

Study on Hickory Plant Environment Management Based on Web-GIS

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Abstract: In this paper, Web-GIS is imported to manage hickory environment condition date, which can make the date visualize and direct-viewing, and also can easily give advises to the farmers where is good for hickory growing. The data including longitude, latitude, altitude, PH value, hydrolysable nitrogen, Olsen P and available K, which was measured by every 5 kilometers in Lin'an City (a city in Zhejiang province in China). These data were converted into map file format - .shp by ArcView. Then geo-spatial interpolation techniques - Kriging were applied to infer the value of unknown points in Lin'an's map. The Web-GIS-Based Information System was developed by Mapserver (one of the open source WebGIS) and C# in Visual Studio 2008. The hickory plant environment management system can help farmers easily find the environment condition and give advises whether the place is suitable for hickory's growing. *Copyright © 2013 IFSA.*

Keywords: Hickory, Web GIS, Information system, Mapserver.

1. Introduction

Hickory nuts is a kind of dried fruit, belong to Juglandaceae *Carya* (*Carya* Nutt), there are 18 species and 3 varieties in the world [1]. In China, Hickory mainly grow in Zhejiang and Anhui provinces at the junction of Tianmushan area, located in north latitude 29° -31°, longitude 118° -120°, with particular reference to Lin'an hickory-based. Hickory is a kind of neutral to slightly overcast plants, has high demands to the climate of growth environment, hi cool and humid climate, require an altitude of 200 to 900 meters of hills, slope less than 25°, between the soil pH 5.5-7

(slightly acidic to neutral) as well as the appropriate content of organic matter [2-4].

Carry out the hickory WebGIS Management Information System has become a concern of society and the focus of government who is eager to carry out research and the important issue to be addressed. The system's research has contributed to increasing the production of hickory, making raising income of the farmers in hickory-producing areas, and promoting the local government's fiscal revenue, balancing the expected benefits between social and environmental which can effectively minimize the natural factors harm on the hickory .So to carry out the hickory

WebGIS Management Information System really has a broader application prospects.

At present, WebGIS has been widely used in various areas, including wetlands [5], landslide monitoring [6], and the regional air quality observations [7-9]. There are many WebGIS platforms such as ARCIMS, GeoMedia, MapServer, OpenMap, and GeoServer, etc. So it is easy for us to develop this idea for hickory WebGIS Management Information System.

2. Technical Support for the Hickory WebGIS MIS

In our hickory Web-GIS MIS, three main technical support were used, which refers to the developer platform—MapServer, the geo-spatial interpolation technique - Kriging and the web developer platform - Visual studio 2008 with C#.

2.1. The Developer Platform—MapServer

MapServer is an open-source WebGIS developed by University of Minnesota (university of Minnesota, UMN) in the 20th century in 1990s, the core is programmed by C script, which can be easily used in Windows, Linux, MacOSX and other operating systems. MapServer has many advancements:

1) Advanced graphics capabilities; 2) Supporting a variety of popular scripts and application environments, including PHP, Python, C #, Perl, Ruby, Java, and. NET, etc.; 3) Supporting for the operating system interoperability; 4) Supporting for multiple open Geospatial Consortium OGC (Open Geospatial Consortium) standards such as WMS (C/S), non-operational, WFS (C/S), WMC, WCS, Filter of decoding (Encoding), LD, GML, SOS, and OM, etc.; 5) Supporting a variety of vector and raster data sources, and supporting sub-block vector and raster data; 6) Support projection transformation and the standard TrueType fonts. Is precisely because of the strong MapServer portability, openness and security, has been widely used in the industry.

2.2. Geo-spatial Interpolation Technique-Kriging

The Kriging technique is a linear inter- polator which belongs to the best linear un- biased estimator (BLUE) family estimators. Thus, the main purpose of the Kriging technique is to estimate a certain unknown variable X^* as a linear combination of the known values X_i :

$$X^* = \sum_i \omega_i X_i \quad (1)$$

In this formula ω_i being the weights computed by the Kriging equations.

3. Design for the Hickory WebGIS MIS

3.1. Data Sources

The data primarily get from our research and the survey data by Zhejiang Forestry College in China. including the altitude, soil hydrolase N, quick-K, the effective P, organic matter, pH value in Lin'an area by every 5 kilometers; Lin'an's 2002-2007 hickory production; 2007 hickory production in the towns of Lin'an regions; the knowledge of hickory diseases and insect.

3.2. The Flow of the Hickory WebGIS MIS

In this MIS we used vector file as the format of data source, it can be ensure the hickory WebGIS MIS's basic information, as well as the efficiency of system implementation. The system flowchart is shown in Fig. 1. To achieve the functions of different modules, we have established 9 layers: 3 polygon layers which used to achieve production distribution, weather warning, administrative divisions; 5 point layers which according to altitude, soil hydrolase N, quick-K, the effective P, organic matter, PH value and one line layer (administrative boundaries).Some attribute parameters' format is shown is Table 1.

