

## Cluster approach to basis of forms of cooperation of the state and entrepreneurship in the forestry management of the sparsely wooded region

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**Abstract.** In this article we study the theoretical-methodological approach to provision of development of small and medium-sized entrepreneurship in the system of forestry management. The instruments of stating the forms of state and entrepreneurship cooperation and organization of entrepreneurial activity in forestry management of sparsely wooded region were suggested. The principles of differentiation of woodlots of sparsely wooded regions in conditions of provision of balance of interests of wood resources owner and forest users-enterprises owners were also provided. We have also suggested the algorithm, which allows defining the predisposition of the region (forestry district, group of forestry districts) to developing certain forms of entrepreneurship.

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### Introduction

The forestry complex, which includes the forestry management and forest-industrial branches in wood procurement, occupies an important place in the state economy.

At the same time forestry management is an important branch of economics of the regions, which defines the provision of the enterprises and population with wood and another wood products. The forming of RF Forestry Code opened new possibilities for passing of the forestry managing to the way of forestry entrepreneurship. More than 60 of big, medium-sized and small enterprises all over the country are involved in wood procurement and wood processing [1]. The main participants in the relations concerning forest management are small and medium-sized enterprises, and their state is different in fully wooded and sparsely wooded regions. During the last 4 years more than 160 million of hectares of woodlots were rented by businessmen and it reflects the growing interest to forest economy sector. The reasons of a low attractiveness of the forest management for business are generally know: high entrepreneurial risks, low profit along with chronic deficiency of financing and low law status of the businessmen [2].

The researchers of this problem admit that in the forestry management in sparsely wooded regions there are few enterprises which work stably and effectively [3]. There are some reasons necessary for developing of the forestry entrepreneurship:

- the cutting of the trees by small enterprises will be the source of satisfaction of demand of the population for wood production;

- growing need of the regions' population in quality rest stimulates the development of recreational entrepreneurship in the forestry fund;

- ecologization of the population promotes the growth of demand for the ecologically clean goods and services, which provides the growing interest for businessmen for different types of forestry usage (picking of mushrooms, procurement of crude drug).

At the time when a lot of attention is devoted to provisions of management of entrepreneurial structures of forestry sector of fully forested zone, the methodological problems of development of entrepreneurship in the system of sparsely wooded regions are still merely studied.

Despite the decentralizing of the forest managing systems, the creation of the open market competitive environment in the sphere of usage, defence and recreation of woods, nowadays the unprofitability of forestry management still can't be fully covered, and the state costs for managing of the forestry management are growing not correspondingly to forest profits [4]. In the system of forest management of sparsely wooded region there were different organization created in different periods, which were remarkably different like in organizational-law forms of management and also in results of entrepreneurial activities. As the experience of forestry management in sparsely regions shows, in sparsely forested regions there were different types of entrepreneurship: up to 1990 the state entrepreneurship was a predominant one, then the mixed type was prevailing and only since 2007 the private enterprises have occupied the first position. Even though till the present moment one problem is

still undefined: which status of the subjects of entrepreneurship activities in the system of forestry management can provide the balance of interests of the forest resources and forest users?

For sparsely forested regions, in which the forest usage is limited by the protective purpose of the forest, their small areas in the structure of land sources, specific ecological and social value, the instruments of small and medium-sized entrepreneurship supports are still not clearly defined, but also the forms of cooperation of private business and state.

### Methods

With the view of evaluating of the forestry entrepreneurship development in the sparsely forested zone and definition of the optimal form of cooperation of the businessmen and state we have discovered with the help of cluster analysis the initial predisposition of the region and territorial units of the forestry management – forestry districts to development of various forms of entrepreneurship – state, mixed state-private and private). The clustering of the forestry districts was done via dividing them in three different groups (regions): region  $K_1$  – state entrepreneurship, region  $K_2$  – mixed state-private entrepreneurship, region  $K_3$  – private. The criteria were the following 4 basic ones:

$$\tilde{\vartheta} = \frac{\vartheta}{\vartheta_{cp}} - \text{coefficient, characterizing the}$$

level of efficiency of the forestry industry on the woodlots, fr. unit;

$$\tilde{c} = \frac{c}{c_{cp}} - \text{coefficient, characterizing the level}$$

of the rent for forestry use as for 1 hectare of the rented areas, thousands of RUB/ha;

$$\tilde{s} = \frac{s}{s_{cp}} - \text{coefficient, characterizing the area}$$

of the rented woodlots as for one renter, thousands of ha/unit;

$$\tilde{p} = \frac{p}{p_{cp}} - \text{coefficient, characterizing the free}$$

non-rented area as for one worker of the forestry district, thousands of ha/person.

