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FELLING AND WINCHING DAMAGE ON REGENERATION FOLLOWING SELECTION LOGGING IN SEYAHKAL FOREST (NORTH OF IRAN)

Seyahkal forest area in east of Guilan province, Iran, consist of hardwood, s species such as Beech (*Fagus orientalis*) and Hornbeam (*Carpinus betulus*), that is managed by selection logging. The forest was logged by a private company under a government concession. A total density of 2.4 tree/ha and 12.77 m³/ha of wood (113 trees in 31 felling gaps) were harvested. The felling and winching damage on regeneration (dbh<10cm) was assessed in total felling gaps and winching strips with handered percent inventory. Damages in winching strips were greater than felling gaps. In felling gaps the percentage of damage on regeneration in height-limit of 0-0.5m, 0.5-2.5 and 2.5-8m were estimated %9.57, %14 and %17.4 respectively. From this amount %28 were bent and %31 wounded and %41 crown breakage were seen.

Also in the winching strips the percentage of damage on regeneration in height-limit of 0-0.5m, 0.5-2.5m and 2.5-8m were estimated %11, %15.3 and %21 respectively. From this amount %17 were bent and %25 wounded, %43 had crown breakage and %15 were uprooted.

Keywords: Hardwood forest; Selection logging; Regeneration damage; Felling gaps; Winching strip

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Пошкодження дерев, завдане рубанням та трелюванням після вибіркової лісозаготівлі у лісі Сеякал (на півночі Ірану)

Метою даного дослідження було встановити шкоду, нанесену регенерації лісів рубанням та трелюванням під час вибіркової лісозаготівлі, що в останні роки, голов-но, застосовується на території Ірану. Для оцінювання пошкоджень, завданих реге-neraції лісів після рубань, використовувався метод вибіркової таксації, а після тре-лювання – метод ручної відсоткової таксації. Сеякальський ліс розміщений на сході області Гуїлан в Ірані. Він, голов-но, утворений деревами твердих порід (листяних), таких як бук (*Fagus orientalis*) та граб (*Carpinus betulus*). Пошкодження на смугах під-трелювання були більшими, ніж на лісосіці. Частка пошкодження залишених дерев на висоті 0-0.5 м, 0.5-2.5 та 2.5-8 м була оцінений у 9.57 %, 14 % и 17.4 % відповідно. З цієї кількості 28 % дерев були зігнуті, 31 % – поламані та пошкоджені, 41 % – із зламаними кронами.

Ключові слова: ліс твердих деревних порід; вибіркова лісозаготівля; пошкод-ження регенерації лісів; лісосічні пасіки; смуга підтрелювання.

Introduction

Development and use of selection system in uneven-aged standard forest management have increased the use of selection logging. In this regards, ground skidding because of low cost and high efficiency is used more than the conventi-onal skidding in primary transportation. On the other hand this system has high da-maging effect on the residual stand and forest soil (6, 10). A report shows that the percentage of damage on residual stand and saplings by using tractor skidding met-hod was up to % 48 (12). Up to known different studies have been carried out on the percentage of damage on regeneration and residual stand of selection and shel-terwood systems. Although selection method has been used in Iran for the last few years but studies have not been done on this system.

In this paper a study has been carried out in the seyahkal forest for determi-ning felling and winching damage following selection logging on regeneration.

Materials and Methods

1. Study site

The study site is located in the Seyahkal region of Guilan, Iran (longitude 49.50"-49.57"N, latitude 36.35"-37.10"N). The forest structure in this region is uneven-aged standard hardwood. Region area was 53 ha (47 ha was logged, 6 ha was protected). Region height-limit was 400-800m. Rainfall is more than 1000 mm/year. The main species are Beech (*Fagus orientalis*), Hornbeam (*Carpinus betulus*) and Alder (*Alnus subcordata*). Slope range is 0-120 % (dominant slope is 30-60 %). Selection methods were used in Harvesting and silviculture (single/group selection). Harvesting volume was 600 m³/year which were extracted by two-stage skidding system (with Zetor crawler skidder and Timberjack 450c wheeled skidder). Logs were extracted to roadside in short/long logs.

2. Inventory methods

2.1. Felling gaps

Inventory method in this region was selective and sample plot forms was circle. Sample plot area was varied due to: (1) region slope in felling gaps, (2) vari-

ation size (diameter/height cuted trees), (3) number of felled trees per gaps and (4) tree crown development. The felling damage on regeneration (dbh<10 cm) was assessed in total felling gaps with handered percent inventory. In total region (31 felling gaps inventories) 113 trees were cut.

