Factsheet

Manual downhill drifting

FORMIN.FINLAND.FI
MINISTRY FOR FOREIGN AFFAIRS OF FINLAND

RECOFTC
THE CENTER FOR PEOPLE AND FORESTS

Manual downhill drifting

RECOFTC - The Center for People and Forests

Bangkok, Thailand

All photos courtesy of RECOFTC except where reference is indicated

This publication has been generously funded by the Ministry for Foreign Affairs of Finland. The views expressed in this publication are those of the authors and do not necessarily reflect the views of RECOFTC and our donor organizations.

For more information about RECOFTC's ForInfo project, visit www.recoftc.org/project/forinfo

Manual downhill drifting

Table of contents

Figures

Tables

1. Introduction

Steep-slope harvesting probably poses the biggest challenges in forest harvesting throughout the world. Traditionally, on slopes above 30 percent, gravitational transport is applied in manual harvesting operations by simply sliding logs downhill. This probably occurs everywhere, at least over short distances, in more or less planned ways without any thought given to efficiency and possible improvements. Until the 1970s, this system dominated even high forest technology countries. Since then it has been replaced by skyline yarding systems and steep-slope tracked harvesters but still account for up to 20 percent of operations on steeper slopes and in sloped areas yielding low harvest volumes. Until the 1920s, the system was applied in the construction of sophisticated, permanently installed log chutes constructed from debarked logs (see fact sheets on chutes).

In logging operations for developing countries, there are few records on the systematic and improved gravity transportation of timber. The system exists in a bigger way in plantation forests where conditions are especially favorable due to high extractable volumes for a given area (Chile, South Africa, China). Gravity transportation of timber is generally unsuitable in tropical natural forests because of low timber volume. In most cases, the yields are too low to justify construction costs for sophisticated, permanent wooden chute systems, like those found in temperate forests. In addition, the damage inflicted on logs often makes this method undesirable for use with high-value heavy timber. However, it is sometimes used in the transportation of low wood grades, especially plantation pulpwood. In compiling this guidebook, however, no application could be found for this basic technology in bamboo forests or plantations where the low weight-to-piece ratio may hamper its suitability.

2. Downhill drifting

In the simplest form of downhill drifting, logs are extracted individually without any systematic arrangement. In the next step of improvement, logs are assembled in a V-shape facing a downhill direction and concentrated in sloping depressions, small dry drainage lines or gullies. Logs that in most cases are manually debarked, are then drifted downhill using sappies or other types of ergonomically designed hooks with wooden handles, with the logs moving on top of each other to reduce friction.

Figure 1. The sappie – the basic tool for manual downhill drifting

Figure 2. Basic sappie configuration

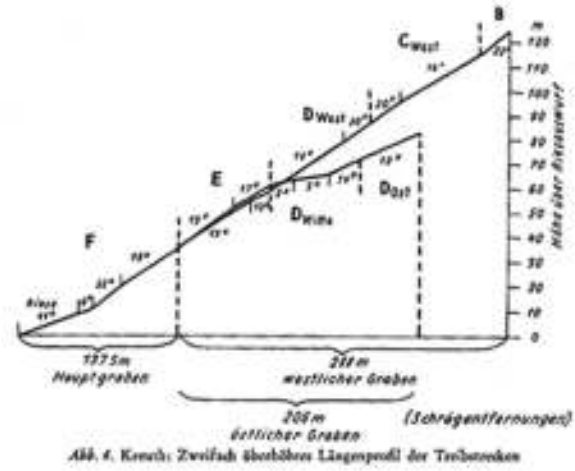
Downhill drifting can be applied to a wide range of situations depending on the kind of friction forces acting on the material being drifted. However, this method works best for:

- Slopes between 30-60 percent on dry soils;
- Slopes 50-65 percent on wet soils; or
- On 10 percent slopes, if wet debarked or very soft-barked wood (bamboo) is moved as stacks.

Figure 3. Logs are assembled in a V-shape, facing a downhill direction and concentrated in sloping depressions

The economic performance and time spent arranging the logs depend heavily on the total amount of material to be harvested in a particular site. If volumes over 100 m^3 are to be extracted, or if the site is vulnerable to soil disturbances, careful planning for repeat operations is advisable. This involves sketch-mapping extraction routes using contour maps and even the drawing of elevation profiles in cases where sections of the sliding routes need increases or reductions in drifting speed. This is usually the case when chutes are permanent or are reconstructed exactly along the same routes during regular harvesting intervals.

