

Guidelines for Logging and Carrying-out during Regeneration-harvesting

1 Purpose

As forest resources enter the period of full-scale utilization, it is necessary to promote appropriate forest improvement by recycling forest resources while securing the multifunctional roles of forests.

Meanwhile, due to the frequent occurrence of heavy rain caused by rain front and typhoons, etc. as well as the intensification and diversification of mountainous disasters, residents are becoming more concerned about the occurrence of landslides, etc. in mountainous areas.

For this reason, when logging and carrying-out standing trees, it is necessary to prevent associated sediment runoff, conserve forest land, and give consideration to the conservation of biodiversity so as not to hinder the regeneration of forest land after logging and carrying-out standing trees.

Based on the above, these Guidelines are presented as a guideline for the minimum matters that forestry organizations, etc. should consider when logging and carrying-out standing trees during regeneration-harvesting.

The contents of these Guidelines should be well known to forestry organizations, etc. carrying-out on-site work, forest owners, project commissioners, forest management practice planners, and other parties involved in logging and carrying-out of standing trees in line with the plan items in a Municipality Forest Plan.

Note that roads that are continuously used for reforestation, etc. after regeneration-harvesting shall be constructed not as skidding roads but as forestry roads for operation based on the "Guidelines for Constructing Forestry Road for Operation" (November 17, 2010: 22 Rinya Sei Sei No. 656: Notice issued in the name of Director-General, Forestry Agency).

2 Definition

- (1) A skidding road refers to a temporary facility constructed for the purpose of temporarily running forestry machinery, etc. for logging and carrying-out standing trees. Note that it is distinguished from forestry roads for operation that are continuously used for forest improvement, such as timber collection and transport through thinning, etc. as well as reforestation after regeneration-harvesting based on the "Guidelines for Constructing Forestry Road for Operation."
- (2) Log landing refers to a place for temporarily accumulating timber, etc. and carrying-out loading operations in order to carry out timber, etc., using a skidding road.

3 Logging method and setting of area

- (1) When carrying-out the purchase or undertaking consignment of logging of standing trees, the necessity of reforestation, etc. shall be explained to forest owners, etc. in order to establish sustainable forestry, and awareness for the implementation of reforestation shall be raised while work efficiency is improved by introducing integrated operations of logging and afforestation, etc.
- (2) When trees are logged, the area to be logged shall be clarified in advance so as to prevent accidental logging beyond the boundary of the land where the target standing trees grow.
- (3) When logging is carried out in a place with a risk of sediment runoff or collapse of forest land, along a mountain stream, along a ridge line, etc., the appropriateness of logging, selective-harvesting, dispersed logging, and other logging methods, as well as regeneration methods shall be determined through discussions with forest owners, etc. so as not to hinder the conservation of forest land and biodiversity.

- (4) In order to conserve forest land and biodiversity, discussions shall be held with forest owners, etc. for the areas and trees to be preserved. If necessary, protective tree belts shall be set along mountain streams and ridge lines, and hollow trees important for the nesting of wildlife shall be preserved. Note that when it is inevitable to pass overhead wires or skidding roads in these places, efforts shall be made to minimize the extent of the impact.
- (5) In order to ensure the public benefit function of forests in light with the topography, geology, soil properties, weather conditions, etc., the scale of logging and the linkage with surrounding logging area, etc. shall be sufficiently considered, and logging shall be spatially and temporally dispersed, such as by dividing the logging area into multiple areas and planting in one area before logging in another area, or by logging in strips or groups to create multi-storied forests.

4 Planning and construction of skidding roads and log landing

As for the skidding roads and log landings, they are assumed to be used temporarily for logging and carrying-out during regeneration-harvesting. Therefore, in principle, they shall be arranged without the need for structures such as log framing and closed conduit, and the following shall be taken into consideration.

