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The Density Management of the Soil-water Preserving Stand

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Abstract: This study deals on the Density Management of Pinus massoniana soil preserving stands in the Yangzi river area between stand branches and leaves biomass as well as undergrowth dead branches and leaves biomass. The result plotted the density table and showed the best density at 0.68.

Key words: Soil-water preserving, Pinus massoniana, Biomass, Best density

Introduction

China employs a huge wildwood protection project area which was divided by ecological environment such as at the upper and middle reaches of the Chianjiang River and the Yellow River, etc. This protected project area was further subdivided into prohibited cutting area and continue management of the ecology area considering the important location of the ecological protection zone. There are many measures of taking and closing the hillsides of closed and sparse forestland to facilitate forestation, afforestation, sowing artificially by airplane and fostering, etc. However, the management and administration of the forest for water conservation in the wild wood protected project concentrates on controlling soil erosion in the area as the most important thing to do. Then how to deal the forests for water and soil conservation scientifically is a practical problem that needs to be solve urgently.

According to the present management level of the ecological public welfare forest of China, the management and administration of the forests for the water and soil conservation technically have functions to; Firstly, afforest on the mountain, and stop artificial destruction and indiscriminate felling of trees. And secondly, control the density of the forest artificially for water and soil conservation which will give the best water and soil protection benefit. But to adjust and control the density of the forest is an effect method which can be done through the study of dialectical relation among the density of the forest, forest stand biological output, and the benefit of water protection. Adjusting the density of the forests for water and soil conservation to a relative suitable block density of management gives full ecological benefits of the forests and improves its management level for water and soil conservation.

Materials and Methods

This study adopts scientifically and technologically produced subject of 120 Pinus massoniana planted in "the Changjiang River and middle reaches shelterbelt network". It is based from the management mode study dealt in "the Eight Five-year Plan Period" of the country that is to adjust and control test analysis the density of Pinus massoniana for water and soil conservation.

This work deals on the density count of the forest that is most rightly for water and soil conservation. It examines the relationship between the amount of live branches and leaves at the upper layer of forests and the amount of live vegetation and withered pieces of fallen leaf layers and its relevant relation with the density (number of tree density or canopy density) of lower canopy forest. The best density of the forests for water and soil conservation and management is derived and plotted on the quality basis and will be offered for managing the forests for water and soil conservation as well.

Results and Analysis

1. The relation between branch and leaf biomass of the stand canopies of Pinus massoniana soil-water preserving stand.

According to the material data of the standard pure forest of Pinus massoniana, the forest stand when divided into the amount of living branches and leaves draws a stand density at a point of canopy that is:

$$W= -21.01764 + 96.38388\ P-69.2773\ P^2$$

Therefore: when $P= 0.6812$, W reaches the biggest. It is said that when the horsehair pinewood (Pinus massoniana) is divided into the upper layer amount of living branches and leaves is relatively heavy, then it should be 0.6812 to keep the stand canopy.

2. The biotic relation between the stand canopies of the Pinus massoniana soil-water preserving stand and under growth vegetation biomass.

The pure forest of Pinus massoniana in the upper and middle reaches of the Changjiang River was divided into nine kinds of forest classifying types. Even if different forest types have similar structure, the amount of the upper living beings may also be approximately the same, but there is a high difference of biological vegetation output under the forest.

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Therefore, it must study the density effect of vegetation under the forest of the different forest types including the horsehair pinewood. Take azalea horsehair pinewood of white oak as an example:

The relationship on the amount of living bush layer and dividing the canopy density of forest is:

$W = -144.4609 + 494.7735\ P - 368.9432\ P^2$

Where: W is one layer of the amount of living bushes (ton/ha); P is the canopy density.

Therefore when $P = 0.671$, W reaches the biggest.

The relationship on the amount of living herbaceous layer and dividing the canopy density of forest is:

$W = -11.5573 + 39.4038\ P - 29.0999\ P^2$

Where: W is one layer of the amount of living herbaceous (ton/ha); P is the canopy density. Therefore when $P = 0.677$, W reaches the biggest.

Because the standard material is restricted to several other kinds of classifying forest types besides azalea horsehair pinewood of white oak, it is difficult to set up forest and divide into the amount of living forest vegetation and divide into relevant mathematics model of canopy density of forest. Comparative analysis of determining the nature of canopy density is presented in table 1.

It can be known according to the above analysis that before the closure of the canopy the local conditions of the forest floor improves and helps the vegetation grow, thereby providing a crescent biological output. After closing on the canopy of the forest, all groups of forest types compete for nutrition space. The illumination condition becomes worst and worst under the forest. The growth of the vegetation suppresses and is unable to bear the darkness. The damp plant grows only in a small quantity and makes the vegetation cover degree smaller and smaller in the forest. Its biological output also becomes smaller and smaller. A ratio relation analyses can be drawn when canopy density strength in the forest through the dialogue oak azalea horsehair pinewood, one layer of bush, one layer of biological output of herbaceous reach relatively biggest at 0.67-0.68 of in the forest. It also provides information based on qualitative analysis that the biological output of the vegetation is different under the forest having other several forest classifying types, namely different forest-classifying types. The maximum is also different. When the relation between the canopy density of forests is at 0.67-0.70 it makes the biological output of the horse hair most heavy under the pinewood.

3. The relation between forest stand and the canopy density of Pinus massoniana forests withered junk weight for water and soil conservation.

