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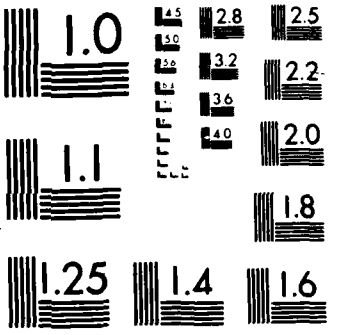
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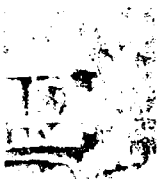

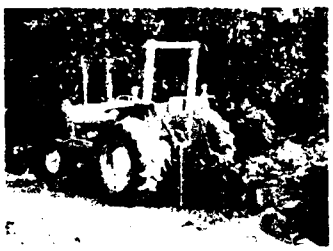

ENVIRONMENTAL IMPACT
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TECHNICAL REPORT EL-86-42

CHAINS AND CABLES

Section 8.2.1, US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL

by

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July 1986
Final Report

Prepared for DEPARTMENT OF THE ARMY
US Army Corps of Engineers
Washington, DC 20314-1000

Under EIRP Work Unit 31631

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SECURITY CLASSIFICATION OF THIS PAGE

AD-A172428

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188
Exp. Date: Jun 30, 1986

1a REPORT SECURITY CLASSIFICATION Unclassified	1b RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3 DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b DECLASSIFICATION/DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S) Technical Report EL-86-42	5 MONITORING ORGANIZATION REPORT NUMBER(S)
6a NAME OF PERFORMING ORGANIZATION USAEWES Environmental Laboratory 6b OFFICE SYMBOL (If applicable)	7a NAME OF MONITORING ORGANIZATION
6c ADDRESS (City, State, and ZIP Code) PO Box 631 Vicksburg MS 39180-0631	7b ADDRESS (City, State, and ZIP Code)
8a NAME OF FUNDING/SPONSORING ORGANIZATION US Army Corps of Engineers 8b OFFICE SYMBOL (If applicable)	9 PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c ADDRESS (City, State, and ZIP Code) Washington, DC 20314-1000	10 SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO / PROJECT NO / TASK NO / WORK UNIT ACCESSION NO EIRP 31631

11 TITLE (Include Security Classification)
Chains and Cables: Section 8.2.1,
US Army Corps of Engineers Wildlife Resources Management Manual

12 PERSONAL AUTHOR(S)
Doerr, Ted B.

13a TYPE OF REPORT	13b TIME COVERED	14 DATE OF REPORT (Year, Month, Day)	15 PAGE COUNT
Final report	FROM _____ TO _____	July 1986	13

16 SUPPLEMENTARY NOTATION
Available from National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161.

17 COSATI CODES			18 SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	Brush control	Equipment	Site preparation
			Cables	Habitat manipulation	
			Chains	Seedbed preparation	

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

An equipment report on chains and cables is provided as Section 8.2.1 of the US Army Corps of Engineers Wildlife Resources Management Manual. The report is designed to assist the Corps District or project biologist with the selection and use of types of equipment and materials available for habitat development and manipulation. Topics covered include description, operation and maintenance, limitations, and availability.

Chaining and cabling are techniques for controlling dense stands of brush by dragging an anchor chain or cable over the soil surface. Management objectives for using chains and cables are stated, and benefits to wildlife habitat are discussed. The design and assembly of equipment are described and illustrated, and general specifications are provided. Methods of operation are described, and maintenance and safety requirements are given. Appropriate cautions and limitations are discussed.

20 DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION Unclassified
22a NAME OF RESPONSIBLE INDIVIDUAL	22b TELEPHONE (Include Area Code) / 22c OFFICE SYMBOL

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE
Unclassified

PREFACE

This work was sponsored by the Office, Chief of Engineers (OCE), US Army, as part of the Environmental Impact Research Program (EIRP), Work Unit 31631, entitled Management of Corps Lands for Wildlife Resource Improvement. The Technical Monitors for the study were Dr. John Bushman and Mr. Earl Eiker, OCE, and Mr. Dave Mathis, Water Resources Support Center.

This report was prepared by Mr. Ted B. Doerr, Range Science Department, Colorado State University, Fort Collins, Colo. Mr. Doerr was employed by the Environmental Laboratory (EL), US Army Engineer Waterways Experiment Station (WES), under an Intergovernmental Personnel Act contract with Colorado State University during the period this report was prepared. Mr. Chester O. Martin, Team Leader, Wildlife Resources Team, Wetlands and Terrestrial Habitat Group (WTHG), EL, was principal investigator for the work unit. Mr. F. R. Jensen, USDA Forest Service, Dixie National Forest, provided equipment specifications and photographs used to prepare line drawings. Photographs of chaining operations were provided by the USDA Forest Service, Equipment Development Center, Missoula, Mont. Review and comments were provided by Mr. Chester O. Martin, WES, and Mr. Larry E. Marcy, Texas A&M University.