- (1) Arrangement and construction of skidding roads and log landings in consideration of forest land conservation
 - (i) The topography, geology, soil properties, weather conditions, water systems such as local inflow of spring water and surface water, and the presence or absence of sediment runoff or ground cracks in the logging area shall be sufficiently checked through materials and field survey. In addition, operation systems in accordance with the topography (timber collecting methods and machines used) shall be selected so that the construction of skidding roads or log landings will not cause soil runoff or the collapse of forest land, and the minimum necessary arrangement of skidding roads or log landings that pass through places with stable topography and geology shall be planned.
 - (ii) When logging and carrying-out standing trees, road networks and overhead wires shall be appropriately combined in accordance with the topography, geology, soil properties, weather conditions, etc. In particular, when standing trees are logged or carried out in places (*) where there is a risk of sediment runoff or forest land collapse due to poor site conditions such as steep slopes, and where the regeneration of forest land or the conservation of land is hindered, the construction of skidding roads shall be avoided, and cable logging shall be used instead so as not to damage the ground surface. Furthermore, when it is inevitably necessary to construct a skidding road or log landing for cable logging, sufficient measures shall be taken, such as supporting the slope with a log frame.
 - *Examples of places that hinder forest land regeneration or land conservation
 - Places with an inclination of 35° or more of natural ground
 - Places with volcanic ash, pumice, scoria, decomposed granite soil, or cohesive soil
 - (iii) Even after the launch of construction of the skidding roads or log landings, attention shall be paid to the soil properties, water system, and other conditions of the logging site so that the layout of the skidding roads and log landings may be more considerate of the conservation of forest land.
 - (iv) The alignment of a skidding road shall be adjusted to the contour lines as much as possible, except for curved parts such as hairpin curves.
 - (v) When it is necessary to install a hairpin curve, it shall be installed on a ridge or other

places with stable ground.

- (vi) In order to prevent sediment from flowing out from the soil exposed by the construction of a skidding road or log landing, and to prevent muddy water and sediment from flowing directly into a mountain stream, skidding roads and log landings shall be arranged at a distance from a mountain stream so that a certain width of forest land acts as a filtration zone. In addition, when the soil properties are cohesive soil which causes long-term turbidity of mountain streams, the construction of skidding roads or log landings shall be avoided as much as possible. When it is unavoidably necessary to carry out construction, fence work, etc. shall be installed as necessary to prevent soil and sand from flowing out into a mountain stream.
- (vii) Skidding roads shall be arranged so as to reduce the number of places crossing a stream. When it is inevitably necessary to pass through a place that is generally liable to collapse, such as a valley including a zero-order basin on a steep slope or a fracture zone, the section to pass through shall be shortened as much as possible, and width, drainage treatment, earth cut, etc. shall be implemented appropriately.
- (viii) When it is difficult to ensure an appropriate alignment, arrangement, longitudinal gradient, etc. of skidding roads within a logging area only, efforts shall be made to pass through the land adjacent to said area. At this time, the construction of skidding roads shall be coordinated with the forest owners, etc. of the relevant adjacent land.

(2) Consideration for the surrounding environment

- (i) With regard to skidding roads and log landings, the places with no houses, roads, railways, other important objects to be conserved, or water intakes of water supply in the vicinity shall be used as a basis, and places that directly damage the objects to be conserved shall be avoided in particular. However, if construction is carried out inevitably, countermeasures shall be taken, such as installing log fencing, etc., above the objects to be conserved, such as houses, roads, railways, etc., as necessary to prevent earth and sand, rolling stones, logged trees, etc., from flowing out or falling.
- (ii) In order to conserve biodiversity, when information on the growth or habitat of rare wildlife is obtained, necessary measures, such as changes in the road alignment and the time of work, shall be considered and implemented.
- (iii) In consideration of the landscape from communities, roads, etc., the layout and construction method of skidding roads and log landings shall be adjusted to the minimum necessary.

(3) Road surface protection and wastewater treatment

It is important to carry out appropriate drainage treatment in order to maintain the skidding roads and log landings in a stable condition.

For this reason, as a general rule, the longitudinal gradient shall be made as gentle as possible after the transverse gradient of the road surface is made horizontal, and the undulating gradient shall be used to disperse the water frequently. When it is difficult to do so, or when there is groundwater discharge, a local inflow of surface water due to topographical conditions, or stagnation of water, a crossing ditch, etc. suitable for the situation shall be installed.

In addition, the following points shall be taken into consideration:

- (i) Crossing ditches, etc. shall be installed at intervals where road water does not flow collectively, by taking into consideration the longitudinal gradient of the road surface, the extension of the relevant section and the extent of the catchment area related to

the section, the presence or absence of mountain stream crossings, etc.

