ON THE IMPORTANCE OF RETAINING LOW-VALUE DECIDUOUS TREES UNDER CLEAR-CUTTING

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The prevailing type of cutting in Russian forests is clear-cutting. According to the official statistics, it accounts for about five sixths of the total volume of harvested timber (83.6% in 2015). In the overwhelming majority of cases, in the taiga zone regions, the felled-out areas are almost always abandoned either immediately or after some activities that imitate forest management (for example, planting forest crops, which most often die later due to the lack of quality care). Nowadays, in Russia, the total area of clear-cutting of all types is about a million hectares per year; the total area of artificial reforestation averages approximately 150 thousand hectares per year; the total area of improvement thinning in young stands (which, on average, require two stages of work on each plot of purposefully cultivated young forest) amounts to about 270 thousand hectares per year. Even the official statistics reveals that the main part of clear-cuttings in Russia (at least three quarters) is healed over naturally, without further human influence after logging. The real share of naturally healed clear-cuts is even greater mainly due to low-quality reforestation and care of young stocks (they are so negligible that these activities in taiga forests do not virtually affect the special, which eventually grow at felling sites).

Spruce forest cultures received the so-called corridor care (through cutting shoots of fast-growing deciduous trees and shrubs only near the rows of spruce seedlings). Poor quality of work both during planting and cherishing led to the death of crops.
The Tver Region, author of the photograph – T.V. Khakimulina.

For example, the internal report of the Federal Forestry Agency (not published in open sources) testifies to the scale of death in the artificially restored forests:

Characteristics of forest crops over the five-year period (2003 – 2007)

Name	Forest crops produced over 5 years, hundreds of hectares	Forest crops died over 5 years, hundreds of hectares	Cost for production and care of died forest crops, million roubles
Russian Federation	914,0	512,1	2511
Tver Region	27,7	48,7	487
Kirov Region	26,1	42,0	420
Irkutsk Region	42,0	26,1	261
Tumen Region	12,1	25,1	251
Kurgan Region	11,9	20,0	200
Leningrad Region	45,9	17,5	175
Khabarovsk Territory	30,8	16,9	169
Republic of Altai	5,8	16,6	166
Kaliningrad Region	3,2	15,1	151
Amur Region	14,1	14,7	147
Chelyabinsk Region	12,0	14,0	140
Altai Territory	28,7	12,7	127
Chita Region	12,6	12,3	123
Arkhangelsk Region	30,4	11,8	118
Yaroslavl Region	11,0	11,4	114
Rostov Region	5,6	11,4	114
Kemerovo Region	4,5	10,2	102

More recent and reliable data on the extent of forest crops mortality are not available, but over the last decade the situation has deteriorated (following the general collapse of forestry as a result of the Forest Code of the Russian Federation introduced in 2006).

Thus, the absolute majority of clear-cuts in Russia, especially in the heavily forested regions of taiga zone, are subjected to natural regrowth without any subsequent economic activity for many years (this is comparable to the standard ages of cutting). Moreover, forest management is actually non-recurrent in many areas where timber is currently being harvested: the economic value of wild coniferous forests commercially justifies their exploitation (building roads, cutting and hauling timber), and the economic value of birch and aspen forests growing in their place does not commercially justify even the maintenance of forest roads. Consequently, the huge felling sites become economically unproductive in the long run, i.e. for many decades and perhaps for centuries. Additionally, the exacerbating shortage of coniferous wood is alleviated through cutting activities in new virgin territories, including unique and extremely valuable ones.

In the short term, it will be impossible to turn from the current model of extensive forest exploitation (timber harvesting in wild forests with abandoned felling sites) to sustainable forestry, i.e. economically viable and environmentally friendly forest management. The reasons may include unworkable legislation, limited funding for the forest sector, severe lack of skilled personnel, etc. It seems quite obvious that extensive forest exploitation, in many cases virtually non-recurrent, will absolutely dominate in Russian taiga zone at least for the next two decades.

In this regard, it is significant to find the ways, within which natural reforestation under extensive forest exploitation can be made more effective and the impact of such exploitation on the forest environment, biological diversity and environment-forming forest functions can be lessened (especially in those cases when forest management is basically non-recurrent).

