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# Digital Soil Mapping Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented By Technology (Soil Spectroscopy & Proximal Soil Sensing, GIS, Remote Sensing Systems, LiDAR Technology, Others), By Parameter (Soil pH, Soil Organic Matter, Available Nitrogen/Phosphorous/Potassium, Others), By Application (Soil Management, Ecosystem Enhancement, Climate Change Abatement, Quality Food Production, Others), By End User (Soil Scientists, Research & Academic Institutions, Government & Federal/Agencies, Agronomists, Others), By Region and Competition, 2019-2029F

https://marketpublishers.com/r/DFA82B4836D7EN.html
Date: April 2024
Pages: 180
Price: US$ 4,900.00 (Single User License)
ID: DFA82B4836D7EN

## Abstracts

Global Digital Soil Mapping Market was valued at USD 146.38 Million in 2023 and is anticipated to project impressive growth in the forecast period with a CAGR of 7.66% through 2029.Digital Soil Mapping (DSM) is an innovative method of soil mapping employing computer algorithms to generate maps depicting soil types, properties, and classifications. By harnessing spatially referenced soil data alongside environmental factors like climate data, vegetation, and topography, DSM utilizes advanced statistical methods to forecast the spatial distribution of soils across a terrain. This technology plays a vital role in contemporary soil science, offering a comprehensive and precise understanding of soil variability crucial for land management and environmental planning.

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The Digital Soil Mapping Market pertains to employing computer-aided techniques for gathering, analyzing, and interpreting soil data and information. This approach utilizes remote sensing and geographic information systems (GIS) to generate spatially referenced soil forecasts. The market encompasses a diverse range of tools and services provided by companies to facilitate soil analysis, crop management, and land use planning. As global demand escalates for sustainable farming practices and precision agriculture, substantial growth is anticipated in the digital soil mapping market.

Key Market Drivers

Rapid Rise in Precision Agriculture

Precision agriculture, which utilizes advanced technologies to optimize crop management, is experiencing rapid growth worldwide. This expansion is expected to significantly increase the demand for Digital Soil Mapping (DSM). DSM, a key element of precision agriculture, involves the use of digital technologies to gather, organize, and interpret soil-related data. As precision farming methods become more widespread, the importance of precise and comprehensive soil information becomes more pronounced. Farmers, agricultural advisors, and researchers can utilize DSM to understand soil characteristics such as pH, fertility, and moisture levels, enabling them to make informed decisions about crop placement, irrigation, and fertilizer usage. The rise of precision agriculture aligns with heightened concerns about sustainability and the imperative for resource efficiency. DSM contributes to this narrative by promoting efficient resource allocation and reducing environmental impact. The global shift towards sustainable farming, driven by the rapid adoption of precision agriculture, is expected to drive the demand for DSM. Given its potential to improve crop productivity, reduce waste, and promote sustainable practices, DSM is poised to become a fundamental component of the global agricultural landscape.

Increased Growth of The Organic Food Industry

The expanding global organic food industry is anticipated to greatly enhance the need for digital soil mapping. As consumers increasingly prioritize the sustainability and quality of their food choices, the appeal of organic farming—seen as healthier and more environmentally friendly—is fueling demand for more efficient agricultural methods. Digital soil mapping, a key method in this regard, offers crucial insights into soil health, nutrient levels, and crop suitability, making it indispensable for organic farmers. By utilizing data-driven insights from these digital maps, farmers can optimize organic

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resource utilization, enhance crop health and yield, and ensure soil sustainability. This improved productivity and sustainability, in turn, attracted more farmers to organic practices, thereby propelling the organic food industry's growth. As this industry expands, the demand for digital soil mapping is projected to rise further, establishing a positive feedback loop. This relationship underscores the pivotal role of modern technology in shaping and supporting sustainable agricultural development.

Advancements in GIS (Geographic Information System) Remote Sensing Technologies

The escalation in the application of Geographic Information Systems (GIS) and Remote Sensing technologies is poised to revolutionize digital soil mapping (DSM) on a global scale. These technologies provide a sophisticated platform enabling soil scientists to model and map soil properties with increased speed, accuracy, and efficiency. GIS, with its ability to store, manage, and analyze geospatial data, is instrumental in the delineation of soil units, while Remote Sensing facilitates the capturing of data over large areas, exploring surface soil characteristics and vegetation indices linked to soil properties. The integration of these technologies in DSM allows for the creation of high-resolution, three-dimensional soil property maps that can be easily updated and shared. This not only aids in the optimal utilization of soil resources but also the decision-making process related to land management, agriculture, and environmental planning. The growth of GIS and Remote Sensing technologies, coupled with an increasing global emphasis on sustainable agriculture and climate change resilience, is anticipated to significantly drive the demand for DSM worldwide. The benefits are myriad: bolstering food security, aiding in disaster risk reduction, and supporting initiatives for sustainable land use. In leveraging these advanced technologies, DSM is set to become an indispensable tool in the global quest for a sustainable future.