- (ii) Drainage shall be dispersed using a crossing ditch, etc., and curves.
If drainage is concentrated, the place where it can be safely drained (stable ridge, stream with ordinary water, etc.) shall be determined in advance. If there is no place suitable for drainage, the water shall be channeled through unsupported gutters, etc.
- (iii) At points that cross mountain streams, construction work shall be carried out so that flowing water does not overflow into roads, etc., and its maintenance and management shall be carried out sufficiently during the work period. At the end of the work, it shall be restored to the original state as much as possible.
- (iv) In the case of construction work to make a ford, the runoff of running water to the road surface shall be avoided by setting the water-passing surface lower than the road surface of skidding roads at the crossing point. The water-passing surface shall be designed to flow water thinly so as not to increase the flow velocity due to the concentration of flowing water in one place, and to prevent erosion of a ford. Larger stone materials shall be installed on the road surface for stabilization to prevent water from becoming muddy even if overflow occurs. If there is a risk of sediment runoff, they shall be removed.
- (v) Rainwater shall be drained before reaching the upper entrance of the curved parts to prevent it from entering the curved parts.
- (vi) When there is local inflow or stagnation of surface water due to groundwater discharge or topographical conditions, gutters and crossing drainage facilities shall be installed to drain water at appropriate shapes and intervals on the assumption of even the situation of heavy rain.
- (vii) When installing an open conduit, etc., using logs, the weight and undercarriage of forestry machinery, etc. that is running shall be taken into consideration. In addition, in order to prevent the filled-up ground from breaking down, drainage destinations such as crossing ditches shall be treated by installing an apron with rocks or stones or covering them with vegetation mats.
- (viii) If a drainage method that slightly lowers the valley side of the transverse gradient is adopted in a non-hazardous area such as a horizontal section, protective measures shall be taken for embankment slopes as necessary. Note that in order to prevent brake failure during downhill driving when loading lumber, etc., as well as fall accidents due to slips in rainy weather or freezing, the valley side of curves shall not be set low.

(4) Earth cut/embankment

In the case of skidding roads and log landing, it shall be basically filled-up ground with a sufficiently compacted solid soil structure.

The effects of compaction are as follows:

- Reducing subsidence when a load is placed.
- Preventing the infiltration of rainwater as well as the softening and expansion of land
- Increasing the engagement of soil particles and giving strength to soil structures

The above effects shall be fully understood, and the construction shall be carried out so that the bearing capacity of filled-up ground can be obtained for the safe passage of forestry machinery, etc.

Furthermore, in order to reduce the amount of earth cut or embankment, the width and the space of log landing, etc. shall be the minimum necessary to secure the safety of the work, and the amount of earth cut or embankment shall be adjusted, in principle, to prevent the need for disposal of surplus soil. When surplus soil is unavoidably generated and needs

to be disposed of, it shall be disposed of appropriately in accordance with various laws and regulations, including the Act on Regulation of Housing Land Development and Specified Embankment (Act No. 191 of 1961).

(i) Earth cut

Earth cut shall be properly made in order to control the volume of generated earth and to stabilize the earth cut slope while taking into consideration the landform, geology, soil properties, and weather conditions of the natural ground at the project site as well as the space required for the work of forestry machinery, etc.

The height of earth cut becomes higher as the slope becomes steeper. It is desirable to keep the earth cut within about 1.5 m in consideration of the stability of the earth cut slope and the turning of the machine, except for the case where the earth cut height must exceed 1.5 m locally such as the entrance of a hairpin curve, so that the high earth cut does not continue.

The slope gradient of earth cut shall be adjusted in accordance with conditions such as topography, geology, soil properties, and weather conditions, with a standard slope gradient of 1:0.6 for well-compacted earth and sand that is difficult to collapse, and 1:0.3 for rocks with slow weathering or joint development.

Note that when the soil properties are rock or even earth and sand, or when the earth cut height is within about 1.2 m, a straight cut may be possible, and consideration shall be made in light of the soil properties.

In the case of talus, even an earth cut height of 1 m leads to a collapse, while in the case of a shirasu, a straight cut is stabilized in some cases. Therefore, the propriety of a straight cut shall be determined based on the soil properties and the situation of the site in the vicinity.

(ii) Embankment

- a. An embankment shall be properly made in consideration of the landform, geology, soil properties, and weather conditions of the natural ground at the project site as well as the width of skidding roads, weight of forestry machinery, etc., so that the filled-up ground has bearing capacity and becomes stable.

The embankment shall be divided into several layers in order to make solid filled-up ground, and each layer shall be sufficiently compacted to have a thickness of about 30 cm.

- b. The slope gradient of embankment shall be roughly less than 1:1.0, although it depends on the embankment height, soil properties, etc. If it is unavoidable that the height of the embankment exceeds 2 m, the gradient shall be less than 1:1.2.
- c. At hairpin curves, road surface height and route layout shall be carefully examined, and when embankments are to project to the valley side, compaction shall be repeated to provide sufficient strength to the filled-up ground.
- d. In places where small mountain streams, streams, and springs can be seen, or where surface water flows in locally due to topographical conditions, embankments should be avoided, and log landings should not be installed. When it is inevitable to make an embankment in such a place, a crossing ditch, etc. shall be installed by paying attention to 4 (3).
- e. When the volume of the embankment is insufficient, the volume shall be adjusted in the vertical direction, such as the adjustment of the subgrade height in front and behind the relevant embankment, instead of simply raising the earth cut to adjust the volume in the horizontal direction from the mountain side to the valley side.

