Population homeostasis and habitats of the sable of the southern Cisbaikalia

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Abstract. The importance of hunting design for the rational use of hunting resources is highlighted. As part of hunting, the role of hunting taxation is defined. Using the example of an exceptionally economically important commercial species, the possibilities of a landscape-interpretation approach for mapping the habitats of game animals are shown. The work makes their inventory on the basis of the landscape-species concept of hunting taxation. According to the habitat conditions, optimal and suboptimal habitats are identified, as well as lands unusual for sable. Criteria for the selection of optimal conditions served as the possibility of providing natural complexes of year-round habitat of sable. The interpretation criteria as suboptimal are the worst habitat conditions of the sable and their use is mainly seasonal. Unusual lands are the areas where the species does not inhabit. In general, the work performed shows the use of ecology (biogeocenology) and modern landscape science in hunting management, including for identifying and displaying natural complexes that are extremely important for homeostasis of the sable population. The region has been identified for the special importance of indigenous Siberian pine (Pinus sibirica du Tour) and the importance of this species for sable is shown. Optimal habitats are characterized by sable population density. The current state of the sable population, taking into account the current commercial use, can be characterized by its homeostasis.

1. Introduction

Rational use of hunting resources is impossible without appropriate design developments. The most important part of hunting management is hunting inventory [2, 14]. The possibilities of using landscape science in inventorying the habitats of game animals were previously shown in [7, 10, 11]. The basis of the hunting design is an inventory of hunting resources, which are the totality of the habitats of animals and livestock of animals living in them [2]. Inventory of hunting resources cannot be done without mapping of hunting grounds. Therefore, it is especially important to display the habitats of animals adequately, especially those that provide the best conditions for their habitat, allow them to survive in years with the worst feeding conditions. In addition to the structure of the natural environment, structural-dynamic landscape science also reflects its dynamics. The geographical facies of the structural-dynamic landscape science is represented on the territory by either variable states or the final states of its development - invariants. While mapping it is shown by the criteria for the dynamism of geographic facies. There are four of them: indigenous, imaginary, stably long-term derived and serial facies [4]. In terms of methodology, landscape-interpretation mapping [3] provides ample opportunities for preparing cartographic foundations for modern nature management including...
for the rational use of hunting resources. In this case, organized sable hunting may be regarded as an integral part of population homeostasis [1].

The purpose of this paper is to show and characterize the importance of the best habitats of sable, which are the basis for the existence of its population groups and provide the population with homeostasis.

The materials were provided by the observations of sable placement from the 1970s to the 2010s for more than 5 thousand km of registration routes in 63 landscape sections in the south of the Eastern Siberia, including the same period in the south Cisbaikalia.

2. Results and discussions
The concept of ecological homeostasis, even taking into account emergence, is applicable both to populations and to biocenoses as a whole. In modern times, homeostasis is interpreted as “self-regulation, the ability of an open system to maintain the constancy of its internal state through coordinated reactions aimed at maintaining dynamic equilibrium; the desire of the system to reproduce itself, to restore the lost equilibrium, ... “. Ecological homeostasis is observed in climax communities with the highest possible biodiversity under favourable environmental conditions. The special importance of dark coniferous (cedar and with the participation in the composition of the Siberian cedar pine) climax forest associations for sable and squirrel had been repeatedly noted [5, 8, 9] before.

From the properties of homeostatic systems with hunting mammals, there is reason to single out the desire for balance, i.e. maintaining balance. The course of the dynamics of abundance in habitat complexes is predictable: a decline in abundance to a certain limit (depressed population) - its subsequent growth to a certain maximum level (peak in abundance). Self-regulation of numbers is only one example of the manifestation of homeostasis. Homeostasis of populations is their ability to maintain a certain number of their individuals for a long time. As it is quite obvious in relation to mammalian populations, in particular hunting ones, the ability of an open system to maintain dynamic equilibrium has an extremely significant aspect of their habitats. For the sustainability of the systems “habitat - population”, combinations of positive and negative feedback between these components are necessary: the deterioration of the forage and protective properties of climax natural complexes (their destruction during logging and fires) leads to the fact that they cease to be the best (optimal), particularly for sable, they are restored, i.e. they appear again, at least not quite as they were, but as such.