According to definition the coefficients values will belong to interval  $[0, \infty)$ . Along with this let's define three intervals for each coefficient  $[0;0,5]$ ,  $[0,5;1]$ ,  $[1, \infty)$ . The number of different variant of coefficients division is defined according to the rule of product in combinatorial theory. When coefficient belongs to to some type in gives the opportunity to put it to a certain group, i.e. class  $K_1$ ,  $K_2$  or  $K_3$ . We have defines the following principles of forestry districts classification:

1. Should  $\tilde{\vartheta} \in [1, \infty)$ ,  $\tilde{c} \in [1, \infty)$ ,  $\tilde{s} \in [1, \infty)$  и  $\tilde{p} \in [0;0,5)$ , the object belongs to class  $K_1$ .

2. Should  $\tilde{\vartheta} \in [0,5;1)$ ,  $\tilde{c} \in [0,5;1)$ ,  $\tilde{s} \in [0,5;1)$  и  $\tilde{p} \in [0,5;1)$ , the object belongs to class  $K_2$ .

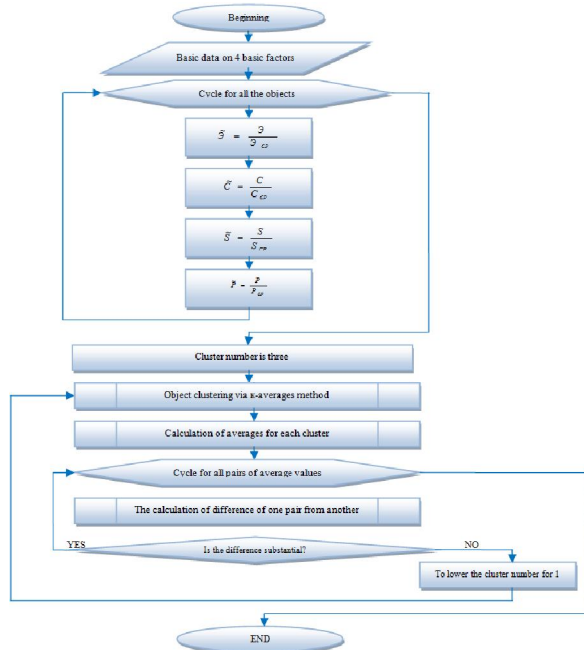
Should  $\tilde{\vartheta} \in [0;0,5)$ ,  $\tilde{c} \in [0;0,5)$ ,  $\tilde{s} \in [0;0,5)$  и  $\tilde{p} \in [1, \infty)$ , the object belongs to class  $K_3$ .

The goal of clustering is for division of the present array of data objects into sub-arrays in the way that all elements of one sub-array substantially differ according to one set of features from the elements of the other sub-arrays [5]. In this case we use the non-hierarchical method of k-averages, also called the fast cluster analysis, which doesn't require additional suppositions concerning the number of clusters. After clustering we have performed the verification via calculation of average values for each cluster. In the research we followed the theory that performance of cluster analysis of forestry districts of sparsely wooded regions with the usage of three classes will provide the arrays of objects. During this some objects will be close to the center of the clusters of their  $C_1$ ,  $C_2$  or  $C_3$  or far from centers of the other clusters, which is the evidence that they definitely belong to that cluster, and some objects will be out of cluster limits. It is the evidence that due to small change of one or several coefficients the object may pass to another cluster.