5 Consideration in executing work in logging, bucking, and yarding/log conveying

- (1) With regard to skidding roads and log landings, when they are not to be used for a certain period of time until the next work after completion of the work, measures shall be taken, such as laying branches on the road surface in order to prevent sediment runoff due to becoming a flow passage and in consideration of vegetation recovery.
- (2) In order to avoid rutting of the surface of skidding roads or log landings, as well as to avoid turning it into a muddy state or a flow passage, do not pass when the base course is covered with a lot of moisture due to rainfall or other reasons. If it is inevitable to pass it, rutting, etc. of the road surface shall be prevented by laying logs, etc.
- (3) In the case where a logging site is unavoidably located in the vicinity of houses, roads, railways, or other important objects to be conserved, the utmost attention shall be paid to prevent logged trees, logs, branches, logging residue, and rolling stones from falling, and necessary measures shall be taken.

6 Arrangement after project implementation

(1) Arrangement of branches and logging residue

- (i) Efforts shall be made to effectively use branches and logging residue as woody biomass materials, etc.
- (ii) The following points shall be taken into consideration when leaving branches or logging residue at the logging site:
 - a. Assuming planting work after logging, branches, etc., shall be arranged so that the operation such as site clearance can be carried out efficiently from the time of logging up to after logging. If the afforestation business operator has been determined, coordination shall be made with the afforestation business operator for post-treatment at the site, etc.
 - b. Measures shall be taken, such as making arrangements by laying branches for the purpose of protecting the surface soil of forest land, dispersing the places where branches or logging residue are to be placed, and driving stakes.
 - c. In areas where natural regeneration is planned, attention shall be paid so that branches, etc. do not interfere with regeneration by sprout, regeneration by fallen seeds, etc., and piling up of branches, etc. shall be avoided.
 - d. In order to prevent branches, etc., from flowing out into a mountain stream at the time of a flood or from causing rainwater to stagnate and resulting in forest land collapse, branches, etc. shall not be piled up in places close to streams, along mountain streams, or at the side of skidding roads, log landing, or forest road.

(2) Arrangement of skidding roads and log landings

- (i) As for skidding roads and log landing, recovery of vegetation shall be promoted, in principle, by planting, etc. In addition, in consideration of the flowing status of road water and other factors, drainage measures that last until vegetation recovery shall be implemented, such as crossing ditches of sufficient depth, in order to suppress the sediment runoff, etc. Note that when the surface soil that was removed during construction is backfilled for the purpose of vegetation recovery, the surface soil shall be tightly compacted to prevent runoff.
- (ii) Materials, fuel, etc., used for logging and carrying-out standing trees shall be securely arranged and removed.

(3) On-site confirmation by forest owners, etc.

After completing all works and before leaving the logging site, forest owners, etc. who have the right to perform afforestation shall confirm on site the status of arrangement of branches and logging residue and arrangement of skidding roads and log landing at the logging site, and shall take necessary measures.

7 Other

(1) In the construction of skidding roads and log landings, when passing through places with an inclination of 35° or more, places with surrounding objects to be conserved, places that are generally liable to collapse, or places along a mountain stream, skidding roads shall be constructed as forestry roads for operation for installing structures such as log framing, etc. When the economic efficiency is lost due to the installation of such structures, or when it is difficult to cope with the environmental and safety aspects, cable logging using a combination of forest roads and tower yarders, etc., shall be used.

(2) In logging and carrying-out of standing trees, including the construction of skidding roads or log landings, various procedures (permission, notification, etc.*) shall be taken without fail based on the Forest Act (Act No. 249 of 1951, hereinafter referred to as “the Act”) and other relevant laws and regulations.

*Examples of permission and notification

- Forest land development permit (Article 10-2 of the Act)
- Notification of logging and afforestation after logging (Article 10-8 of the Act)
- Permission for logging of standing trees in protection forests (Article 34, Paragraph 1 of the Act)
- Permission for work in protection forests (Article 34, Paragraph 2 of the Act)

(3) Forestry organizations, etc. shall comply with the Industrial Safety and Health Act (Act No. 57 of 1972) and other labor-related laws and regulations, and make efforts to prevent industrial accidents and improve the working environment.

(4) These Guidelines shall be reviewed as appropriate based on nationwide case studies.

(5) Please also refer to the “Explanation of Guidelines for Constructing Forestry Roads for Operation” which summarizes geological characteristics and specific examples of drainage facilities.