Table 1. Information of harvested trees in felling gaps

Species	Fagus orientalis	Carpinus betulus	Alnus subcordata	Fraxinus carpini- folia	Peterocaria fraxini- folia	Acer veloti- num	Dios- pirus lotus	total
Number of harvested trees	33	64	12	1	1	1	1	113
Diameter – limit (cm)	30-150	35-125	35-105	70	45	30	30	
Volume (m ³)	309.745	225.354	58.472	4.559	0.993	0.556	0.524	600.203

Table 2. Information of cuted logs in felling gaps

Species	Number of harvested logs	Volume of logs
Fagus orientalis	125	182.627
Carpinus betulus	121	120.665
Fraxinus carpini- folia	26	35.3
Peterocaria fraxini- folia	4	2.25
Acer velutinum	3	1.108
Total	279	341.89

After determining type and percentage of damage per felling gap in different height-limit of saplings the type and percentage of damage for total felling gaps is determined by mean weight because the area of the felling gaps are different:

$$d_{fg} = \frac{N_d}{N_h}, \% \quad (1)$$

where: d_{fg} – % damage per felling gap; N_d : Number of damaged saplings; N_h – Number of helthy saplings;

$$D_{fg} = \frac{\sum_i (a_i \cdot d_{fg})}{\sum_i a_i}, \% \quad (2)$$

where: D_{fg} – % damage total of felling gaps; a_i : area per felling gap; $\sum a_i$: area total of felling gaps

2.2. Winching strips

In order to determine the percentage of damage and type of damage to the height-limit at log skidding stage in winching strips-limite, the handered percent inventory were used. Also percentage of damage for total winching strips is determined by mean weight because the area of the winching strips are different.

$$d_{ws} = \frac{N_d}{N_h}, \% \quad (3)$$

where: d_{ws} – % damage per winching strip; N_d – Number of damage saplings; N_h – Number of health saplings

$$D_{fg} = \frac{\sum_i (a_i \cdot d_{ws})}{\sum_i a_i}, \% \quad (4)$$

where: D_{fg} – % damage total of winching strips; a_i – area per winching strip; $\sum a_i$: area total of winching strips

In (2), (4) formula area were determined according to hectare.

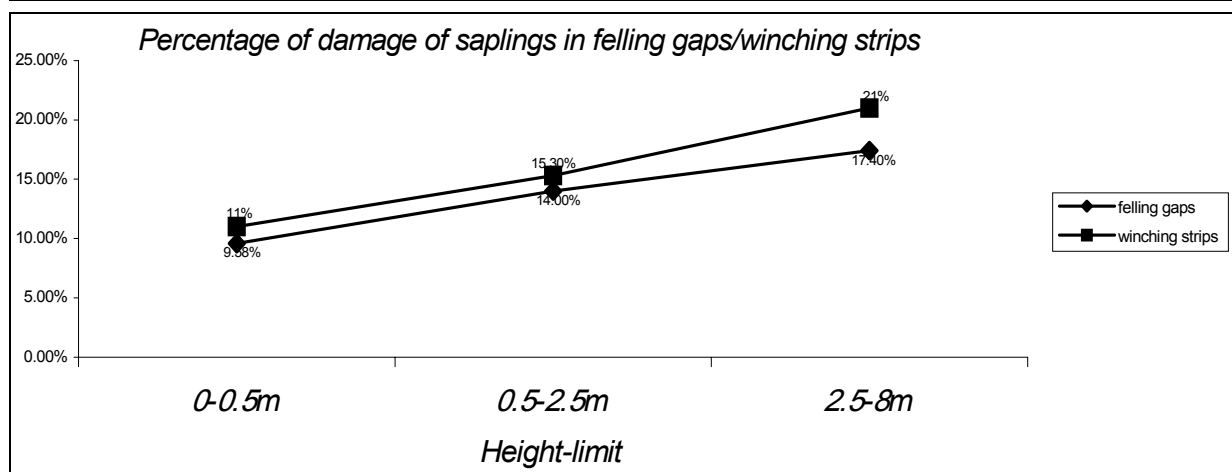
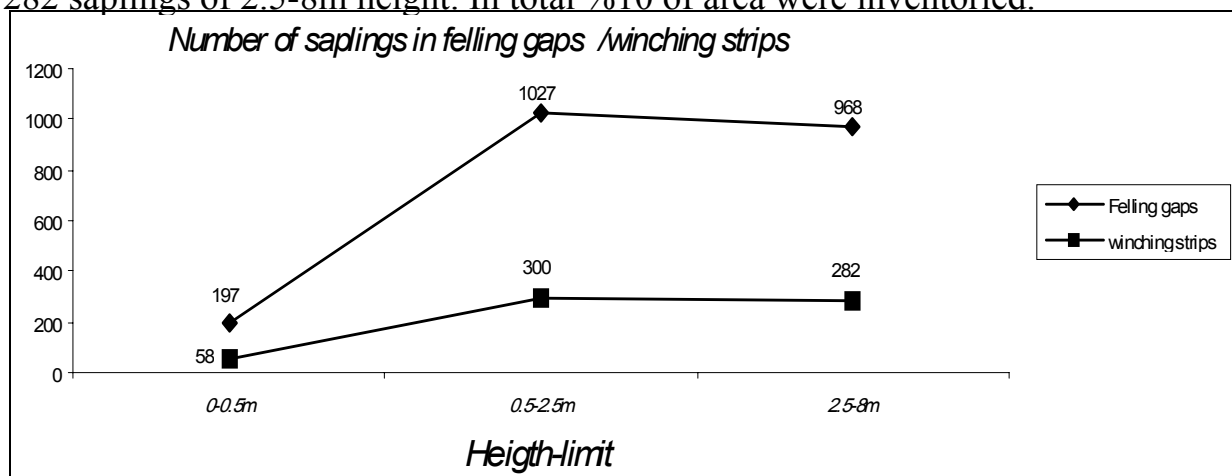
For determining type of damage the following code were used:

