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ASSESSMENT OF FORESTS STRUCTURE AND FOREST CARE EFFICIENCY

The search of the most acceptable approaches is carried out in assessment of forests care efficiency.
The system from 17 indicators and the equations for result calculation of young growths care, thinning
out, re-form, reconstructive cuttings, forest protection and other actions is proposed.

Introduction. Forests care means a complex of actions directed on special purpose formation of steady and high productive forest plantations, conservation and increase of biological diversity and multi-purpose properties of the forests.

Chronologically the care of forests includes the entire period of forest growing. It adopts a period of reforestation, when as a result young planting is formed, and proceeds with general cutting of a matured forest stand.

Cleaning, reconstructive, biotechnical cuttings, pruning, reform cuttings, forest reclamation, biodiversity conservation actions, care of undergrowth and underbrush, landscape cutting and other similar actions are related to care of forests.

Earlier [1] the system of indicates for reforestation actions assessment was proposed. The material of the present publication proceeds with performance of GNTP "The forests of Belarus — efficiency, stability, effective exploitation" task aiming at the development of TKP "System of Indicators for production increase and woods structure optimization of forestry".

Method approaches and regulatory base for assessment indicators choice. Regulatory base STB 1708-2006 follows "Steady forest management and forest exploitation. Basic provisions", STB 143-2008 (02080) "Cutting rules of the forests in the Republic of Belarus", TKP 228-2009 (02080) "Rules of forest pests and diseases protection", TKP 377-2012 (02080) "Forest management rules of forest fund", etc. The correct choice assessment of special-purpose species was determined by soil and technological groups [2]. Forest stocks assessment follows a growth process of standard forest types [3] and other tables [4].

In the course of the task development two variants of indicators system were proposed and approved experimentally by the results of forests care in GLHU "Molodechno Forestry".

Option A for general efficiency assessment of forest care on the basis of 7 indicators:

– the ratios of the plantings area designed and having been actually carried out for care of the forest: refining; clearings; thinning, accreting cuttings and re-form cuttings; reconstructions; forest protection actions; cleaning of litter; –the part of plantings where the desired result of forest care is obtained in the part of special-purpose plantings compositions, of target completeness, litter liquidation and of sanitary condition;

– the part of healthy and viable, the I class of biological stability plantings, included the lands covered with the forests;

– the dynamics of fires area in the expired auditing period relatively to the previous auditing period;

– the dynamics of dead forests area in the expired auditing period relatively to the previous auditing period;

– the efficiency dynamics of pine (admitted and (or) spruce, hard-wooded) forest stands of the II age class in the expired relatively to the previous auditing period;

– the dynamics efficiency of pine (admitted and (or) spruce and hard-wooded broadleaved) forest stands of the III age class in the expired relatively to the previous auditing period.

Option B for general assessment on the species basic assessment of forests care results. The systems of assessment indicators are proposed for 7 types of forests care, namely:

– refining and clearing (5 indicators of an assessment);

– thinning and advance thinning (4 indicators of an assessment);

– reconstruction cutting (5 indicators of an assessment);

– protection of the forests (6 indicators of an assessment);

– litter cleaning (4 indicators of an assessment);

– the forest conservation from fires and disturbances (10 indicators of an assessment);

– the actions of forest efficiency increase (5 indicators of an assessment).

As a result of experimental check comparability of the both variants (A and B) was ascertained regarding a success forests care work assessment of Molodechno forestry management (both variants have a mark "well") was established. More precise indicators of an assessment are recommended. The performers are recommended to continue the development of uniform indicators system. As a result the following system was proposed.

Substantial part of the developed indicators system. To have efficiency of forests care is carried

out on the basis of indicators system designed by forest management (project) and actually (fact) executed (or reached) by the forestry establishment (or its structural subdivision) for the auditing period.

The list of basic original data for production assessment of forests care:

S_{um} – the designed area of plantings (Sum. the project) and with actually carried out (Sum. fact) clarification and clearing, hectare;

S_{us} – the area of plantings in which are designed (Sus. the project) also are carried actually out (Sus. fact) actions for care of middle-aged and ripening plantings, thinning, advance thinning, reform cuttings, hectare;

S_{rf} – the area of the plots including into the reconstruction fund of forestry establishment, hectare;

S_{ur} – the area of plantings with designed (Sur. the project) and actually carried out (Sur. fact) reconstructive cuttings, hectare;

S_{lz} – the area of plantings in which are designed (Slz. the project) also are carried actually out (Slz. fact) forest shelter actions, hectare;

S_{uz} – the area of plantings with designed (Suz. the project) and actually carried out (Suz. fact) cleaning of litter, hectare;

V_{uz} – an average stock of clutter on the forests lands with accounted litter, m^3/hectare;

$Sum.$ to – the area of forest crops with designed (Sum.k the project) and actually carried out (Sum.k. fact) clarification and clearing, hectare;

$S_{lz.}$ – the area of plantings with carried out forest protection actions at stated time, hectare;

V_{lz} – the volume of the stored live wood on carrying out forest protection actions, m^3;

$V_{lz.}$ d – the volume of the stored wooden taking care of the forest with terms violation of its removal, m^3;