Landscape-species concept [8, 10] is based on the following positions: 1 - using structural-dynamic landscape science (appropriate landscape map, Earth remote sensing data) as the basis for taking into account the most important components of natural complexes, their dynamics and reflecting the population of mammals in the territory; 2 - the use of “types of habitats of groups of animals” in their regional interpretation, as complexes of habitats providing groups of the species with living conditions throughout the entire annual cycle of life within the corresponding region; 3 - ecological interpretation of the differentiation of the earth's surface into geomers, thereby inventorying habitats and preparing the territory for subsequent reliable counts by providing a representative sample and subsequent correct extrapolation of the data obtained in the samples [6].

Structural-dynamic landscape science and population ecology [14, 12, 15] underlie this concept. The dynamics of natural complexes is shown by the criteria of dynamism, the release of indigenous, imagined, stably long-term derivatives and serial groups of facies. The basis of this division of the natural environment on the landscape map was vegetation [4]. Indigenous natural complexes are characterized by the fact that it is fully consistent with the natural environment. Imaginary ones are those whose vegetation is not indigenous, only looks as such. Steadily long-term derivatives grow mainly on the site of extensive old garey in the valleys of large rivers, as a result, mainly of anthropogenic impact. Serial grow on the alluvium of river valleys; such groups of facies consistently repeat each other in certain series.

Sections of the landscape map can be interpreted as habitats based on the fact that its scale is rather small. This makes it possible to ignore the marginal effect of A. Leopold [16], the zone of
manifestation of which in the sable usually fits into 1.5-2 km. The interpretation of the natural complexes identified on the landscape map as the habitats of certain species (in this case, sable) makes it possible to display those that form the basis for maintaining population homeostasis. For example, watershed indigenous dark-coniferous natural complexes, mainly cedar and with cedar shrub thickets, and also with the participation of these phanophytes for sable; watershed root cedar and valley serial spruce, and with the participation of these species - for squirrels; indigenous coniferous and derived light coniferous and serial lowlands, together with slopes, for roe deer; derivatives and indigenous plain coniferous and serial valley for foxes, etc. However, such natural complexes form the basis of the type of habitats of groups of animals of a certain species, being the best (optimal) habitats. The type of habitats in the composition of natural complexes reflects regional properties, differentiating into differently populated territories: optimal, suboptimal habitats and unusual lands; the selected territories of different populations and regional types of habitats are integrated into the area of distribution of the species - the range [10].

Along with abiotic factors (position on the terrain, density of the river network), the vegetation that forms the landscapes is of particular importance in the composition of habitats: overgrown with cedar pine forests, forests of Siberian pine cedar (and with their participation), imaginary pine forests in place of cedar forests (in Priangare) for sable; the share of natural steppe complexes for roes and others. Using the example of the sable of the Southern Baikal region, a fragment of the map with an inventory of habitats and their type is presented. On this fragment, along with others, are presented natural complexes that are extremely important for population homeostasis (figure 1).

![Diagram](image1.png)

**Figure 1.** Sections of different sable populations estimated on the basis of the landscape maps developed by V.S. Mikheev, V.A. Ryashin et al.

Interpretation of landscape map sections [4] as sable habitats is presented in table 1.
Table 1. Assessment of the sable habitats of the Southern Cisbaikalia.

| Optimum habitat, stratum | Suboptimal habitats, stratum | Unnatural land, stratum |
|-------------------------|------------------------------|------------------------|
| 3 - gently sloping indigenous cedar forests of high-mountain-rhododendron shrub-green moss-bearing trees with bergenia. | 6 - indigenous pine forests of flat surfaces with understory of Daurian rhododendron. 7 - imaginary pine forest slope grass with shrub undergrowth. 8 - imaginary pine forests sloping grass with underbrush from Daurian rhododendron steppe. 9 - indigenous pine forests of hillsides with larch shrub-grass with alder undergrowth. 10 - imaginary pine forests of the slopes of lowlands and elevations with an admixture of grass-cowberry larch. All of the above pine forests belong to mountain taiga. | 14 - imaginary bottoms of the basins of the kobresia-fescue and low-grass steppe-meadow frozen natural complex. |
| 4 - indigenous flat surfaces with cedar and fir shrub-small-grass-green moss. | 5 - sloping imaginary fir-cedar blueberry-grass-green moss, in places with bergenia. | |