- code 1: bent saplings
- code 2: wounded saplings
- code 3: crown breakage saplings
- code 4: uprooted saplings

For drawing charts and extracting results the excel software were used.

Results

1) - In 31 felling gaps a total of 2192 saplings were Considered (192 saplings of 0-0.5m height, 1027 saplings of 0.5-2.5m height and 968 saplings of 2.5-8m height) in 3.4 hectare. In winching strips of 1.11 hectare 640 saplings were considered, 58 saplings 0-0.5m of height, 300 saplings of 0.5-2.5m height and 282 saplings of 2.5-8m height. In total %10 of area were inventoried.

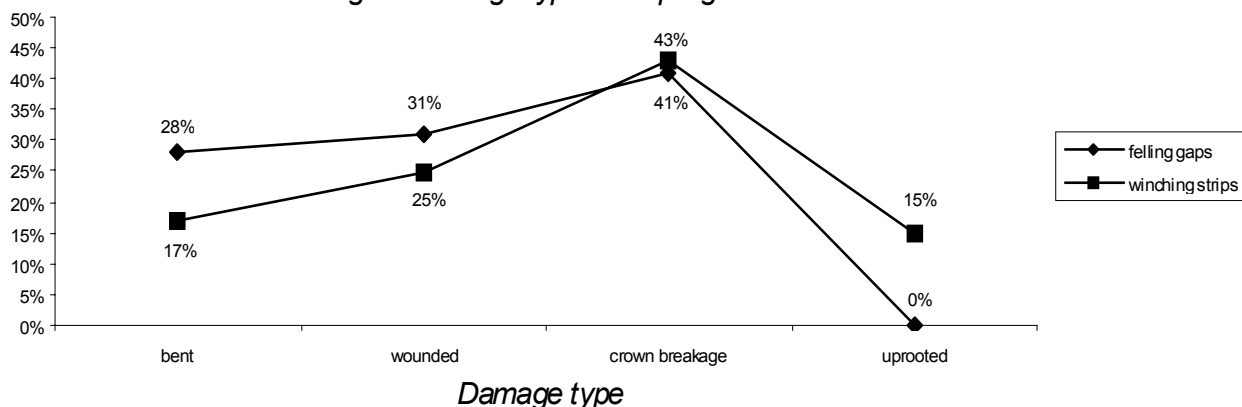


2) - In felling gaps the percentage of damage on regeneration in height-limit of 0-0.5m, 0.5-2.5 and 2.5-8m were estimated %9.57, %14 and %17.4 respectively.