$S_{um.}$ – the area of plantings with the carried-out clarifications and clearings having unachieved results (structure, density), hectare;

$S_{us.}$ – the area of middle-aged and the ripening plantings with the carried-out care measures having unachieved target care results (structure, density, marketability), hectare;

$S_{ur.}$ – the area of plantings with the carried-out reconstructive cuttings having unachieved care results, hectare;

M_m – a wood stock of plantings aged up 20 years with the carried-out clarifications and clearings, designed by forest management (Mm. the project) and actually ascertained by forest management (Mm. fact), thousand m3;

M_s – a wood stock of plantings at the age of over 20 years with the carried-out thinning, advanced thinning and re-form cuttings, designed by forest management (Ms. the project) and actually ascertained by forest management (Ms. fact), thousand m^3;

$S_{ur.}$ – the area of the reconstructed plots transferred to woodlands, hectare;

$S_{lz.}$ – the area of plantings with carried - out forest protection actions having provided the prevention of pests and diseases seats formation, hectare.

The assessment of forest care production indicators is ascertained by the following way:

C_{m1} – the plan implementation of clarification and clearings:

$$C_{m1} = Sum.\ fact\ /\ Sum.\ project; \qquad (1)$$

C_{c1} – implementation of thinning, advanced thinning, re-form cuttings plan:

$$C_{c1} = Sus.\ fact\ /\ Sus.\ project; \qquad (2)$$

C_{r1} – implementation of reconstructive cuttings plan:

$$C_{r1} = Sur.\ fact\ /\ Sur.\ project; \qquad (3)$$

C_{lz1} – implementation of clarification and clearings plan:

$$C_{lz1} = Slz.\ fact\ /\ Slz.\ project; \qquad (4)$$

C_{uz1} – implementation of litter cleaning:

$$C_{uz1} = Suz.\ fact\ /\ Suz.\ project; \qquad (5)$$

$C_{m.}$ – the plan implementation of clarifications and clearings in forest crops:

$$C_{m.} = Sum.\ fact\ /\ Sum.\ project; \qquad (6)$$

C_{rf} – extent of plantings coverage of by reconstruction cuttings:

$$C_{rf} = Sur.\ fact\ /\ Srf; \qquad (7)$$

C_{lz2} – timeliness of carrying - out forest actions:

$$C_{lz2} = Slz.\ /\ Slz.\ fact; \qquad (8)$$

C_{m2} – target result achievement of clarifications and clearings:

$$C_{m2} = 1 - (Sum.\ /\ Sum.\ fact); \qquad (9)$$

C_{c2} – target result achievement of thinning, advanced thinning, re-form cuttings:

$$C_{c2} = 1 - (Sus.\ /\ Sus.\ fact); \qquad (10)$$

C_{r2} – target result achievement of reconstructive cuttings:

$$C_{r2} = 1 - (Sur.\ /\ Sur.\ fact); \qquad (11)$$

C_{r3} – transfer of reconstructed sites towoodlands:

$$C_{r3} = Sur.\ /\ Sur.\ fact; \qquad (12)$$

C_{lz3} – prevention of pests and diseases seats formation:

$$C_{lz3} = Slz.\ /\ Slz.\ fact; \qquad (13)$$

C_{lz4} – timeliness of the stored live wood removal from the forest during forest protection actions:

$$C_{lz4} = 1 - (V lz. / V lz); \qquad (14)$$

C_{uz2} – litter degree of forests:

$$C_{uz2} = S/V uz; \qquad (15)$$

C_{m3} – efficiency of clarifications and clearings concerning achievement of target plantings stocks:

$$C_{m3} = M m. \text{ fact}/M m. \text{ project}; \qquad (16)$$

C_{c3} – efficiency of thinning, advanced thinning and re-form cuttings concerning achievement of target plantings stocks:

$$C_{c3} = M s. \text{ fact}/M s. \text{ project}. \qquad (17)$$

Indicator calculation of integrated forest care efficiency is carried out in the following way:

$$\Pi_{ul} = \sqrt[17]{\begin{array}{l} C_{m1} \cdot C_{c1} \cdot c_{r1} \cdot C_{lz1} \cdot C_{uz1} \cdot C_{m. k1} \times \\ \times Crf1 \cdot Clz2 \cdot Cm2 \cdot Cc2 \cdot Cr2 \cdot Cr3 \cdot Clz3 \times \\ \times Clz4 \cdot Cyz2 \bullet Cm3 \bullet Cc3. \end{array}} \qquad (18)$$

The success work assessment of forestry management in care of the forest is ascertained by earlier proposed scale (table) [1].

Conclusion. The proposed technique allows to estimate objectively the forestry management success in forestry care work on the basis of a small indicators list determined by statistical report, to reveal key factors of care types, having unsatisfactory results, to make administrative decisions on forestry care efficiency increase actions.

The assessment scale of success forestry management in the forest care for the auditing period 20 … –20 …

The integrated indicator Π_{ul}	Success work assessment
≤0.30	1
0.31–0.50	2
0.51–0.80	3
≥0.81	4

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