EO Satellite Based system for monitoring Bracken Fern in Scotland

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Bracken fern (Pteridium) is ranked among the most invasive species of the world (Holland & Aplin 2013). The fern's intrusion has caused great reduction in the quantity and quality of land accessible for grazing (Birnie & Miller 1986). In some cases, farmers permanently abandon agricultural land severely invaded by bracken fern (Schneider & Geoghegan 2006).

Literature has shown that the fern also obstructs secondary forest reestablishment, and does not deliver adequate quality biomass, which improves soil nutrients regeneration (Schneider & Geoghegan 2006; Oldham et al. 2013). In some cases, bracken fern patches have excluded conifer seedlings despite several post-harvest planting efforts (Ferguson and Adams 1994), and even when seedlings do survive, bracken fern can retard seedling growth (Dimock 1964). Bracken fern spread is also a strong obstacle for re-introducing the autochthone fauna.

Empirical evidence from literature has demonstrated that spatial data on bracken fern's spread, its life cycle and fern status cannot be accurately mapped using field surveys in the remote and inaccessible mountainous environments in many parts of the world (Mehner et al. 2004; Ngubane 2014; Odindi et al. 2014). Several studies have used available remote sensing platforms for detection and mapping bracken fern spatial distribution at various scales (e.g. Miller et al. 1990; Holland & Aplin 2013; Ngubane 2014; Singh et al. 2014).

This work concerns the feasibility of developing an EO satellite-based system capable of mapping the presence of bracken fern vegetation and monitoring its distribution in a predefined area of western highlands in Scotland.

The study considers also the impact of clouds, often present in the area of interest, and assesses the suitability of different available satellite sensors and their products (in terms of spatial, spectral and temporal resolution) as a means for achieving the objective.

The challenges encountered include problems of similarity in the spectral signatures of bracken and other vegetation species, leading to low classification accuracy. This aspect has been minimized by using an approach which considers the specific phenology of the behaviour of the vegetation of interest. Preliminary results shown summer months (June, July) as the best period during the year to monitor this area of interest, due to the minimum presence of clouds and...
shadow areas. Regarding the use of SAR imagery, also foreshortening and layover effects caused in this mountainous area limit the possibility to monitor the evolution of these plants.