Adoption of Machine Learning AI in Soil Mapping

Machine Learning (ML) and Artificial Intelligence (AI) are transforming numerous industries, including agriculture, particularly through their utilization in soil mapping, which has significant potential to drive the adoption of Digital Soil Mapping (DSM) worldwide. ML and AI algorithms excel at swiftly and accurately analyzing extensive soil datasets, enhancing the precision and efficiency of soil mapping processes. By deciphering patterns in soil attributes like nutrients and properties, these technologies offer vital insights to enhance crop productivity and refine land management strategies. This unprecedented level of detail and accuracy in soil mapping signals a shift from traditional to digital methodologies.

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Additionally, ML and AI-driven soil mapping can anticipate future soil conditions under varying climates and management practices, aiding proactive decision-making. This predictive ability is crucial for meeting rising food demands amidst climate fluctuations. Furthermore, the capacity to integrate and interpret soil data across different scales, from local farms to global contexts, promotes cross-regional analysis and collaborative efforts in sustainable farming practices. Consequently, the integration of ML and AI in soil mapping is not merely a burgeoning trend but a necessity in our swiftly digitizing world, expected to drive the global demand for DSM.

## Key Market Challenges

### High Costs Associated with Soil Data Collection Analysis

The high costs associated with soil data collection and analysis are anticipated to curtail the global demand for digital soil mapping. Digital soil mapping, while offering numerous benefits such as improved land use planning and enhanced agricultural productivity, requires sizable resource allocation for soil data gathering and interpretation. This process often necessitates the use of advanced technologies and expertise, which can be prohibitively expensive, especially for developing countries. Furthermore, the need for continuous monitoring and updating of the soil information to maintain the accuracy of digital soil maps adds to the overall expenditure. The expensive nature of these processes creates a barrier, making digital soil mapping less accessible and thereby decreasing its demand on a global scale. This situation is especially prevalent in low-income countries where budgetary constraints significantly limit the uptake of such technologically advanced and cost-intensive soil mapping methods. Consequently, unless strategies are implemented to lower these costs or increase funding, the high expense associated with soil data collection and analysis will continue to dampen the global demand for digital soil mapping.

### Lack of Skilled Professionals

The burgeoning demand for Digital Soil Mapping (DSM) is anticipated to experience a deceleration on a global scale, largely attributable to a stark shortage in skilled professionals in this field. DSM, a sophisticated technique that applies statistical and geostatistical methods to predict the spatial distribution of soil properties, has proven instrumental in agriculture, landscaping, and environmental science. However, the complexity of these methods necessitates a deep understanding of both soil science and digital mapping technologies. The dearth of professionals with such dual expertise is proving to be a significant bottleneck. Furthermore, inadequate training opportunities

and a lack of emphasis on DSM in mainstream education contribute to this scarcity. The growing divide between the technological advancements in DSM and the skill set of the available workforce is expected to undermine the potential of DSM, thus decreasing its demand. Therefore, to ensure continued growth and utilization of DSM, it's imperative to invest in educational programs and training that can produce competent professionals in this sphere.

Key Market Trends

Rise in Integration of IoT (Internet of Things) in Agricultural Practices

The surge in the integration of Internet of Things (IoT) technology into agricultural practices is anticipated to catalyze global demand for digital soil mapping. IoT devices provide real-time data collection and analysis, allowing for precise soil characterization and management. These smart devices, equipped with sensors, can monitor various parameters such as soil moisture, temperature, pH, and nutrient levels. This data, when fed into digital soil maps, enables farmers to implement targeted irrigation and fertilization strategies, optimizing resource usage and enhancing crop yield. Furthermore, IoT facilitates remote monitoring, adding a layer of convenience and efficiency to farm management. The predictive capabilities of these technologies also help in proactive decision-making, mitigating potential risks associated with unpredictable weather conditions or pest infestations. By fostering precision agriculture, the amalgamation of IoT and digital soil mapping is set to revolutionize farming practices, making them more sustainable and productive. Given these advantages, the rise in IoT usage in agriculture is expected to significantly drive the global scale of digital soil mapping.

Increased Demand for Smart Greenhouses

The escalating demand for smart greenhouses is inevitably contributing to the global demand for Digital Soil Mapping (DSM). As the world becomes more technologically reliant, the agricultural sector is no exception, exploring forward-thinking approaches to boost yield and efficiency. Smart greenhouses use advanced technologies, including DSM, to optimize growing conditions. DSM is a powerful tool that leverages digital technology to analyze soil data and generate detailed maps reflecting soil properties. This technology is fundamental in smart greenhouses, facilitating precision farming by providing insights into soil characteristics, nutrient status, and potential yield. As more smart greenhouses are established globally, the usage of DSM will invariably rise. Further, DSM's ability to promote sustainable farming by improving fertilizer application

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and reducing environmental degradation has garnered significant attention. Therefore, as the global focus shifts toward sustainable and efficient farming methods, DSM's demand is expected to concurrently escalate. The inevitable expansion of smart greenhouses will catalyze this growth, making DSM a cornerstone of modern, sustainable agriculture.