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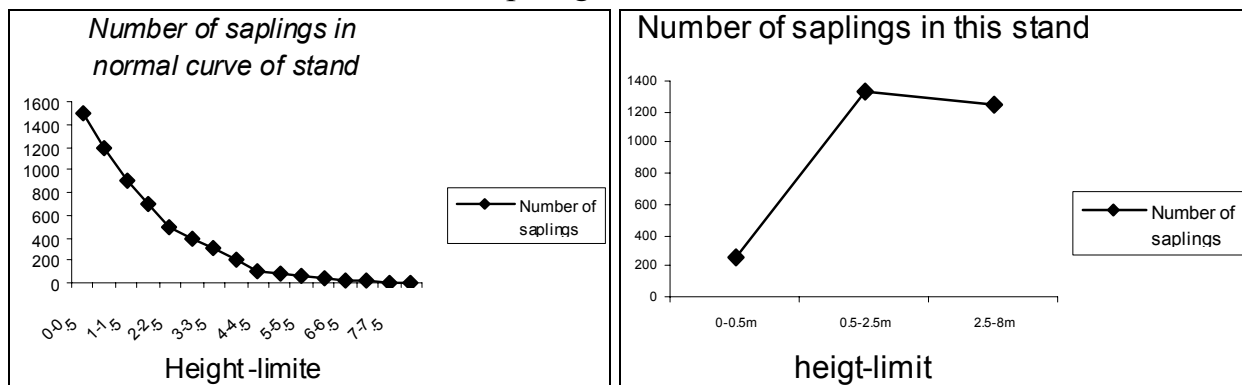
3)- In felling gaps, %28 were bent and %31 wounded and %41 crown breakage were seen. Also in winching strips, %17 were bent and %25 wounded, %43 had crown breakage and %15 were uprooted.

Percentage of damage type on saplings



Discussion

1) - The height-limits of 0-0.5, 0.5-2.5 and 2.5-8 in felling gaps and winching strips are shown in graphs below. Since the curve of number of trees per hectare in uneven-aged stands in normal distribution showed a decreasing form, but in this stand the curve does not obey the normal form, this is due to the dense cover *Ruscus hyrcanus*. The height of *Ruscus hyrcanus* were 40-50cm which had a decreasing effect on regeneration process. Therefore for eliminate this problem the forest soil in this stand should be ploughed.



2) - The results shows that the damage to the saplings increases as height of saplings increases. The damage in 2.5-8 m height were highest because as the saplings increases in height the elasticity decreases. On this basis in upper height-limit with minimum pressure the damage increases.

3) - The amount of damage in selection logging for different height-limits in the forest of north of Iran is lower than the shelterwood logging.

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RECYCLING BIODEGRADABLE OILS FOR THE HYDRAULICS CIRCUITS AND PROTECTION OF THE ENVIRONMENT

The paper deals with problems of biodegradable oils produced on a rape-seed basis. The oils replace mineral oils heavily disturbing natural ecosystems. Biodegradable oils are manufactured as raffinates but the substance of our research is the development of recycled products. Recycled products are produced from already used food oils in which refining and additivization are carried out. It is demonstrated that oils can be evaluated by methods of tribotechnical diagnostics using several parameters (viscosity, acid number, water content), however, the only parameter reliably determining its quality and service life is peroxide number which is much more better in recycled products than in raffinates. In diagrams, changes related to time are given in the peroxide value in six samples, data on the mean time of service life and relative lifetime.

Keywords: protection of the environment, biologically degradable oils, hydraulic circuits, gearbox, recycling oils, reliability

**Проф. Мирослав РОУСЕК – Ун-т сільськогосподарського та лісового
госп-ва ім. Менделя в Брно, Чеська Республіка**

Зниження впливу на довкілля шляхом повторного використання біологічно розщеплюваних олив для гідравлічних систем

Розглянуто проблеми використання біологічно розщеплюваних олив, вироблених з насіння рапсу. Для зменшення негативного впливу на довкілля запропоновано заміну мінеральних мастил біологічно розщеплюваними, які виробляються із використаних харчових олив. Якість оливи може бути оцінена методом триботехнічної діагностики за декількома параметрами (в'язкість, кислотність, вміст води), однак визначальним якісним показником оливи є вміст перекису водню. Цей показник є вищим у біологічно розщеплюваних оливах, ніж в очищених нафтопродуктах. На діаграмах показано динаміку зміни вмісту перекису водню в біологічно розщеплюваних та мінеральних оливах за певний проміжок часу експлуатації.

Ключові слова: охорона довкілля, біологічно розщеплювана олива, гідравлічна система, редуктор, повторне використання олив, надійність.