The withered junk materials under the forest and stand vegetation has important function in some respects such as biological circulation of nutrient, energy shifting, ability to control flow of water, water and soil conservation and maintenance of soil fertility of the forest ecosystem, etc. As to Pinus massoniana the main compositions of the withered junk are loose leaves, branches and fruits. The leaf of Pinus massoniana

Table 1. The relationship between the amount of living vegetation under the forest stand and canopy density of Pinus massoniana with different kinds of classifying forest.

(ton/ha)

Kinds of forest classifying	Canopy	Shrubbery Biomass	Field Biomass	Dead thing Weight	Summation
Cogonal Pinus massonina	0.5	542	254	159	955
	0.6	756	284	182	1222
	0.7	838	357	184	1379
	0.8	700	302	176	1178
China Loropetal Pinus massonina	0.5	518	48	227	793
	0.6	881	107	331	1299
	0.7	1013	92	629	1734
	0.8	813	14	216	1076
Tea-oil Pinus massonina	0.5	284	92	87	463
	0.6	305	162	98	565
	0.7	362	216	93	671
	0.8	319	91	55	468
Dicranopteris Linearis Underw Pinus massonina	0.5	70	307	38	415
	0.6	84	318	32	434
	0.7	89	384	36	509
	0.8	72	338	20	430

is a major metabolism in producing the vegetation under the forest. According to the result of the analysis between the relationship of the amount of living beings of Pinus massoniana branch and leaf above mentioned, the amount of living beings when divided into the forest canopy density gave a 0.67-0.70. The horsehair pinewood when divided into the biological amount of non-essentials and the amount of living vegetation under the forests reaches the biggest. Therefore, the weight when dividing the withered junk of forest also reaches the heaviest.

4. Managing the density of Pinus massoniana as the most rightly forests for water and soil conservation.

Consider the relationship synthetically of withered junk weight and stand canopy of horsehair pinewood if divided into the amount of living branch and leaf and the amount of living vegetation under the forest. It is confirm that the best canopy density range of the Pinus massoniana forest to protect water flow is 0.66-.070. With respect to the density structure of the forest, it is necessary to keep the density range at 0.66-0.70 as it is the most favorable to distribute and wave water in order to protect the efficiency of the horsehair pinewood. So therefore, the best canopy density is fetch at average of 0.68.

The canopy density in the forest is a function of average tree crown and the number of trees. Therefore, it can be infer that the canopy density of the forest can divide with one of its breast-height diameter and number of trees of the first and then dividing with the average wood of forest.

As to pure forest of the Pinus massoniana, it can be done through analyzing

$$P = 0.004 \times [ln\ (DN)]^{2.25}$$

Where: P divides the canopy density for the forest; D divides the average breast-height diameter (cm) for the forest; N is the number of trees of forest per hectare.

It is known by law on how this model reflects, i.e., when the same average diameter in the forest· is divided with more number of trees on a per unit area, the larger the canopy density is. When an increase in the canopy density is divided with an increase in the average diameter, the number of trees does not change. Therefore, if it is to keep the forest canopy density intact, the average diameter of the forest and the number of trees should both have an inverse ratio relationship.

According to the relevant model, the ratio relation of the canopy density, the average diameter, and the number of trees of the forest definitely gave a canopy density of 0.68. When any average diameter D is divided with any corresponding number of tree N, gives a value that protects the optimum density of the Pinus massoniana from water flow. The ratio relationship between the average diameter and the permutation in pairs of the number of trees deals with the density of Pinus massoniana as the most rightly forest to protect from water flow.

Make use of the ratio relationship of the average diameter and the best corresponding number of trees given in table 2 as a guide to adjust and control the density of Pinus massoniana forests for water and soil conservation.

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Table 2. Managing the density of Pinus massoniana as the most rightly forest to protect from water flow

(n./ha)

D/ cm	5	6	7	8	9	10	11	12	13	14
N/Stump/ha	3614	3011	2581	2258	2008	1807	1643	2506	1390	1291
D	15	16	17	18	19	20	21	22	23	24
N	1205	1129	1063	1004	951	903	860	821	785	730
D	25	26	27	28	29	30	31	32	33	34
N	723	695	669	654	623	602	583	565	548	532

水土保全林の密度管理

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キーワード: 水土保全林、タイワンアカマツ（馬尾松）、バイオマス、最適林分密度

要　　約

本研究は、長江上・中流域に植栽されたタイワンアカマツ（馬尾松）水土保全林120箇所を対象に、林冠層や下層の枝葉及び枯死枝葉バイオマス等の関係を調査し、適切な林分密度管理基準を検討したものである。

林冠層における枝葉のバイオマスは、林冠密度との関連で表すことができ、林冠密度が0.68の時最大となる。

林冠層と下層植生のバイオマスの関連については、下層灌木は林冠密度が0.67で最大となり、下層草本も0.67の時に最大となる。

枯損量については、林冠密度0.67－0.70で植生合計量が最大となり、枯損量もそのとき最大に達する。

これらのことから、水土保全林としてのタイワンアカマツ林の適正樹冠密度は0.66－0.70の範囲にあって、最適値は平均0.68である。なお、林冠密度は平均胸高直径とha当たり立木本数によって推定できる。

表2 に水土保全林としてのタイワンアカマツ林分の密度管理基準を示した。