One of the solutions is to retain excessive trees within timber harvesting, which means not cutting those trees, groups of trees or entire forest areas that have too low economic value and do not justify the costs of cutting and hauling.

A clear-cutting site with abandoned birch and aspen trees one year after felling. Vytegorsky district of the Vologda Region.

In the past (until the last quarter of the 20th century), so-called nominal clear-cutting was allowed in Russia, and then in the USSR, under which loggers had the right not to cut down all low-value trees that were difficult to transport or use. Deciduous trees (birch and aspen trees) were mainly retained. Typically, it was impossible to haul them from remote harvesting areas, since the dominant method of wood transportation was floating, but the logs of these trees sank. Not to mention that demand for this timber was very limited. In addition, all low-value (doted, small-sized or having various wood defects) trees were left.

Since the late 1970s, the authorities gradually began to prohibit nominal clear-cutting and impose sanctions for incomplete felling, when trees or forest areas allotted for cutting were abandoned. The Government Decree No. 67 dated 5 February 1992 “On incomplete felling in the form of groups or individual trees” introduced fines in the amount of four-time stumpage value of timber. These fines were formally abolished in 2007, when the new Rules for Wood Harvesting were issued. In fact, the penalty remained in force for several more years, as these fines were previously included in most lease agreements for forest areas. In some places, forest management bodies are trying to claim damages from forest owners up to date, the last known cases refer to early 2017.

Despite that fines for incomplete felling are annulled now, and the Rules for Wood Harvesting generally allow loggers to retain low-value deciduous trees (unless the forest planning documents for a particular plot provide for artificial reforestation), traditions in the forest sector are so strong that actually all trees are fallen under clear-cutting in most cases.

The logic behind the half-century struggle of Russian forest legislators and forest management bodies against nominal clear-cutting and incomplete felling is understandable. Firstly, leaving a part of wood at felling sites was considered as waste in the epoch of the planned economy, regardless of how valuable this timber was and how much its cost justified the expenses involved in harvesting and hauling. Secondly, the ideology of the “conquest of nature” prevailing for many decades implied that intense economic activity minimally dependent on the natural features of the area should be conducted on territories developed by human. From this perspective, complete cleaning of felling sites accompanied by planting new forest crops from scratch was more reasonable.

However, reality had shown that this idea was mistaken. The economy did not manage to involve the majority of developed forests in intensive forestry, and still does not, as evidenced by the above data. As a result, pure birch and aspen forests were formed at the sites, which underwent real clear-cutting, so that these areas are unsuitable for any economic use. In contrast, thanks to much smaller transformation of the forest environment, mixed and even conifer plantings generated from undersized and young coniferous trees at the sites, where nominal clear-cutting was conducted in the past. Many forest enterprises and villages in taiga zone, especially in the northern part of European Russia and the Urals, are now persisting due to the fact that for many decades these areas underwent not clear-cutting but nominal clear-cutting. In purely economic terms, this historical experience should be seriously and thoroughly examined with a view to its potential application in modern conditions.

The main arguments for this standpoint – the advantages of retaining low-value deciduous trees and, in some cases, conifers, during clear-cuttings – are as follows:

1. Retaining of some trees (for example, low-value deciduous trees) within clear-cutting allows reducing the degree of conversion in the forest environment. Clear-cutting sites and generally open areas significantly differ from forests in terms of microclimatic conditions, such as humidity, temperature, shade density, and their change during the day. For example, temperature at felling sites may diverge from temperature under the forest canopy in several degrees, while humidity – in tens of per cent. At that, fluctuations in temperature and humidity in open cutting areas are much greater than under the forest canopy. As a result, late-spring or early-summer frosts (quite common in taiga forests) can considerably damage young shoots of spruce, fir and other sensitive plant species. On the following day the influence of night frosts is aggravated by the impact of hot spring sun on the damaged tissues. Consequently, in some years, young coniferous trees are almost completely eliminated at felling sites in northern forests. In especially cold areas (for example, in lowlands or in windy places), such frosts can annually destroy early undergrowth of spruce until the felling site is covered by the complete canopy of deciduous trees and the forest microclimate restores at least partially.

