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Development and application of settlement Index of Forest pests and

Diseases for Large Areas through Using modis-ndvi Data

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Abstract: settlement to forest pests and diseases to Large areas is one of Most pressing challenges For the " Development of Forest insurance. This Study , taking , forestareas of of East Inner Mongolia, developed A settlement index to forest pests and diseases at the County scale to Large areas, based on MODIS - NDVI Data , Field surveydata , Successfully applied It to East Inner Mongolia to The year of 2016. The results Show [] This Proposed settlement Index has the Advantage in being simple in Calculation, wide coverage and ? - space continuity, Could monitor The serious Damage , even , moderate Damage for Conifer For est effectively. therefore , The settlement Index of Forest pests and diseases could provide Reference and support for forest Insurance .

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missing leaves caused by forest pests , Tree Death is global sen The main factors of the forest disturbances are _ . According to statistics of forest diseases and insect pests cause great harm to our forests , frequency and subject to disaster area is on the rise every year., annual due to disease and pest death tree up 4 many million strains ,cause economic loss up to 1 - Billion , eco-service loss 856.1 billion . to achieve our country Forestry Sustainability , policy Forest Insurance on a nationwide scale to wide launch , Up to 2013 covers an area up to at the end of 1. billion HM 2 , National Forest insurance coverage rate reached 19%,2013 year To complete the claim 166 up , Pay Amount 4. $ billion 2 . forest Insurance in the rapid development of the same time also faces many problems : 1) cover protect area large , Survey Difficulty high , claims-less aging , when using a manual face survey when surveying forest pests , restricted on fixed-selected samples , Lines and limited manpower , survey real Poor time , not accurate , Quickly reflect the quality of the forest in real

time change ; 2) for remote forest areas where field investigation is not possible method , survey coverage

not wide ,Survey Incomplete , Because it is not comprehensive In time to control the disaster , easy to miss the best time to survey , forward The passive situation occurred after the disaster survey is not timely ; 3) Pest Infestation type more , disaster loss assessment difficulty Big . so , How to develop and applied by , Advanced claims method for forest pest and disease compensate for , is an urgent problem .

Remote Sensing technology has a ground survey for forest pest monitoring damage Unmatched Advantage , The principle of all forms of pest Damage will eventually result in tree growth. , canopy spectrum in change , and these spectral changes can be recorded by satellite . The spectral characteristics of the are identified by . Medium-High resolution satellite data , Landsat (+m) has been widely used in the afternoon poison moth (Gypsy moth,) Mountain Pine size Stupid (dendroctonus _ ponderosae)/ Jackson Color volume Moth (choristoneura _ Pinus),, deciduous pine moth (_piree mothetc) Pest monitoring . due to Landsat etc Sensor time resolution rate Low , It's difficult to get multiple periods of valid data during growth period , to Quarter section-marked diseases and pests cannot be monitored effectively . High resolution operator data acquisition capability for multi-temporal phases , but The High cost of restricts its application at the regional scale . low resolution data , such as novv AVHRR (> 4km) also used with wide range of forest pests and diseases caused by leaf loss monitoring , The result Provide reference for the discovery of forest-affected areas at the macro scale ,but its the smallest unit is approximately dozens of square kilometres of spatial resolution , cannot meet the demand for precision claims . MODIS sensor with ? m Space Resolution , Daily Time resolution , in forest pests harm monitoring shows better potential B _Ten , successfully passed health Green blade discoloration or loss implements dynamic monitoring of forest diseases and pests Test . is worth noting , existing MODIS monitoring results are targeted at special Set Pest type , specific Region , Its methods to promote in other regions Be very cautious , and need to go through the ground real pests and diseases data enter row demarcation . Even so , take advantage of MODISNDVI Monitored forests blade discoloration or loss as an indication of the severity of ground

pest and disease instructions agreed . thus , using MODIS NDVI build - the claim relative scale on the reflect area , Forest Pest claim indices , Yes .