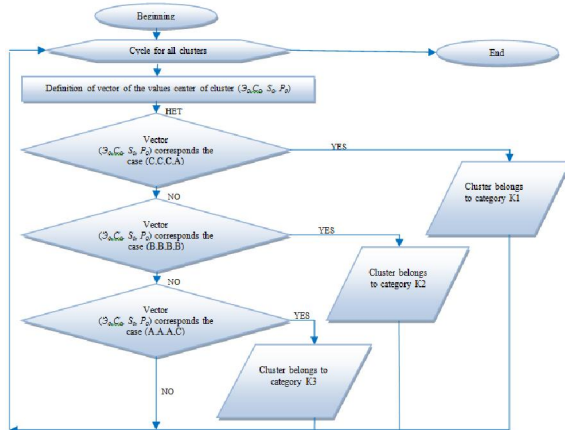
Thus we can form the algorithm, allowing defining the predisposition of the regions (forestry district, group of districts) to developing of certain forms of entrepreneurship. According to this algorithm, for all the studied forestry districts there are four basic factors on the basis of data of the viewed period. Then the corresponding coefficients are calculated via division of the factors values into average on the country level.

On the next stage we choose the number of clusters, which is three, and perform the classification of the chosen objects according to studied rates via method of k-averages.

After the clustering performance we verify it. We calculate the average values for each cluster. Should we get the averages for all the measures, which differ much from one another, or for the major part of them, then the process ends. In the other case it is necessary to lower the number of clusters for one unit and then conduct the clustering once again. The block-scheme of the described algorithm is on the figure 1.



**Figure 1 – Block-scheme of the algorithm of defining the predisposition of the region to developing certain forms of entrepreneurship**



**Figure 2 – Block-scheme of the algorithm of clusters type definition**

On the example of 23 forest districts of the sparsely forested regions (Voronezh district) the characteristics of the efficiency of entrepreneurial activities were defines along with those of organization of the forestry usage in the forestry management branch. The centers of possible clusters also were formed (table 1).

The comparison of the results of the clustering performed via hierarchical method and the method of k-averages showed a full concordance which results in conclusion about results plausibility and the possibility of singling out of three forestry district clusters for sparsely wooded regions.

**Results**

In order to put the defined clusters to certain categories  $K_1, K_2$  or  $K_3$ , let's use the following rules. For each cluster we should calculate the vector of its center' values  $(S, C, S, P)$ . Should the vector correspond to the case (C, C, C, A), then the cluster belongs to category  $K_1$ , to the case (B, B, B, B), then to the category  $K_2$ , and finally, to the case (A, A, A, C) – to the category  $K_3$ . The created algorithm of definition of cluster categories for differentiation of the woodlots of the sparsely wooded regions is recreated on the figure 2.

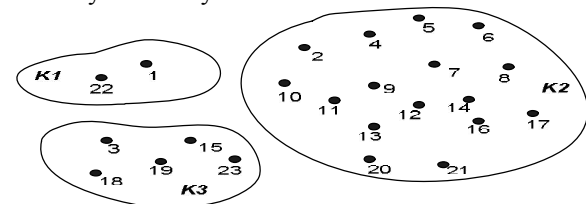
**Table 3 – The dynamics of the characteristics of the forestry usage efficiency in different clustering regions in sparsely forested zone**

Year	Cluster number	Average characteristics of the forestry usage efficiency (cluster center)			
		C	S	P	S
2008	1	5.0944	0.2317	0.0339	0.2606
	2	857.1000	0.0001	0.0400	0.2300
	3	177.7000	0.0002	0.0350	0.3275
2010	1	0.7309	0.9401	0.0321	0.7125
	2	50.9220	0.0008	0.1044	0.3667
	3	402.1133	0.0004	0.0484	1.2133
2011	1	0.7309	0.9401	0.0321	0.7125
	2	402.1133	0.0004	0.0484	1.2133
	3	50.9220	0.0008	0.1044	0.3667
2012	1	0.6996	0.9574	0.0906	0.7583
	2	379.1732	0.0005	0.0892	0.5067
	3	47.8667	0.0008	0.1575	0.4000

Thus via dividing the forestry districts we have obtained the opportunity to define their predisposition to one of the regions:  $K_1$  (state entrepreneurship),  $K_2$  (mixed state-private entrepreneurship),  $K_3$  (private entrepreneurship).

It is defined that a great part of the forestry districts of the sparsely forested regions is predisposed to state-private entrepreneurship. It is stated that on these territories state and private enterprises can be mixed (state-private entrepreneurship), their interests can be balanced. The performance of forestry works can be conducted by unitary enterprises.

It was found out that in five forestry districts of the sparsely wooded region there are conditions for developing of the private business. These territories are characterized by the substantial amounts of wood along with high level of the forestry industry efficiency.



