

A REVIEW ON SUSTAINABLE CROPPING PRACTICES: REMOTE SENSING

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Abstract:

For agronomic, environmental, and economic reasons, the need for spatialized information about agricultural practices is expected to rapidly increase. In this context, we reviewed the literature on remote sensing for mapping cropping practices. The reviewed studies were grouped into three categories of practices: crop succession (crop rotation and fallowing), cropping pattern (single tree crop planting pattern, sequential cropping, and intercropping/agroforestry), and cropping techniques (irrigation, soil tillage, harvest and post-harvest practices, crop varieties, and agro-ecological infrastructures). We observed that the majority of the studies were exploratory investigations, tested on a local scale with a high dependence on ground data, and used only one type of remote sensing sensor. Furthermore, to be correctly implemented, most of the methods relied heavily on local knowledge on the management practices, the environment, and the biological material. These limitations point to future research directions, such as the use of land stratification, multi-sensor data combination, and expert knowledge-driven methods. Finally, the new spatial technologies, and particularly the Sentinel constellation, are expected to improve the monitoring of cropping practices in the challenging context of food security and better management of agro-environmental issues.

Keywords: Agroforestry, Cropping Pattern, Irrigation, Multiple Cropping, Rotation Tillage.

I. INTRODUCTION

In phrases of productiveness, use of natural assets, and farmer earnings, the significance of cropping practices has long been identified by way of the worldwide community, who therefore described the concept and hints of properly agricultural practices (hole) under the meals and Agriculture organisation (FAO) steering. The distance intention at generating safe and wholesome food and non-food agricultural products, even as handling and improving environmental habitats. For this reason, the guidelines inspire stepped forward water and soil control, crop and fodder manufacturing, pest and disease control, and electricity and waste management, on the farm scale. As meals is produced on a worldwide scale, it's far an increasing number of tough for countrywide governments and consumers to manipulate the

production technique. therefore, traceability and verification of top agricultural practices is critical and to acquire this, the needs for spatial facts are expected to develop hastily[1].

Remote sensing has been proven to be an effective tool for tracking cropping practices. Because of a large kind of on-board sensors on increasingly more civilian satellites, the spectral and temporal properties of the land floor due to human practices can be captured and monitored at unique spatial and temporal scales. But, a detailed literature evaluation confirmed that much less than 10% of the courses on remote sensing and agriculture really recognition on cropping practices. Given its importance, a status record on the abilities of faraway sensing for mapping and characterizing cropping structures is past due. Consequently, we reviewed the literature on far off sensing statistics and the techniques used to produce spatial information on cropping practices. Significantly, crop type mapping the use of far off sensing changed into now not covered, because it was already reviewed in recent guides[2].

II. DISCUSSION

Cropping pattern

Cropping pattern is defined here as the yearly series and spatial association of vegetation, or of crops and pasture, on a given piece of land. More than one cropping is while more than one crop is concerned, rather than unmarried cropping[3].

Single Cropping

For single cropping, the cropping sample refers to the spatial arrangement of the plants. The full-size majority of the far off sensing research cope with the spatial styles of tree plants, consisting of orchards and vineyards. Few studies have reported on annual crop row orientation[2].

Tree Crop Planting Pattern: Tree crops represent a full-size part of agricultural landscapes, and their specific cropping practices imply they have to be mapped one at a time from annual plants. The information in their presence and associated cropping practices contributes each to panorama ecology and within your budget surveys. some tree crops, inclusive of nut groves and vineyards, are eligible for aid payments from the ecu common Agricultural coverage for precise plot sizes and tree planting densities. Faraway sensing has hence been evolved as a tool for subsidies control, as an example, with the primary intention being to map the areas of everlasting crops[4].

