

Chapter 5

Applications of GIS in Trend Analysis of Forest Insects and Diseases

Geographic Information System (GIS) is a technological system which provides the functions supported by computer software and hardware to enter, store, update, inquire, manipulate, analyze, synthetically apply, display, map and output the data describing the real world. At present, GIS has been applied in many fields, such as checking and management of resource and environment, and come into being colossal technological industry. Many domestic forest industries have taken the GIS as the important tools in forest management which can not only accomplish general data management, but also establish the professional model for growth, forecast, management and decision based on spatial attribute table and select the best management scheme through simulation, evaluation and comparison for all kinds of management process. If combined with GPS and RS technology, GIS can survey the forest resource dynamic change. But now, there is no GIS for survey and management of forest diseases and insects in true sense in our country.

1. Forest damage forecasting based on GIS

Remote sensing has been used to monitor the damage caused by insects and disease. However, forest protection units are more concerned about the state of insects. There is a relation between the damage and insects, but it is not the same. It is necessary to obtain insect information from damage data. GIS has provided a strong tool manipulating spatial data. Based on the roles of damage occurrence and development and its relation with ecological factors, the state of insect distribution can be obtained with the help of expert knowledge. By using GIS's simulation capability of diffusion, dynamic damage diffusion models can be established, and it can be used to analyze and predict the damage trend. Taking the severe pine caterpillar(*Dendrolimus punctatus* Walker) and pinewood nematode(*Bursaphelenchus xylophilus*) damages in China as examples, analysis and researches have been done. We find that it is still far away to fully integrate Remote Sensing, GIS and GPS in the monitoring and prevention of forest insects and diseases.

2. Management information system of forest pest based on GIS

Now we have built management information system for forest diseases and insects based on GIS in China. The main functions of the system are :

1) Management of basic data of forest diseases and insect pests

Because many investigations and general surveys are carried out by countryside units, we entered the basic maps of roads, water system, terrain and forest distribution with a higher rank than all-provincial district and town rank with countryside unit and built the database corresponding to the image library with all information achieved by many years survey of forest diseases and insects, which can realize the rapid inquiry for past years data and plain display. Now the database mainly includes: all symptom images of forest diseases and insects, all ecological behaviors information of forest diseases and insects and past year's occurrence information which are stored with many style, such as image, word, graph, sound and video, and so on.

2) Processing of basic data of forest diseases and insect pests

With the development of RS technology, it is more and more applied in surveying forest insects and diseases, and at the same time many methods, such as gender enticement, have been introduced to survey and investigate

the forest diseases and insects to mend the disadvantage of manual ground investigation. The investigation results of all approaches need to be rapidly analyzed and processed to make scientific decision.

3) Diffusion of forest diseases and insects decision support

Diffusion of forest diseases and insects is a spatio-temporal dynamic process which need relevant spatial data tools and models to research its occurrence and the relationship with natural and human environment. The perfect spatial analysis function of GIS provides a good condition for this requirement. In the past ten years, many overseas research achievements have firmly supported the efficient management. But in our country, this field is still a undeveloped area.

4) Result output

With the database and image output function of GIS, we can measure the areas with forest diseases and insects, make statistical analysis to the relative data, draw the graph of distribution of forest diseases and insects and the tendency graph of diffusion and extension, and so on.

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