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# Application of Remote Sensing Technology in Forest Resources Investigation

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***Abstract:*** The continuous development of remote sensing technology further provides an effective guarantee for the development of forest resources management, and the scientific application of remote sensing technology can continuously improve the level of forest resources investigation. Based on this, this article explores the specific application methods of remote sensing technology combined with the development of forest first-class and second-class investigation.

***Keywords:*** Remote Sensing Technology; Investigation of Forest Resources; Strategy

## 1. Introduction

Forestry is an important foundation of China's sustainable development. It provides many services and social benefits, including carbon storage, animal and plant habitats, and leisure activities, as well as wood or non-wood products. Nowadays, with the increasingly complex and urgent demand for forestry, it is necessary to plan and manage forestry better, with the emphasis on the need for efficient and accurate tools. Remote sensing is a powerful tool for analysis, synthesis and reporting, which can provide a lot of detailed information about forestry and help to make decisions in advance. Moreover, there's a huge area of forestry land in China, so it is an arduous task to manage such a large area of forestry in a timely and effective manner. Therefore, it is very urgent to apply advanced and scientific remote sensing technology to forestry management. In order to improve the level of forest resources management, remote sensing technology should be applied scientifically. Based on the actual work, this article explores the specific application measures of remote sensing technology, hoping that the analysis can provide effective reference for relevant staff, thus further ensuring the application efficiency of remote sensing technology.

## 2. Overview of remote sensing technology

Remote sensing refers to the science of obtaining information about objects without contacting them. It is mainly accomplished by sensing and recording the emitted energy, and then analyzing, processing and applying the information. In the process of applying remote sensing, different materials will produce different levels of radiant energy, which is due to factors such as surface roughness, intensity, incident angle and wavelength of radiant energy. The tools commonly used for remote sensing in forestry are airplanes and satellites. Besides, it includes sensors, radar laser altimeter, radiometer and spectrometer. The so-called remote sensing technology is to use airplanes and satellites to collect photos of the earth's surface and its phenomena. It can also be used in forestry to forecast weather and study forest ecosystem.

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In the past ten years, remote sensing technology has achieved great scientific progress with many technologies that can retrieve information in various management fields from strategic forestry to operational forestry. New systems such as radar, lidar or other optical sensors complement the traditional use of aerial photography. The advantages of these methods are fast data collection, easy integration into GIS data sets, automatic data processing and large-area sampling. However, remote sensing technology can't replace on-site investigation. In fact, both methods should work in a complementary way. Field data is always needed to calibrate and verify remote sensing analysis. Similarly, remote sensing can help increase the value of field investigation. The synergy between the two methods will create a more effective data capture system to present rich and reliable information.

# 3. Application of remote sensing technology in forest survey

## 3.1 Digital image processing

Using remote sensing technology to carry out the survey work can effectively break through the limitation of space, and feed back the specific situation of the survey object by means of the transmission of images and data. Images and other information processed by technicians can truly reflect the relevant information of the investigation environment, thus assisting technicians to predict the development trends of forests. The above information is integrated into the system network, and the basic information of the survey object is presented in the form of digital images, so as to realize the comprehensive investigation and control of the present situation of forest resources.

## 3.2 Problems faced in the investigation of land types and related factors

In the investigation of geographical types, it is necessary to make comprehensive judgment based on the data information obtained in the past to re-determine the specific location of the sample circle. A relatively fixed way for investigation may cause the inconsistency between the actual position and the position on the map due to the limited technical level, which will affect the effect of remote sensing technology due to inaccurate data. If there is a certain error in positioning, it will be impossible to accurately determine the geographical type. Therefore, in order to improve the accuracy of positioning information and give full play to the role of remote sensing technology, technicians should combine GPS means to make up for some functional deficiencies of remote sensing technology. It should be noted that before using GPS to assist positioning, the value of acquired positioning information should not be denied. These data can be used as basic materials for carrying out research work, and can also play an important reference role when necessary. Technicians can gather the previously located coordinate positions together to form an image database, which can be used as important reference for judging geographical types. In addition, when the survey is carried out in a fixed area, the accuracy of the survey data will be affected by the artificially set protection measures. To deal with it, GPS can be used for random positioning and locate the survey area without preset coordinates, so that the acquired data information is more real and accurate, which is conducive to improving the accuracy of judgment on geographical type. The above investigation area can be used as an auxiliary reference, so as to obtain information more objectively and complete the established investigation task.

## 3.3 Investigation of stand factors

For forest areas with large resources, the maintenance efforts of management departments have been strengthened day by day. During the implementation of maintenance and management, the logging ban policy has been implemented in many places to limit the exploitation of resources to the maximum extent. In such areas, the data obtained by the remote sensing survey are of certain reference value. When using remote sensing technology to investigate, it is necessary to integrate the obtained data to establish a digital model, and then carry out the research and analysis of stand factors. Based on the acquired data, technicians can also make a more comprehensive and accurate judgment on the stand factors. The acquired data information can not only ensure the maximum efficiency of remote sensing technology in application, but also save a lot of expenses for investigation. In the later large-scale investigation, this information can also become an important reference for judging stand factors. Therefore, technicians should pay enough attention to the acquired information, and try their best to tap the value of the above information, so as

to provide maximum data support for the investigation.