This article takes the eastern Inner Mongolia region as the test area , analyzes Inner Mongolia The characteristics of common pests and diseases in eastern forests ,development based on time series MODIS NDVI assessment model for forest pest loss type , combined with the actual disaster characteristics of ground pest and severity letter - rest , building large area forest disease and pest claims in county scale number , calculated 2016 year East Inner Mongolia Forest claims index , and compare to local forest pest disaster data to verify its Apply Effects .

1. Research Overview

Research area includes Inner Mongolia Holonbuyr , Xing an union , Cylinder Gol Union , Tongliao , Chifeng , wulanchabu city . Area Existing sen forest area close to 2 000 Universal HM2 . in recent years , Inner Mongolia annual occurrence Forest Pest rodent area up to € million HM2, disaster Kind has 109 more species One , not only for ecological , The economy causes very serious direct danger harm , further affect the green barrier ecological safety in north China .

2. Research Methods

2.1 Remote sensing data and preprocessing

Normalized difference vegetation index (NDVI) is the most commonly used to refer to the "" " vegetation Index for vegetation changes " . This research uses MODIS TER RA NDVI Products (MOD Q 1) , Space Resolution , m, Time resolution to D . Data covers time range 2010-2016 year , every year period . data is downloaded from the U.S. Address Bureau Web site . with MODIS MRT tool extract from NDVI Wave paragraph , and then tif format , Original SIN projection to Albers projection . use filter processing on time domain (S - G filter) log

to refactor , to reduce noise levels .

2.2 feature Data

Forest distribution data comes from National Ecological 10-year assessment Land Cover classification data A . The dataset is made in China satellite HJ Primary Data source , data processing based on Super platform method , automatic sorting work , and after a massive ground investigation point 's revision , the final classification precision is higher than 85%.

2.3 Ground Survey

2016 Year in Chifeng with Tongliao Forest disease Pest Ground sample survey , to correct forest based on remote sensing parameters Pest and disease disaster provides data support . The investigation principle is as follows : 1 with small The class is the unit , and has an area of at least 6. HM2 (+ mu) above , coordinates as much as possible in the central location , not on edge position . 2) Culvert The main diseases and insect pests in the eastern part of Inner Mongolia, specific survey standard parameters See forest pest occurrence and disaster criteria M ; 3) Sample Space- The cloth needs to have _ Fixed representation .

2.4 Remote Sensing monitoring model for forest diseases and pests

through ground surveys and literature studies , , occurs in the test area of disease-causing leaf discoloration or deciduous conditions in a growing season Green or grow less likely . hence , If occurrence sen Forest Pest , 7-8 months NDVI will definitely receive an impact reduction . other , Conventional forest disease outbreaks usually persist 1 ~3 year around , so , relative to 2016 Year , in 2010-2015 Year 7- 8 Month time series NDVI There will always be a year or years of healthy ND- VI values can be used as references .

Follow these guidelines , Reference Jepsen proposed methods such as , to pilot Zone forest area 2010-2015 year 7-8 of the month 4 period time series NDVI data for image-by -pixel analysis , Select of the decimal point NDVI as a reference to a healthy forest NDVI , Yes after , use 2016 for the corresponding period of the year NDVI value With reference value contrast , Sustainability considerations from Pest effects , if 3 continuously d NDVI pixels with a value lower than the reference value can determine that the This is the area affected by forest disease collection . last , pair OK to sen image of forest pest effects , calculation 2016 year 7-8 Month 4 period NDVI reduction of data and reference values , Add and build a forest disease pest Hazard degree parameter .

combined with the ground forest Pest survey data , analyze varying degrees of forest Pest and Disease hazard Remote Sensing parameter , OK The threshold values the extent of forest pests and diseases as .

2.5 claims index design

taking into account the forest Insurance Administration Regulations , in flag counties , Set Forest Pest and disease claims index for forest pest disaster area ratio Example, The proportions of the affected area to the total insured forest area , to the macro View the reference to insurance company claims .