The undergrowth and undersized spruce, which was left without a protective forest canopy after clear-cutting, mostly extinguish through dramatic changes in living conditions. Sheksninsky district of the Vologda Region.

The changing microclimate at clear-cutting sites is a major cause for the loss of natural conifer undergrowth (especially spruce and fir) left after felling. In addition to damage by spring frosts, young trees (particularly large) strongly suffer from low humidity. Frequently, large spruce undergrowth cannot adapt to the changed conditions fast enough and dries up in the first years after cutting. At the same time, spruce undergrowth, which is at least in the mild dark of remained deciduous trees, adjusts to new conditions more easily and survives more effectively.

In terms of preserving forest microclimate, retaining of individual trees as the protective canopy at clear-cutting sites is crucially important in northern forests (northern and middle taiga), as well as in cold areas, i.e. in lowlands, in foothills, on slopes and at windy sites. This solution is even more critical for larger felling coupes (square and width). The protective effect of the adjacent forest borders (with regard to microclimate formation) is minimal on clearings, the area of which exceeds several hectares. The destruction of forest microclimate is vital here. At such felling sites, the retained protective trees should become the rule, especially when it is expected to regenerate trees (primarily spruce and fir), which are sensitive to frosts and changing microclimate.

A clear-cutting site with abandoned aspen trees three years after felling.
Vytegorsky district of the Vologda Region.

2. Retaining of some trees provides conditions for better preservation of biological diversity, which is an integral part of modern and advanced forest management. The requirements for forest biodiversity conservation are stipulated in the Russian legislation, including the Forest Code. The measures to preserve the variability of life during logging are necessary. Forest biodiversity depends on the extent, to which these forests maintain the internal structure (mosaic) of habitats, ecological niches that are necessary for the entire variety of species naturally living there. In other words, it is a mosaic of conditions under the forest canopy and substrates, including dead wood, trunks of old trees, dishes and hillocks formed during the fall-back of such trees, etc., where certain species can live. The simpler structure of the stand generates after felling, the more homogeneous conditions are under the canopy of this stand afterwards (after its closing) and, respectively, the smaller number of species finds suitable conditions under the canopy of this stand. Leaving of some elements from the old stand ensures the necessary homogeneity of the future forest and subsequently facilitates the formation of dead wood in it, which serves as a substrate for habitation of many plant species and small animals.

The importance of retaining specific elements of the original stand increases with expanding area of cutting sites. If harvesting areas are small (within a few hectares), the high-mosaic structure of conditions under the forest canopy is ensured by the large total length of marginal zones, i.e. boundaries between old and young forests, stands of different ages, which arose after different types of felling. If large cutting areas prevail, the significance of maintaining the mosaic conditions within harvesting area exaggerates many-fold.

A clear-cutting site with abandoned aspen trees six years after felling.
Vytegorsky district of the Vologda Region.

3. Retaining of unwanted trees reduces the impact on soil, living ground vegetation, and trees undergrowth. The refusal to cut and haul redundant timber mitigates the number of vehicles passes through the cutting area, which means that the solidification and damage to ground vegetation declines. Soil compaction during timber skidding or hauling within felling sites is a major factor that can later negatively affect the growth of young trees. Mixing of surface soil layers often leads to increased soil erosion and washout of the most fertile layer. Therefore, the reduced impact of technical equipment on ground vegetation is undoubtedly a positive consequence of abandoning unwanted trees (although, it is not the most crucial one).

Leaving of unwanted trees, especially if these trees are arranged in groups or entire small forest areas, enables preserving both the undergrowth of conifers, due to the fact that there is no need for tractors and other vehicles to enter these groups, or forest areas, and the undergrowth inside these groups. It should be noted that the most viable groups of spruce undergrowth are most frequently formed under the groups of deciduous trees or even individual large deciduous trees in taiga dark coniferous forests, as the shade density under the canopy of deciduous trees is greater.