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Table 1. The Parameters In hickory WebGIS information management system.

Parameter	Caption
Soil hydrolase N	Units--mg/kg
The effective P of soil	Units --mg/kg
Soil quick-K	Units --mg/kg
PH value of soil	National Standard GB
Organic matter of soil	Units --g/kg
Altitude	Units --meter
Production	The production in 2007 in rural as a unit

3.3. System Architecture for Hickory WebGIS MIS

System mainly includes hickory plant suitable analysis system, weather warning system, yield forecasting system, pest and disease expert decision-making system.

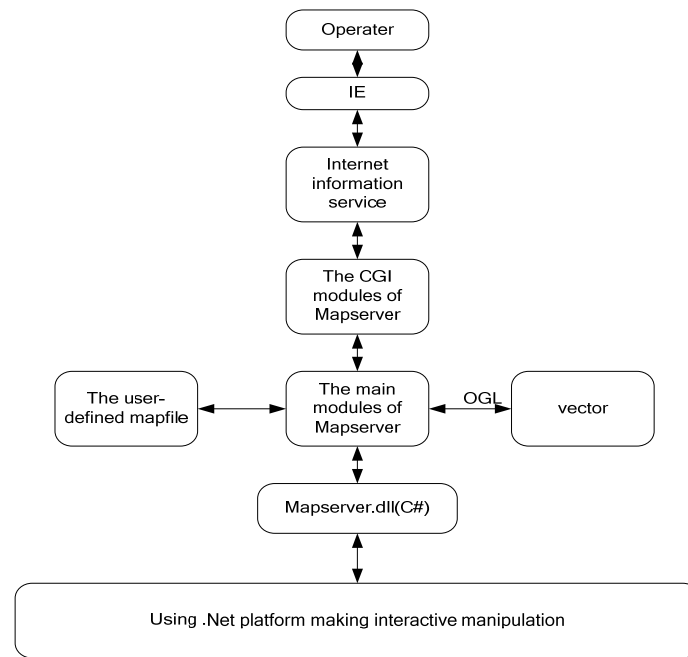


Fig. 1. The flowchart of hickory WebGIS information management system.

Hickory plant suitable analysis system, that is, mainly make analysis of altitude and soil organic matter to ensure if the surroundings is suitable for hickory plant, through the operator entered the region to assess whether it is a large area suitable for planting hickory cultivation.

Weather warning system, that is, according to the season and the region to give an advice of early warning forest protection rating, and warning levels for different suggestions for actions.

Pest and disease expert decision-making system, that is, the operator depending on the chosen forest hickory tree symptoms may be given to the prevalence of pests and diseases, and to give treatment advice.

quick-K, the effective P, organic matter, PH value and so on. Operator can also after enter into the sub-system, click on the map in any one area, the left column will also be prompted to give information to the point of information and the results of the analysis given to whether suitable for planting hickory rating criteria.

Weather Warning System (Fig. 4). From this sub-system, Operator can find the current season, and then the system will give different temperature grades warning.

Yield forecasting system (Fig. 5). From this sub-system, operator can fill the in the need to the year, and click OK, Fig. 5b will show the results. Clicking the button of view or view the graphical trend charts can show the historical data of Linan hickory in different ways.

Pest and disease expert decision making system (Fig. 6) From this sub-system, the operator clicks on the incidence of symptomatic plants in different locations, and selects it, then clicks Next to start the decision-making, or chooses to re-select the Empty the contents and re-select the previous selection.

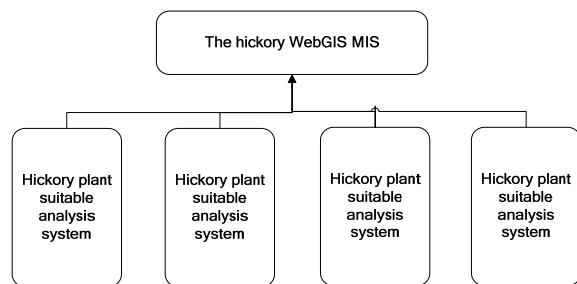


Fig. 2. The overall structure of hickory WebGIS information management system.

4. The Hickory WebGIS MIS

Hickory plant suitable analysis system (Fig. 3). From this sub-system, in addition to the basic operation of the map such as zoom, the alternative view different properties of the distribution of parameters which include altitude, soil hydrolase N,

5. Conclusion

This article was based on WebGIS, using .Net platform and the open-source WebGIS- Mapserver to achieve the Hickory WebGIS management information system. Make an implement on the remote control of hickory production and the protection of cultivation; a networked system for information transmission and dissemination; an information analysis and processing model; the visualization of information services and decision-making.