Figure 4. Sketch map of extraction routes on contour maps (Bernhart 1960)



Time studies on downhill drifting are sparse and very site specific. The only study found falling within the scope of this factsheet was carried out by Bernhart (1960) in southern Germany as part of research determining performance-based payment for forest workers. The Bernhart (1960) study and additional observations resulted in the development of special piece rate tariffs for manual downhill drifting in Austria, Germany and Switzerland between 1970 and 1990.

Table 1: Performance-based payment for forest workers

Sites (Bavaria Germany)	Kreuth	Tegernsee
Stand description	Thinning in 120 year spruce forest	Thinning in 110 year spruce forest
Number of workers	4	4
Extraction distance	300 m	77 m
Elevation difference	120 m	
Average slope	32 %	70 bis 15%
Total volume harvested	88 m^3	73m
Harvest area	3.25 ha	1 ha
Mean volume of logs	0.13 m^3 (80 to 100 kg)	0.17 m^3
Mean diameter of logs	19 (10-34) cm	22 cm
Average length	4.5 m	4.5 m
Total number of logs moved	1 800	430
Total work time	162 hours	49 hours
Observation time	47 hours	11 hours
Terrain assessment design/layout	Not measured	Not measured
Task of total work time	%	%
Removing obstacles (e.g. rocks)	3.1	1.5
Assembly of the logs in downhill arrangement	12.4	26.6

Sites (Bavaria Germany)	Kreuth	Tegernsee
Manipulating logs: loading into upper section of drift course, reloading stuck logs in lower sections	36.3	28.3
Walking between different positions along drift course	13.2	12.3
Stand by watching movement of logs	14.8	9.8
Guarding drift course during closure of operation (safety precaution)	18.6	15.0
Rest periods	1.6	6.5
Total work time (efficiency)	19.5 min/m^3	47.5 min/m^3

Table 2: Harvesting time requirement in relation to distances

Average drifting distance (m)	Time requirement (min/m^3 under bark)
Below 30	13
31 to 60	15
61 to 100	17
101 to 150	20
151 to 200	23
201 to 250	25
251 to 300	28
301 to 400	30
401 to 500	33
Over 500	34

The following table presents some estimates of additional influencing factors on work performance in the system. Both tables suggest a reasonable way of organizing work tasks and providing fair remuneration in this rather variable harvesting system.

Table 3: Additional criteria influencing work performance

Factor	Criteria	Additional time requirement up to %
Slope	Slope under 41%	20
Speed of moving logs	Terrain conditions, obstacles	30
Volume per piece	Below 0.31 and over 0.41 m^3	50
Total harvest volume	Volume/area	40
Others	Requirement to drift parallel to slope Protect regeneration	20 20

3. Conclusions

Manual gravity downhill drifting of logs is a simple system with relatively low planning and organizational requirements. In spite of its economic viability in easy situations, it should only be applied where other mechanized, safer and less strenuous operations cannot be applied.

Manual gravity downhill drifting is physically demanding and can be dangerous if applied without observing sufficient care and precaution. However, it remains a key choice in areas lacking upslope road access or in places with very dispersed harvest volumes (minimum 60 m^3), which is a key prerequisite for alternative mechanized systems to be applied.

References

Bernhart, A 1960, "Leistungsuntersuchungen beim Treiben von Blochholz (Performance studies on gravity drifting of short length logs)," Forstwissenschaftliches Zentralblatt, Vol. 79, No. 5, p. 6.

Bavarian Institute for Forestry (LWF) 2002, "Aktuelle Holzernteverfahren am Hang (Current forest harvesting systems on slopes," No. 36, Freising, Germany.

Wald Wissen.net, Bergabseilung von Schwachholz oberhalb von Forststrassen, http://www.waldwissen.net/technik/holzernte/arbeit/wsl_bergabseilung/index_DE.

Forst Holz Papier, http://www.forstholzpapier, Holzernte im Seilgelände.

RECOFTC

THE CENTER FOR PEOPLE AND FORESTS

RECOFTC's mission is to enhance capacities for stronger rights, improved governance and fairer benefits for local people in sustainable forested landscapes in the Asia and the Pacific region.

RECOFTC holds a unique and important place in the world of forestry. It is the only international not-for-profit organization that specializes in capacity development for community forestry.

RECOFTC engages in strategic networks and effective partnerships with governments, nongovernmental organizations, civil society, the private sector, local people and research and educational institutes throughout the Asia-Pacific region and beyond. With over 25 years of international experience and a dynamic approach to capacity development – involving research and analysis, demonstration sites and training products – RECOFTC delivers innovative solutions for people and forests.

RECOFTC – The Center for People and Forests
P.O. Box 1111
Kasetsart Post Office
Bangkok 10903, Thailand
Tel (66-2) 940-5700
Fax (66-2) 561-4880
info@recoftc.org
www.recoftc.org

Printed on recycled paper