Multiple Cropping

Sequential Cropping: Sequential cropping includes harvesting multiple crop sequentially in the course of the equal growing season. In regions with enough rainfall and a protracted frost-free duration, one, two, or maybe three harvests are feasible per 12 months. The main cause for adopting sequential cropping systems is financial because it creates a rapid boom inside the land productiveness. Nonetheless, sequential cropping also can be associated with the adoption of ecological cropping practices. As an example, the second crop is frequently sown both to enjoy the quit of the wet season and to enable the adoption of no-tillage practices. Via doing so, the soil pleasant is progressed with the aid of limiting the loss of chemical merchandise and organic matter thru erosion, and through retaining water for a longer length, which permit

farmers to achieve better yields. Sequential cropping may help combat against crop diseases, as was the case with the Asiatic rust soybean disorder, whose enlargement inside the Southern Amazon become aided via the soy monoculture. Subsequently, considering double cropping increases crop manufacturing in present agricultural areas, it limits land use changes together with tropical deforestation pushed with the aid of agricultural expansion[5].

Intercropping/Agroforestry: Few far flung sensing studies address intercropping. This could be explained by the infra-metric scale of the intra-area variability of blended crop fields. Most effective agroforestry structures may be taken into consideration as an exception, and are detailed hereafter. Agroforestry is the practice of developing crops and bushes, and once in a while preserving animals, together. That is a multifunctional land-use machine and generation that gives a extensive range of economic, sociocultural, and environmental advantages. The ecologically-based dynamic integration of bushes on farms and in the agricultural landscape diversifies and sustains production for land customers at all degrees, improving food supply, income, fitness, and environmental sustainability, even within the most industrialized nations. Among these benefits, agroforestry supports food manufacturing through improving fertility, controlling soil erosion, improving water fine, and by way of sequestering large quantities of carbon[6].

Cropping Techniques

Crop management strategies are the ensemble of strategies used to develop a given crop on a given land, from the soil coaching to the publish-harvest practices, together with application of inputs (fertilizers, irrigation, insecticides and herbicides), crop variety choice, harvest mode, and implementation of agro-ecological shape associated with the fields. now not all strategies may be remotely sensed, however a few can be effortlessly identified from area. Hereafter, we selected best to give the crop management strategies that were largely represented in the faraway sensing literature. however, we are conscious that many other practices had been investigated, which includes, for instance, cowl crop adoption or plastic-mulching in China. Fertilization is a particular case, as many research exist on using far flung sensing for estimating the reput of a wide range of vegetation in phrases of nitrogen, phosphorus, or potassium content, however to our know-how, none of them targeted on mapping the lifestyles or absence of fertilization. Consequently, this crop management method isn't addressed on this paper[7].

Irrigation: Among all crop control techniques, irrigation is of top significance for growing crop productivity. Since the 1970s, agricultural production has doubled inside an area that has handiest accelerated with the aid of 12%, and part of this gain may be attributed to an increase in irrigation, around 50% of the sector food is produced beneath irrigation or tired soils, making agricultural production responsible for about 80% of worldwide water consumption. growth of irrigated agriculture is hence one of the driving forces for the growing worldwide call for water. Because of growth in populace and meals call for, irrigated regions are anticipated to nearly double by means of 2050 in a context of weather change and reducing water availability, even as inflicting large environmental changes. Consequently, cropland products ought to discriminate between crop watering strategies (rainfed vs. irrigated areas) to display crop water use and analyze food protection situations[8].

Remote sensing can provide valuable facts related to irrigation that can be applied to water control making plans and assessment, along with water use, performance prognosis, strategic

planning, and effect evaluation. We awareness here on the usage of far flung sensing for identifying and mapping irrigated areas. We considered irrigated land as areas, from smallholder to intensive farming, artificially receiving complete or partial supplemental irrigation to atone for the inadequate precipitation during the developing season[9].