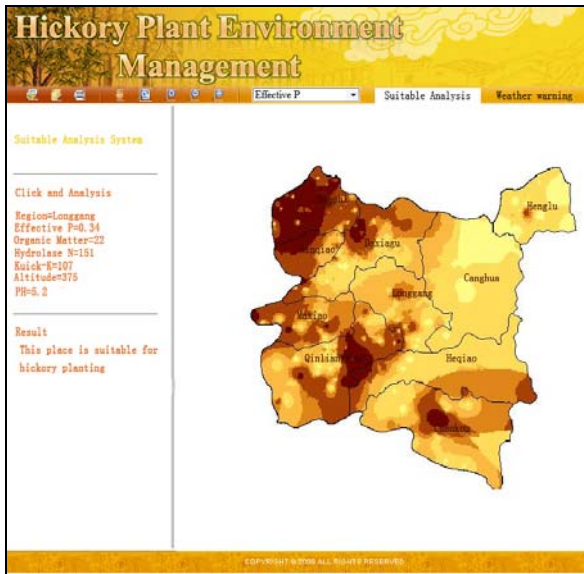


Fig. 3. Hickory plant suitable analysis system.

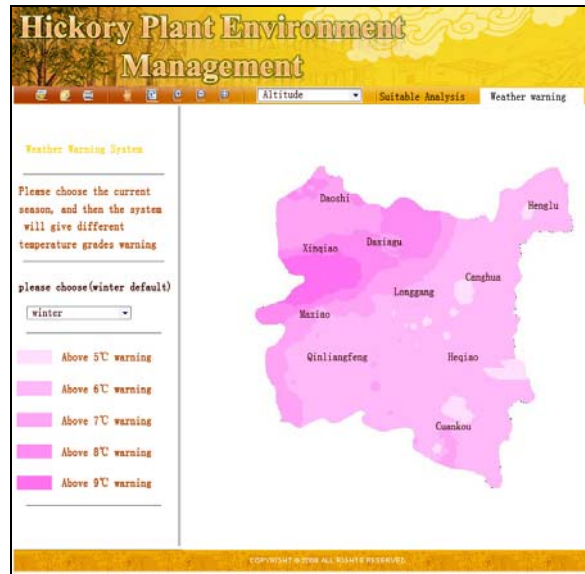
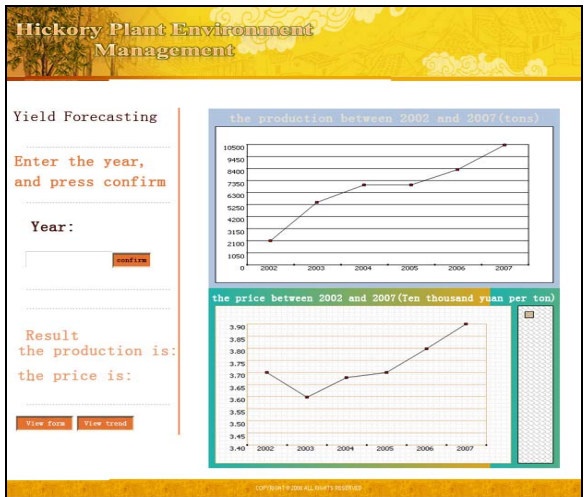
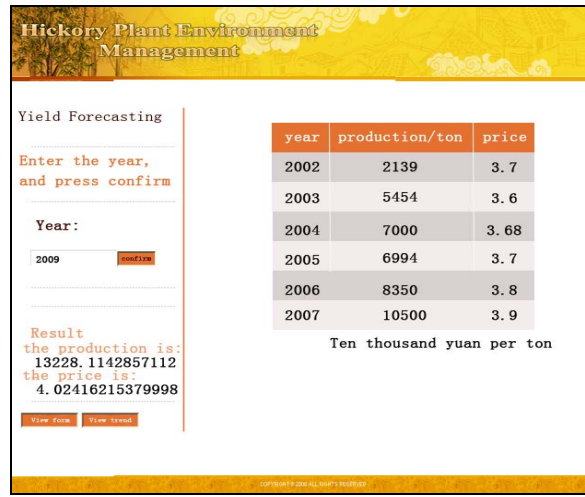


Fig. 4. Hickory Weather Warning System.



(a)

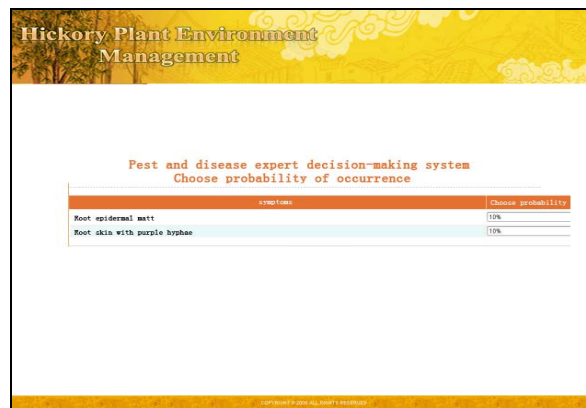


(b)

Fig. 5. Hickory yield forecasting system.



(a)



(b)

Fig. 6 (a-b). Expert decision-making system of diseases and insect pests.



Fig. 6c. Expert decision-making system of diseases and insect pests.

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