4. Retaining of a part of trees, mostly deciduous, prevents the rise in groundwater, flooding and bogging on cutting areas. In many cases, especially when groundwater embeds close to the surface, clear-cutting can lead to the noticeable rise in groundwater levels, flooding, or even waterlogging of harvesting sites. This is related to the fact that the growing forest is a very powerful evaporator of water extracted from soil. Therefore, the surface soil layer is often not saturated with water even in the hyper-humid areas. The herbaceous vegetation formed at felling sites in the first

years evaporates much less moisture and the moisture-regulating role of vegetation is significantly reduced. In some cases (very frequent), flooding of cutting areas can result in the death of most remaining coniferous undergrowth or newly planted forest crops. Forest growth is slowing down for many years, until a new forest is formed at the felling site, which will bring the groundwater level to its initial state. At the worst, waterlogging may be permanent (for example, this often happens in the vicinity of large raised bogs, where the processes of cutting areas bogging and grinding are particularly fast).

In this case, the importance of retaining individual trees or forest areas increases with the size of harvesting sites. The adjacent forest borders can have a significant drying effect on the narrow and small cutting areas. In the vast-size logging areas, such impact is almost negligible, and the abandonment of individual trees as “water pumps” assumes particular significance. It should be noted that deciduous trees, which most actively evaporate moisture, are best suited for it.

5. Retaining of unwanted trees improves the profitability of forest management. Obviously, the possibility of reasonable and high-quality forestry, the effective protection of forests, and the maintenance of decent state of forest settlements and roads depend on the profit-making capacity of forestry. In its turn, the profitability depends on the ratio of costs and revenues raised by forest owners. If the latter can somehow divest from unnecessary economic operations (which require expenses, but do not generate income, either immediately or in the long term), this increases the yield of forest management. It is clear that there are inevitable cost-intensive measures in forestry. These measures are necessary if they enable preserving forests or generating some return in the future. But it is necessary to dispose of pointless measures and actions that incur losses at present and do not foresee benefits in the future.

The irrational activities may include cutting of low-value deciduous trees within harvesting sites, especially when leaving of such trees has obvious benefits for reforestation (through preserving and protecting undergrowth), maintaining biological diversity (through encouraging the diversity in the structure of new forests), preventing waterlogging, etc.

In fairness, it is worth mentioning the concerns of many foresters, which are caused by low-value (including deciduous) trees abandoned during clear-cutting.

Concern No. 1. Retaining of damaged trees (low-value trees are often unacceptable in terms of their biological indicators) can lead to the degradation in the gene pool of forest trees. In fact, this concern is not necessarily always true. For example, the abandonment of all deciduous trees at harvesting sites (except for those that grow on the skidding tracks and technological areas), which mingle with mostly coniferous forest, will not affect the gene pool of the deciduous part in the stand. This is obvious, since no negative tree selection will be made within this approach. The left aspen trees, even the worst one, also cannot noticeably affect the gene pool of this tree species, since its renewal at harvesting sites is almost exclusively generated by shoots from the roots of both cut and abandoned trees. Not to mention the fact that usually the old generation of aspen trees has young origin and it can be represented by one or several clones within the cutting area. Since it is mainly the issue of leaving deciduous trees (as wind-resistant and usually least valuable) at harvesting sites, the consequences of such measure for the gene pool of forest trees can be considered as minimal.

This concern is also greatly exaggerated with regard to conifers. The low commercial quality of coniferous trees can be often caused not by the genotype of trees, but by the conditions, under which these trees developed and grew. For example, the presence of fire scar on pine trunks or decays on spruce trunks on the places, damaged by elks or previously fallen trees, does not apparently refer to the genotype of these trees. The abandonment of such trees will not entail any adverse consequences for the forest gene pool.

Concern No. 2. The abandonment of low-value deciduous trees during clear-cutting will enhance the process of forest crop rotation and lead to the greater transformation of coniferous forests into the deciduous ones. In fact, this concern is far from being true. As stated earlier, the sparse protective canopy of deciduous trees can much better preserve coniferous (spruce) undergrowth and small-sized trees and therefore the greater share of conifers in the young stock at those harvesting sites, where no reforestation will be performed. The saying “Aspen is a nanny for a spruce” reasonably dominated among foresters in pre-revolutionary Russia.