It happens, as we noted earlier [10], the manifestation of inversion of this kind of population, when in suboptimal habitats the density of sable population is higher than in optimal ones. Yet this is a seasonal phenomenon, due to the presence of feed in suboptimal habitats and their lack of optimum. Table 2 presents a generalized characteristic of the best habitats of sable, which provide the population homeostasis of this important commercial species in the Southern Cisbaikalia.

Table 2. Characteristics of the sable habitats that provide homeostasis for the sable population of the Southern Cisbaikalia.

| Numbers of landscape stratums (figure 1) | Generalized characteristics of environmental conditions | The amplitude of the average population density per 1 thousand hectares |
|-----------------------------------------|------------------------------------------------------|---------------------------------------------------------------|
| 3, 4, 5                                 | Drive-area flat surfaces and sloping, eluvial, shrub (including blueberry) grass-green moss, in some places with Badan; usually heavily charged | 5,0-5,3 |

Judging by the data of table 2, the optimal habitat of the sable is characterized by a dividing position and rather high average density of its population.

3. Conclusions

So, besides the inventory of habitats as a whole, the landscape-species concept allows us to show the spatial structure of habitats that provide homeostasis for the sable population. By this, it provides an opportunity for a long-term prognosis, which can be based on population homeostasis, which in its turn, can be quantified by the amplitude of the population density of the species.

References

[1] Zyryanov A N 1998 Population homeostasis and the sable fishery. Sable. The state of resources and prospects for the fur trade Proceedings of scientific and practical. conf. St. Petersburg, June 1998 Kirov pp 39-46
[2] Kneise A and Leontiev V A 1934 The main issues of hunting (Moscow)
[3] Bessolitsyna E P, Vladimirov I N, Istomina E A et al 2005 Landscape-interpretation mapping (Novosibirsk: Institute of Geography)
[4] Mikheev V S, Ryashin VA et al 1977 Landscapes of the south of Eastern Siberia (Moscow:
GUGK under the USSR Council of Ministers)

[5] Leontiev D F 2007 Geocological aspect of commercial mammals of the Baikal region *Bulletin of the development of science and education* 1 10-7

[6] Leontiev D F 2009 Inventory of hunting grounds as preparation of the territory for the accounting of commercial mammals: reflection as accounting *Bulletin of the Krasnoyarsk State Agrarian University* 3 118-21

[7] Leontiev D F 2009 Structuring the territory and the accuracy of the number of game animals *Bulletin of the Krasnoyarsk State Agrarian University* 8 76-9

[8] Leontiev D F 2009 Patterns of spatial distribution of commercial mammals in the south of Eastern Siberia *Bulletin of the Krasnoyarsk State Agrarian University* 2 109-14

[9] Leontiev D F 2009 Spatial organization of commercial mammals in the natural complexes of southern Eastern Siberia *Bulletin of the Krasnoyarsk State Agrarian University* 4 65-72

[10] Leontiev D F 2009 Landscape-species approach to assessing the placement of game animals in the south of Eastern Siberia (Krasnoyarsk)

[11] Leontiev D F 2017 The possibilities of using the landscape-species concept of hunting taxation for mapping habitats during homeostasis of hunting mammals (using the sable of the Southern Baikal region as an example) *Topical issues of agrarian science* 25 28-36

[12] Naumov N P 1966 Population ecology and hunting economy *Hunting and hunting economy* 3 14-5

[13] Puzachenko Yu G 1964 The main issues of hunting *Hunting and hunting economy* 10 6-8

[14] Sochava V B 1969 Taiga as a type of natural environment. *Southern Taiga of Angara region. Structure and natural regimes of the south-taiga landscape* (Leningrad: Science publishing house) pp 4-31

[15] Schwarz S S 1970 Ecological and population basics of hunting management *Proceedings of IX International congress of hunting biologists* p 74

[16] Leopold A 1933 *The Game Management* (London. New York: Scribners Sons)