Segmental Insights

Technology Insights

Based on the technology, geographic information systems (GIS) have emerged as the most dominant and ground-breaking technology in the realm of digital soil mapping. Its exceptional capacity to capture, store, manipulate, analyze, manage, and present diverse geographical data has rendered it invaluable in this context. By seamlessly integrating multiple types of data, including satellite imagery, remote sensing data, and ground-based measurements, GIS enables the creation of comprehensive, multidimensional views that reveal intricate soil attributes with unprecedented detail.

This deep understanding of soil characteristics and dynamics greatly contributes to soil conservation efforts and facilitates more effective agricultural planning. By leveraging the power of GIS, researchers and land managers can develop precise soil management strategies, optimize resource allocation, and implement sustainable land use practices. The insights gained from GIS-based soil mapping play a vital role in ensuring a greener future, where agricultural productivity is maximized, environmental impacts are minimized, and the delicate balance between human needs and natural ecosystems is maintained.

Application Insights

Based on the application, climate change abatement has emerged as the dominant sector in the global digital soil mapping market. This dominance can be largely attributed to the escalating urgency among international communities to mitigate the far-reaching impacts of climate change. As the world grapples with the consequences of global warming, there has been a significant surge in the demand for advanced and precise soil mapping technologies. These innovative technologies play a pivotal role in developing effective strategies for carbon sequestration and reducing greenhouse gas emissions, thereby contributing to the overall fight against climate change. By providing accurate and detailed information about soil properties, composition, and nutrient levels, digital soil mapping enables policymakers, scientists, and land managers to make

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informed decisions and implement targeted interventions. The integration of advanced technologies in soil mapping not only enhances our understanding of soil dynamics but also facilitates the development of sustainable agricultural practices and land-use planning. With climate change being one of the most pressing challenges of our time, the significance of the Global Digital Soil Mapping Market in driving impactful solutions cannot be overstated.

Regional Insights

The digital soil mapping market is currently led by North America, largely due to its advanced technology, active research efforts, and strong emphasis on precision agriculture. The region's well-established infrastructure and highly developed agricultural sector enable it to adopt innovative soil mapping technologies effectively. These technologies have empowered farmers in North America to enhance agricultural productivity, refine soil management practices, and promote sustainable farming methods.Moreover, North America's dominance underscores its steadfast dedication to agricultural innovation and driving progress in soil mapping. Continuous investments in research and development, along with collaboration among stakeholders, have facilitated groundbreaking discoveries and state-of-the-art solutions in this field. As the demand for precise soil information grows, North America remains well-positioned to lead the digital soil mapping market. Its proactive stance in embracing new technologies and commitment to precision farming solidify its role as a major influencer in shaping global agricultural practices.

Key Market Players

SoilOptix (Hubei Forbon Technologies Practical Precision)

Veris Technologies, Inc.

Crop Nutrition Laboratory Services Ltd.

Soil-Right Consulting Services, Inc.

SmartCloudFarming GmbH

H L Hutchinson Limited

In this report, the Global Digital Soil Mapping Market has been segmented into the

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following categories, in addition to the industry trends which have also been detailed below:

Digital Soil Mapping Market,By Technology:

oSoil Spectroscopy Proximal Soil Sensing

oGIS

oRemote Sensing Systems

oLiDAR Technology

oOthers

Digital Soil Mapping Market,By Parameter:

oSoil pH

oSoil Organic Matter

oAvailable Nitrogen/Phosphorous/Potassium

oOthers

Digital Soil Mapping Market,By Application:

oSoil Management

oEcosystem Enhancement

oClimate Change Abatement

oQuality Food Production

oOthers

Digital Soil Mapping Market,By End User:

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oSoil Scientists

oResearch Academic Institutions

oGovernment Federal/Agencies

oAgronomists

oOthers

Digital Soil Mapping Market, By Region:

oNorth America

United States

Canada

Mexico

oEurope

France

United Kingdom

Italy

Germany

Spain

oAsia-Pacific

China

India

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Japan

Australia

South Korea

oSouth America

Brazil

Argentina

Colombia

oMiddle East Africa

South Africa

Saudi Arabia

UAE

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Digital Soil Mapping Market.

Available Customizations:

Global Digital Soil Mapping market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

Company Information

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Detailed analysis and profiling of additional market players (up to five).

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