# 4. The application of remote sensing technology in the second class investigation of forest resources

## 4.1 Geometric correction

TM, ETM and other methods are adopted to carry out geometric correction, all of which can bring out ideal results with an error less than one pixel, and unexpected situations will occur only in a few cases. When using remote sensing technology to investigate the forest situation, the reflection projection of terrain factors will change according to the different heights of equipment when shooting. Therefore, the technician should first correct the shot projection in an orthographic way. DEM is often used for correction to get more accurate data information. In the survey conducted by remote sensing technology, appropriate correction technology should be selected according to the characteristics of the actual survey objects, so as to obtain survey results with higher accuracy and thus achieve the ideal survey purpose.

## 4.2 Band combination ability of multiple remote sensing information sources

There are a large number of bands in most technical categories, so technicians can use various combinations to process images. According to the practice, the combination of TM345 and TM742 is of ideal effect, while the combination of SPOT5 and IKONOS may produce many color bands. The above-mentioned combination methods can be selected for marking soil moisture and other investigation objects, and ideal results can be obtained.

## 4.3 Ability to divide compartments and sub-compartments

There is still some detailed improvement in need in the image information of forest resources obtained by remote sensing technology. It is impossible to clearly and accurately mark the specific positions and lines of ridges or ditches in the images, which causes some obstacles to accurately define compartments and sub-compartments. In practice, the topographic map of this area can be combined with remote sensing technology. The map can accurately and clearly mark the location information of various areas, while remote sensing technology can divide and investigate the above areas more carefully with higher resolution. Combination of the two can finally distinguish compartments from sub-compartments more accurately. It should be noted that technicians should master and apply different kinds of technologies to bring their technological advantages to the best level, and at the same time, pay attention to completing the investigation work together with other auxiliary forms to ensure that the accuracy of the investigation results meets the standard requirements.

## 4.4 Optical technology

Optical technology is the most mature remote sensing method in forestry, in which aerial photography is included. However, the processing methods of aerial photography and digital multispectral data are different. The main purpose of aerial photography is to produce corrective products that can be used for manual interpretation. In addition, photogrammetry can measure images quantitatively. On the other hand, multispectral data mainly depends on radiation information, in which the intensity of light reflected or emitted from the ground is measured in multiple discrete bands (usually the visible and infrared parts of the spectrum). By comparing the reflectivity of ground under different wavelengths, these data can be correlated with the characteristics of ground and vegetation canopy. The most potential application areas are the assessment of population number, classification of vegetation types and estimated forest parameters, such as height, base area and volume. Sensors with high spectral resolution can be used to map forest health based on nutrient and water deficiency and damage caused by pests and diseases.

## 4.5 Radar sensor

Radar sensors (radio detection and ranging) are active systems, which transmit their energy sources as radio signals to determine the characteristics of echoes. They work in the microwave region (mainly X, C, L and P bands) of the electromagnetic spectrum. Each wavelength interacts with the canopy in a different way, so that its components can be better defined. Longer wavelength (P or VHH) can penetrate forest canopy to some extent and retrieve information about potential soil properties. Because microwaves are sensitive to the water content of forest structure and canopy, they can generate complete three-dimensional information about forest

canopy. Optical detection and ranging is an active sensor, which emits laser pulses and uses ultra-high precision clock to measure the return time of each beam traveling between the sensor and the target. By using differential GPS and precise motion positioning of orientation parameters obtained by inertial measurement unit, each return to the known coordinate system can be accurately located. Most commercial systems can collect 20,000 to 75,000 points per second. The system can achieve high vertical and horizontal accuracy, ranging from 15-20 cm root-mean-square error in the vertical direction to 20-30 cm in the horizontal direction. Light detection and ranging instruments can be used to generate crown height models, which can then provide accurate estimation of important forest parameters (such as crown height, stand volume and vertical structure of forest canopy).

## 5. The prospect of remote sensing technology in forestry application

Since the rapid development of remote sensing technology in the last century, various related hardware and software have emerged, such as the launch of various satellites, the relaxation of policies by governments of various countries and the exchange of remote sensing technology among countries, which provides a great opportunity for the development of remote sensing technology. A distinctive feature of the era of big data is the integration of various technologies. Therefore, the application of remote sensing technology must complement other technologies in the future, including the internal and external integration of various remote sensing technologies with other technologies. For example, the combination of airborne laser scanning and digital aerial photogrammetry may have the greatest impact on forest clearing practice in the next ten years; a comprehensive system combined forestry remote sensing with forestry GIS and GPS may realize the automation of forest resources adjustment, planning and management. Biodiversity is constantly changing, thus monitoring is very important. In addition, the data from remote sensing can be used to predict the environment after some species are cleared. Generally, it is very difficult to predict dual diversity without remote sensing data. However, researchers can now fill the gaps by playing with remote sensing information to fill in the accurate results. For example, to predict the environment of a place without trees, the only thing needs to do is erase the data of trees and work with the rest. The results provided are always accurate or close and can be regarded as a reliable source.

## 6. Conclusion

In a word, more standardized technical means should be introduced scientifically in the process of forest resources adjustment. Through the summary of remote sensing technology above, this article puts forward specific application countermeasures, hoping to further promote the sustainable development of forestry construction.

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