**Figure 3 – The scheme of dividing the forestry districts in Voronezh district into clusters in 2012 (forestry districts are defined by numbers)**

Only two districts tend to choose state entrepreneurship. Entrepreneurial activity in these forestry districts was dominantly oriented on the recreational forestry usage. In this case only the state, realizing the principle of social and ecological defence of the region population can take expenses for managing of the forestry industry in the sparsely forested region, and small profit will partially cover the costs of the forestry management.

### Discussion

We can't but agree with the scholars of this problem, that during the period from 2008 to 2013 (i.e. during the period after validation of the new Forestry Code) there was a stable tendency in the enterprise sphere of the forestry management of Voronezh region to develop the state-private entrepreneurship [6]. At the same time the realization of the state interests, directed on the increase in [7] isn't favorable for development of entrepreneurship in the sparsely forestry regions and in some cases doesn't provide the increase of the budget efficiency [8]. It is known that the goal of forestry management is to overcome the economic underrun of the forest branches [9]. An important role belongs to forming the stable connection between forest-growing and wood procurement on the economic level and on the management level. We suggest, that creation of forest unitary enterprises will increase the entrepreneurial activity in the forest management branch, the quality of the performed works and it will provide a substantial economy for organizations involved in these works i.e. wood procurement [10-11].

Performed calculations conform the necessity of creation of regional state unitary enterprises of the priority organization-law system of entrepreneurial activity for solving the problems of forestry industry in the sparsely wooded regions. The key moment of the provision of the forestry entrepreneurship is the relations of unitary enterprises with the state and competitive enterprises [12-14]. The economic essence of the forestry unitary enterprise is of a double nature; on the one hand is a contractor of performing the state tasks, and on the other hand it is a distributor of the works and services for entrepreneurship structures [15]. The goal of the unitary enterprise activity is the usage of forest resources, and also the wood procurement, the realization of the recreational forest usage.

Obviously, the development of the entrepreneurship in the sparsely forested regions is characterized by irregularity, and the reasons are natural-climatic and also the differentiated coverage of the territory with forests. Thus some sparsely forested regions undergo substantial difficulties in performing agricultural works due to the absence of

the businessmen in the forestry management industry [16]. Due to this we should mention that unitary enterprises will be the only ones specialized in the sphere of forest management, the part of the cooperation allocated on territories, unattractive for private business. We should mention that for financing of the works of such type the following way can be used: financial profit as the rent for usage of woodlots. The clustering of the woodlots, forest districts gives the opportunity to conduct more specific forest planning, to provide the address support of small and medium-sized businesses and businessmen of the forestry system of sparsely forested regions. The performed clustering defines the development vectors of the entrepreneurship, but is not a limiter of the appearance of some new forms of managing business on the territory of woodlots. I.e., the predisposition of the forest districts to state entrepreneurship is not hindering the appearance of private business.

### Conclusion

Studying of the peculiarities of the forest management along with the use of the indicators of efficiency of entrepreneurship activities performance in the forest managing of sparsely forested region has given us the opportunity to create methodological approach to choosing of the organization forms of entrepreneurship and evaluating of cooperation of forestry owner – the state and users of the forestry. The effective condition of the effective cooperation of entrepreneurship and state in the sphere of forest management are the transformation of the current institutional surrounding and the provision of the legislation stability.

The application of clustering method, based on specific factors, expressing systemic relation of organization of entrepreneurship activity with the condition of the forestry resources and resource potential, climatic-natural conditions gives us the opportunity to define the effective organization-law form of management of entrepreneurial structures and fast and in time indicate the direction of their development and establish the form of cooperation in the forest management of sparsely forested region – the state-private entrepreneurship. Due to this we can't but precede the studies in the direction of obtaining of plausible models and conducting of different prognoses of entrepreneurship development in the scopes of the specific clusters.

The usage of created algorithms in the practice of performance of forest management has given us the opportunity to define the content of the strategic alternatives of entrepreneurship development in sparsely forested regions, and also the ways of their realization.

Created theoretical-methodological approach to provision of entrepreneurship development on the basis of forest zones clustering not only promotes the objective evaluation of efficiency of forest usage organization, the indicating of priority organization-law forms of organization of entrepreneurial activities for achieving the goals of forestry management, but also gives the opportunity to predict and provide the support of forest enterprises in the sparsely forested regions.

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