3. Results and Analysis

3.1 parameter analysis of hazard degree of forest pests

to map forest pest hazard parameters to ground survey For analysis , , broad leaved Forest Mild disaster , Moderate Disaster sample corresponds to the forest pest and disease degree parameters for are all invalid values , Show this study mentioned out based on MODIS - NDVI time series analysis model cannot Light for broad-leaved forests ,Moderate disaster effective recognition , and broad-leaved Forest the degree of forest pests and diseases corresponding to the severity of the disaster the parameters are all have the value , average of -85%, It is proved that the model can effectively monitor the severe pest and disease disaster of deciduous broad-leaved forest. ; coniferous forest mildly affected the forest pest and disease degree parameter is invalid value , indicates that The model cannot be effectively identified for minor disaster in coniferous forests . for coniferous forests , Severe disaster-prone , Forest Pest hazard process Degree parameters are valid values , average is -45%, Moderate and severe parameter overlap between due to disease and pest type , so

no to differentiate between . so , for broad-leaved forest select mean minus standard deviation to threshold to identify pests and diseases severe disaster , threshold is -50%; for pins leaf Forest Select Average minus standard deviation as a threshold to identify the bug . , , Severe disaster ,threshold is -30%.

3.2 spatial analysis of forest pest infestation

According to the threshold of the broad-leaved and coniferous forests , to 2016 year test area Forest Pest Infestation estimates , results in Figure 1 shows . statistics show, overall disaster area 5 252km2 , close , million HM2. where the affected area is over 1 Universal HM 2 with Flag County , is Elunchunqi , Yakeshi , Jalaid Qi , Keerqin right frontflag , Jarud Qi , Eerguna , Zalantun , Aershan , A Rong , Moliqi , Ewenkizu Zizhiqi , Bairin Zuoqi, Horqin Youyi Zhongqi ; affected area in 1 HM 2 has Flag County , is Hexigten Qi , Bar forest right flag Liangcheng County , Ar Horqin Qi , Genhe , Linxi County , Black Blue Hot City , songshan District , Aohanqi , Xi Ujimqin Qi , Tuquan County , Ongniud Qi, Zhenglanqi , Harqin Qi, Xinghe County , Ningcheng County. affected by disaster area less than 1 HM 2 has Flag County .

3.3 claims index and validation

uses a well-designed index to 2016 year Inner Mongolia East Forest region Forest Pest claim results are calculated and plotted in the diagram (Chart 2), sets the claim result to 6 class : is the same as 1%,> 1% ~2% for , >2%~3%,>3%~5%,>5%~10%,>10%. claims index 1% has Seven flags County , > 1%!2% with flag County ,>2%!3% has tenflag counties , >3%!5% with @ Flag County ,>5%!10% has 9 flag counties , is mainly distributed in Tongliao with Chifeng North ,>10% has 2 Flag County .

This study collects the 2016 year Inner Mongolia Autonomous Region 9 Flag County Forest Pest Insurance Data , Hexigten Qi , Teeth Keshi city , Arongqi , Elunchunqi , Kulunqi , Naimanqi ,A Baga , Fengzhen and Shangdou County . then , Take advantage of this item compensation Index and forest pest disaster area and insured forest area ratio case Analysis , to verify the feasibility of the project claim index application . related analysis results as shown 3 ,, You can see the reason "" highly linear correlation between the escalation ratio , The decision factor can be to reach 0.911 3, This shows that the claims index has a better application effect fruit . Taking into account the enormous workload of ground surveys , based on time series

4. Epilogue

This article uses the time series MODIS NDVI data , combined face actual survey data , Forest diseases and insect pests based on time series data occurrences feature ,Forest Pest hazard path reflecting loss of leaf rate is designed degree parameters , building large area forest diseases and pests with flag County as unit claims index , The validation results are in good correlation with the actual reported disaster situation. sex , provides important support for forest insurance claims work . then and , affected by spatial resolution and forest pests and diseases and spectral response Miscellaneous effects , The method proposed in this study cannot be used for mildly forested Pest Effective identification , for broad-leaved forests and even moderate disaster Law reflection , future needs to be further refined .

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