Soil Tillage: Tillage, described as the set of soil operations done for diverse reasons inclusive of seedbed guidance, weed control, nutrient incorporation, and water management, is a key element of cropping structures. Tillage modifies the soil cover, water content, temperature, aeration, and aggregation, affecting soil organic carbon and vitamins, soil susceptibility to erosion, and soil organisms. Specially, the function of crop residue cowl inside the protection of agricultural soils in opposition to water or wind erosion may be very essential. in the united states, estimates of soil loss because of specific tillage practices ranged from 328 kg/ha/y to 8619 kg/ha/y. Inside the Pampas area of Argentina, variations of up to a few Mg/ha of soil organic carbon (C) had been located because of tillage practices. Tillage practices can be coarsely categorised as conservation or conventional, primarily based on the amount of plant muddle closing at the soil floor. Conservation tillage usually involves few interventions, and is also referred as no-tillage (i.e., direct sowing) or reduced tillage (i.e., vertical tillage) practices. In preferred, conservation tillage maintains greater than 30% of the residue cover. Conversely, traditional tillage generates widespread soil displacement as the soil is turned over and furrows are cut with the aid of plough implements. As preliminary soil aggregates are coarse, conventional tillage calls for numerous interventions earlier than sowing. far off sensing techniques are primarily based at the assessment of the 2 capabilities which might be strongly changed via tillage systems: residue cover and surface roughness. Many research have pronounced at the qualitative and quantitative estimation of residue cowl with optical multi or hyperspectral sensors. Optical far flung sensing exploits the spectral differences among crop residues and soil the usage of the shortwave infrared location of the electromagnetic spectrum and, especially, with an absorption feature from cellulose and lignin at 2100 nm. for example, Researchers tested 5 supervised classification strategies to map no-till and traditional tillage the usage of a unmarried Landsat 7 ETM scene. They found that the spectral perspective techniques outperformed the traditional techniques, with an universal accuracy above 96% and a Kappa above zero. similarly, Another researcher discovered ideal consequences, with general accuracies ranging from sixty six% to 91%, the usage of artificial neural networks and single Landsat five TM scenes. But, Few researchers did not detect tilled fields using a unmarried Landsat scene the use of regression and classification bushes, suggesting that discrimination capability is time dependent. indeed, investigators considerably progressed tillage category accuracy through growing the variety of Landsat scenes fed to a random woodland classifier[10].

Crop Varieties: The capacity to as it should be classify crop sorts should potentially improve yield forecasting models and monitoring the signs of crop situations thru better parameterization. Information of crop range also can assist to reduce terrible impacts associated with ailment spread, presenting important records for certification and manipulate. For instance, the identity of sorts the use of information from an orbital-borne sensor should help institutions that breed types for royalty fees for the propagation in their genetic cloth, by means of lowering assessment time and discipline-checking efforts. Ultimately, sorts can be important to the definition of a geographical indication, like in vineyards wherein the inventories

maintained via authorities authorities from information passed on with the aid of producers may want to, to a few diploma, be certified the use of faraway sensing statistics[11].

III. CONCLUSION

The overview of the literature suggests that the far flung sensing network has focused at the detection and characterization of agricultural practices. The practices worried are numerous, the use of distinctive assets of information and strategies, but are typically restricted to case research. This shortcoming is easily explained with the aid of the extensive variety and variability of agricultural practices, which can't be well captured and described on the plot scale over massive regions, because of the shortage of suitable satellite tv for pc information, which include dense time collection of optical and radar pix at decametric decision. The growing availability of remote sensing statistics, specifically the loose european Sentinel-1 and 2 constellations records appropriate for small to medium discipline size monitoring, and the emergence of recent data processing strategies inclusive of records mining and deep mastering, have to stimulate the research on this region, as well as the education applications of the subsequent satellite tv for pc era with LiDAR and hyperspectral sensors on board. Pending the next generation of satellite tv for pc sensors, the research must awareness on the modern-day satellite tv for pc technologies, and discover the mixture of various satellite sensors (optical and radar, multi decision, and so forth.) and ancillary statistics (expertise, census records, and so on.), for homogeneous land devices. Consequently, remote sensing is expected to improve spatial expertise of agricultural practices and cropping structures, and therefore enhance its position inside the sustainable control of those complicated structures.

IV. REFERENCES

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