
References

- Dawkins HC (1959) The volume increment of natural tropical high-forest and the limitations of its improvement. *Emp For Rev* 38(2):175–180
- Dykstra D (1996) FAO model code of forest harvesting practice. FAO, Rome.
- Hammond D (ed) (1995) Forestry handbook. New Zealand Institute of Forestry, Christchurch
- Holmes T, Boltz F, Blate G, Zweede J, Perreira R, Barreto P, Boltz F, Bauch R (2000). Financial costs and benefits of reduced-impact logging relative to conventional logging in the eastern Amazon. Tropical Forest Foundation, Washington
- FAO (1974) Logging and log transport in tropical high forest. A manual on production and costs. FAO, Rome
- FAO (1976) Harvesting planted forests in developing countries. A manual on techniques, roads, production and costs. FOI: TF-INT 74 (SWE). FAO, Rome
- FAO (1977) Planning forest roads and harvesting systems. FAO forestry paper 2. FAO, Rome
- FAO (1999) Code of practice for forest harvesting in Asia-Pacific. RAP publication 1999/12. FAO and Asia-Pacific Forestry Commission. <http://www.fao.org/docrep/004/ac142e/ac142e00.htm>
- FAO (2005) Regional code of practice for reduced-impact forest harvesting in tropical moist forests of west and central Africa. FAO, Rome
- FAO/ILO (1980) Chainsaws in tropical forests. FAO/ILO, Rome
- Kantola M, Harstela K (1988) Handbook on appropriate technology for forestry operations in developing countries. Part 2. Wood transport and road construction. Forestry Training Programme publication 19. National Board of Vocational Education of the Government of Finland, Helsinki

Further Reading

- Brown C, Sessions J (1999). Variable tire pressures for tropical forests? A synthesis of concepts and applications. *J Trop For Sci* 11(2):380–400
- Cermak FI, Lloyd AH (1963) Timber transportation in the tropics. FAO, Rome
- Chandra R (1975) Production and cost of logging and transport of bamboo. FAO/SWE/TF 157. FAO, Rome
- Dykstra D (2003) RILSIM 2.0 user's guide. Software for financial analysis of reduced-impact logging systems. USDA Forest Service
- FAO (1981) Cable logging systems. FAO forestry paper 24. FAO, Rome
- FAO (1982) Basic technology in forest operations. FAO forestry paper 36. FAO, Rome
- FAO (1984) Self-loading winch trucks – based on the work of JL Wilson. JG Groome and Associates, Rome
- FAO (1987) Appropriate wood harvesting in plantation forests. Training materials from the FAO/Finland training course on appropriate wood harvesting operations, Mutare, Zimbabwe, 9–26 June 1986. FAO forestry paper 78. FAO, Rome
- Folkema MP, Hermelin J, Saunders J (1977) Handbook for logging with farm tractor-mounted winches. Forest Engineering Research Institute of Canada, handbook 2. Forest Extension Service, New Brunswick
- Forestry Training Programme (1988) National Board of Vocational Education. Appropriate forest operations. Proceedings of the FAO/Finland training course, Philippines, 23 November–11 December 1987. FAO, Rome
- Garland JJ (1983) Designated skid trails minimize soil compaction. Extension circular 1110. Oregon State University, Corvallis
- Hakkila P, Malinovski J, Siren M (1992) Feasibility of logging mechanization in Brazilian forest plantations. Finnish Forest Research Institute, Helsinki
- Kantola M, Virtanen P (1986) Handbook on appropriate technology for forestry operations in developing countries. Part 1. Tree felling and conversion clearing of forest plantations. Forestry Training Programme publication 16. National Board of Vocational Education of the Government of Finland, Helsinki
- Lysons H, Mann C (1967). Skyline tension and deflection handbook. PNW-39. USDA Department of Agriculture, Forest Service
- Oregon State University LoggerPC 4.0. Forest Engineering Department, Oregon State University, Corvallis
- Sessions J, Heinrich R (1993) Harvesting. In: Pancel L (ed) Tropical forestry handbook. Springer, Berlin Heidelberg New York, pp 1325–1424

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