESA world-cover and ESRI land-cover over Kastamonu study plot

Discussion and Conclusion

Although similar in overall accuracies, ESA world-cover and Google dynamic-world clearly surpassed ESRI land-cover apparent from simple visual comparison. Despite the fact that the very same data, Sentinel-2, were the only imagery used in the construction of all datasets, the different methodologies used in each were the reason that the first two were aesthetically coinciding with the actual land cover parcels and partitions in studied plot while ESRI land-cover fell short in defining them as much precisely. Owing to the exceptionally good quality of Sentinel-2 imagery, such rather detailed land-cover maps that have been produced either with global intentions or with regional interests, will keep surfacing as the satellites operational life-time continues. Near future is ripe for fierce competition in global land cover mapping racing.

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