Quantum Spatial, Inc. (QSI) has extensive experience delivering aerial LiDAR, orthophotos, oblique imagery, and HD video; as well as providing mapping services, products, and analytics in support of vegetation management. The QSI team offers a comprehensive Transmission Vegetation Management Program (TVMP) for our utility customers seeking regulatory compliance and Integrated Vegetation Management (IVM) best practices. QSI has developed a thorough understanding of data quality, format, and specifics. With extensive expertise in utility vegetation management, engineering-grade as-built surveys, PLS-CADD modeling, thermal line rating analysis, data-synchronized full motion HD video, clearance reporting tools, and interactive software, QSI has resources and expertise unmatched in our industry. Further, we have earned a reputation for developing client-centric solutions that promote maximum utilization of the data we deliver. Having completed over 60,000 miles of electrical transmission surveys for as-built, reconductoring, siting & new construction, re-rates, NERC clearance detections and ROW management, our professionals have the expertise to provide accurate, cost efficient, and timely results. The QSI team has successfully surveyed transmission projects for diverse utility clients across North America and internationally.

**Spatial Rectification and PLS-CADD Asset Model**
Knowing the precise 3D location of transmission assets is the only way to fully understand vegetation encroachment issues. QSI uses remotely sensed data to determine the exact spatial relationships between transmission infrastructure and encroaching vegetation, reducing or eliminating the need for traditional field verification. Each remote sensing survey creates a snapshot in time that serves a permanent record of system status which can be referenced for planning, mitigation, review, and restoration.
**Obstructions and Detections**
QSI has created a system for identifying varying levels of severity for vegetation grow-in and fall-in analysis. Encroaching vegetation clearance points are identified in the LiDAR point cloud for wires of ambient temperature and standard loading, and for maximum operation conditions. Obstructing vegetation is associated with an individual treetop point and crown polygon and attributed with the most severe of each detected LiDAR point cloud cluster comprising a single tree. MGCC, or Minimum Ground to Conductor Clearance, indicates the minimum ground clearance distance at any point along a wire catenary and the results can be infinitely sampled for analytic use.

**Cage Clearances**
LiDAR point cloud data is analyzed to identify areas of vegetation encroachment around transmission structures; this process is referred to as cage clearance analysis. Cage clearance is reported by zone, with zones based on distances from the structure and determined by tower design. All surrounding vegetation near the tower base or legs is spatially identified at its bounds.

**Vegetation Health and Species**
The QSI TVMP solution incorporates both vegetation health and species into its analysis results. It is understood that certain tree species in certain geographic regions are responsible for a majority of vegetation-related outages. Whether it’s Pines and Oaks in the western US or Ash on the East coast, QSI will single out the species of highest concern and identify whether the tree is diseased or dead in order to preserve the reliability of the transmission system. Hyperspectral and traditional orthographic imaging sensors are both used in identifying species and tree health.
Programmatic Vegetation Mitigation
Vegetation within the LiDAR point cloud is classified as such, which then allows for the extraction of tree crown polygons and identification of treetops. A vector model of transmission poles and wires is used to test the 3D distance between vegetation-classed points and conductors. Tree health is assessed with the aid of orthophotography utilizing the Near-Infrared band to highlight chlorophyll. Alternately, hyperspectral data can be used for the same purpose. Tree-level analytics are provided that define the distance and severity of vegetation encroachments. Hyperspectral signatures are collected for species and genus-level identification of problem vegetation. The combination of all of the above analysis allows a utility to manage its vegetation with confidence from end to end.

Integrated Vegetation Management
Vegetation between 18 inches and 6 feet are analyzed to identify potential areas of Integrated Vegetation Management (IVM). The US Environmental Protection Agency defines IVM as “the practice of promoting desirable, stable, low-growing plant communities—that will resist invasion by tall-growing tree species—through the use of appropriate, environmentally sound, and cost-effective control methods.” (EPA’s IVM Fact Sheet). QSI creates IVM candidate polygons for areas of IVM-classified points larger than 1/10 of an acre (4,356 square feet). While LiDAR analysis alone cannot confirm IVM, the IVM polygons produced through QSI’s analysis delineate areas that are highly likely to meet IVM criteria. In addition, species identification with hyperspectral data can be assessed within IVM areas. IVM analysis makes it possible to track changes over time and show marked improvement and environmental stewardship in Right-of-Way management.

Vegetation Change Quantification
Change detection can isolate any identifiable features captured by remotely sensed data year-over-year. Vegetation growth and maintenance effectiveness can be evaluated each year or season if desired. The high degree of absolute accuracy of our data (~5-10cm) allows for detailed vegetation change detection at the branch level. QSI couples this precise change detection analysis of the LiDAR point cloud with proprietary “tree tracking” methods for detailed comparisons of individual trees year after year.

Vegetation Risk Analysis
Vegetation management can be performed more efficiently and effectively with the use of LiDAR analytics. Identification of all tree crowns and treetops on or near transmission lines, paired with health and species attributes, identifies potential risk. LiDAR-based clearance, health, and species analysis provides a “prioritization prescription” that is applied to identified vegetation encroachments. The combination of all TVMP analysis and analytics is best consumed in Quantum inSITE for Vegetation Management, where risk can be evaluated, reported, and converted into actionable work orders.
Quantum inSITE
The Quantum inSITE™ product suite consists of two distinct classes of functionality that together allow utilities to create and manage a single source of information for location-based data across an organization. Q-inSITE desktop users not only have access to complete vegetation analytics derived from data analysis, they can also make the data actionable through its integration with a utility’s existing legacy vegetation management database or digital records. Quantum inSITE™ is an interactive software tool that unifies cloud-based data and analytics through a web browser or Application Program Interface (API).

The Quantum inSITE™ platform offers a wide range of data integration to existing electric utility management systems for accounting, engineering, and operations. Detailed virtual inspections derived from remotely sensed technologies, such as LiDAR, imagery, and hyperspectral data, can guide workers to the right tree, span, or transmission corridor mile. The tools automate work management to provide real-time tracking and ensure that data stays current; a vegetation management team can confidently direct management efforts to maximize budget and impact.

Contact Quantum Spatial
QSI is the go-to partner for organizations that want to map, model and better manage their world. Our mission is to create actionable information tailored to the client needs and extend it to as many people as possible. Our comprehensive capabilities encompass the acquisition, analysis, integration, and management of geospatial data. We offer a diverse portfolio of advanced imaging and remote sensing technologies, backed by powerful modeling, visualization, GIS, and software tools.

QSI does it all. We go well beyond data acquisition. We excel at transforming data into usable information. We carefully consider technology choices and survey design to optimize data quality, and then transform pixels and points into meaningful analytics based on the questions you want to answer. For any request, large or small, please contact the Business Inquires Line, 800-558-6707.