In addition, the left sparse canopy of deciduous trees will actually suppress the formation of young shoots of these species, since both birch and aspen trees are light-demanding sorts, and some shading reduces their chances to prosper. Mostly coniferous undergrowth (or already quite mature coniferous trees, depending on the age of felling) can be found at old sites of nominal clear-cutting in the place of abandoned groups of deciduous trees. Current growing stock is mainly represented by deciduous trees at the sites, where the stand was completely cut down (for example, in the vicinity of loading areas, hauling roads, etc.).

As for the left trees, they are commonly in the ceiling biological age during felling of the main part in the stand (if felling is conducted in predominantly coniferous forest), and such trees naturally die during the first several decades after logging. In general, retaining of low-value deciduous trees within clear-cutting does not contribute to, but impedes the replacement of coniferous forests by deciduous species.

A clear-cutting site with abandoned aspen trees twelve years after felling. The main part of the left aspen trees has already been dumped or broken by wind.
Vytegorsky district of the Vologda Region.

Concern No. 3. The abandoned low-value trees will serve as a place for cultivating various pests and forest diseases, which can then spread to the neighboring forest areas. This concern is also groundless. Firstly, the deciduous trees left at harvesting sites often smoothly survive the changed conditions and they do not become easy prey for pests and diseases. Secondly, in the overwhelming majority of cases, diseases and pests of deciduous trees do not constitute a danger to conifers. Consequently, the most valuable (in economic terms) trees in the surrounding forests are generally unaffected. Thirdly, many logging residues are usually left at Russian harvesting sites, so that the increase in their volume by some more living trees still does not fundamentally change the situation.

At the same time, retaining of the sparse canopy or even individual deciduous trees in the cutting areas can significantly mitigate damage to the forest walls adjacent to the harvesting sites. Frequently, forests adjacent to clear-cuttings (especially of spruces) start to dry out mainly due to the changing microclimate, sunburn, and wind injury. If the degree of the forest environment transformation at felling sites is reduced by leaving some of the wind-resistant trees (deciduous trees are exactly wind-firm), the adverse effect on the forest walls will be also lessened.

Concern No. 4. Retaining of low-value trees in cutting areas will lead to underutilization (incomplete use) of tree resources. This concern is actually the most common among forestry workers. However, it is worth noting that the application of wood resources is precisely their harvesting for the benefit and for meeting some needs. If low-value deciduous trees are cut down (since it is prescribed by the rules), and then burned at the felling sites (to avoid paying fines for abandoning commercial timber) or simply left, this is not the use, but the wanton destruction of forest resources. Such destruction of forest reserves does not make any sense (even if it fully complies with the rules), and it must be ruthlessly eliminated.

Timber of low-value deciduous trees, even transported from the logging sites and piled along the roads, is often abandoned due to lack of demand for it and it gradually rots.
Sortavalsky district of the Republic of Karelia.

The abovementioned statements should be reinforced by the following ideas. Retaining of low-value deciduous trees during clear-cutting will hardly become a universal mandatory rule (nowadays, the general compulsory standard is cutting of these trees). A forest is a complicated biological system for being governed by one rule, which is undoubtedly right at all times and in all places. Sustainable forestry always implies a creative approach, including cutting and logging. All enumerated ideas about the usefulness of leaving low-value trees (especially deciduous) during clear-cutting will be relevant in remote taiga forests, where no intensive reforestation and afforestation measures are planned or actually taken. However, there may be exceptions. For example, maintaining some types of taiga landscapes with prevailing light coniferous trees (pine and larch) may particularly require the great transformation of the forest environment during clear-cutting (including clearing or even burning of harvesting sites).

Retaining of some elements in the initial stand may also be inappropriate when conducting high-intensity plantation-type forestry (although such economic form ce be found in Russia mainly in the study guides). However, no rule, neither concerning the abandonment of deciduous trees during clear-cutting, nor their cutting, should be absolute. Nevertheless, final decisions (in health economy) should be made by forest experts working in the field, knowing their forests and understanding the objectives of the economy in each particular case. It is only necessary to give these specialists the opportunity to apply their knowledge in practice and act on their own initiatives, including those associated with leaving deciduous trees or any other components of the initial stand.