The report was prepared under the general supervision of Dr. Hanley K. Smith, Chief, WTHG, EL; Dr. Conrad J. Kirby, Chief, Environmental Resources Division, EL; and Dr. John Harrison, Chief, EL. Dr. Roger T. Saucier, WES, was Program Manager, EIRP. The report was edited by Ms. Jessica S. Ruff of the WES Publications and Graphic Arts Division (PGAD). Drawings were prepared by Mr. John R. Harris, Scientific Illustrations Section, PGAD, under the supervision of Mr. Aubrey W. Stephens, Jr.

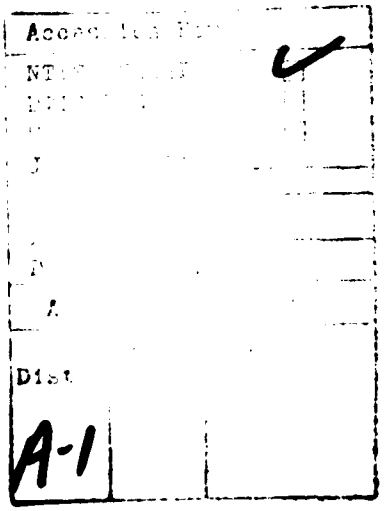
COL Allen F. Grum, USA, was the previous Director of WES. COL Dwayne G. Lee, CE, is the present Commander and Director. Dr. Robert W. Whalin is Technical Director.

This report should be cited as follows:

> Doerr, Ted B. 1986. "Chains and Cables: Section 8.2.1, US Army Corps of Engineers Wildlife Resources Management Manual," Technical Report EL-86-42, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

NOTE TO READER

This report is designated as Section 8.2.1 in Chapter 8 -- EQUIPMENT, Part 8.2 -- SITE AND SEEDBED PREPARATION EQUIPMENT, of the US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL. Each section of the manual is published as a separate Technical Report but is designed for use as a unit of the manual. For best retrieval, this report should be filed according to section number within Chapter 8.



CHAINS AND CABLES

Section 8.2.1, US ARMY CORPS OF ENGINEERS
WILDLIFE RESOURCES MANAGEMENT MANUAL

Chaining and cabling are inexpensive methods of brush control accomplished by dragging an anchor chain or cable over the soil surface. These techniques are most effective on even-aged brush and tree stands and are widely used in the western United States on big sagebrush (*Artemisia tridentata*) and juniper (*Juniperus* spp.) communities. The primary objective of chaining is to create clearings by removing dense brush stands. The secondary objective is to prepare a rough seedbed that is particularly suitable for aerial broadcast seeding. Cabling does not create clearings but is an effective method to thin dense brush.

Cables and chains can be used to rapidly and cost-effectively control brush and prepare a rough seedbed on large areas. Plant density of treated vegetation can be as high as 1000 stems/acre, but stem diameters should not exceed 18 in. (Scifres 1980). Both chains and cables can be used in rough terrain, although chaining is more effective. Cables are good for thinning but not eliminating stands; conversely, chains are appropriate for eliminating mature stands but are too efficient to use for thinning.

Large chainings will set back succession in an existing stand of vegetation, and small chainings in large stands of mature vegetation can increase habitat diversity. Chainings of less than 100 acres are most useful for habitat management for most species of wildlife. Chaining can increase winter food supplies by stimulating root-sprouting browse species, and forbs and grasses generally respond positively to chaining treatments. Cabling does not clear all brush from an area and can be used to create greater interspersion of cover and food sources than chaining.

DESCRIPTION

Chains vary in length from 90 to 1000 ft, but lengths of 90 to 600 ft are most common. Links weigh 20 to 110 lb each. Hallman (1983) reviewed data from earlier chaining studies and recommended that chains weigh a minimum of 70 lb per link for effective brush removal. Cables are usually 1.5 to 2.0 in. thick and 200 to 600 ft long, although cables up to 1000 ft have been used (Larson 1980). Flywheel power requirements are 170 to 290 hp for dual-tractor work and 260 to 290 hp when a tractor is at one end and a ball is at the other end (for use on steep slopes). Chain specifications are given in Table 1.

Several chain modifications are used to make them more effective. Swivels at each end of a chain allow free rotation to clear the chain of brush (Figs. 1 and 2), and pieces of railroad rail and car axles can be welded perpendicularly on chain links to enhance soil scarification (Fig. 3); these devices are referred to as "digger teeth" (Jensen 1969). Digger teeth are usually 1 in. thick, 3 to 4 in. wide, and extend 4 or 5 in. beyond each link (Larson 1980). Approximately 45 ft of unmodified chain should be attached between the tractor and the first swivel when digger teeth are used (F. R. Jensen, Dixie National Forest, pers. commun., 1984). A "clevis" or connecting link should be used to attach the unmodified chain to the tractor hitch (Fig. 2). Another modification is to attach a weighted ball (usually a modified naval buoy) on the downhill end of a chain to control brush on areas with slopes greater than 30 deg. The balls generally weigh 2.8 to 5.5 tons.

Table 1. General specifications for chains

Feature	Range
Length	90-1000 ft Normally 200-300 ft
Weight	20-110 lb per link Normally >70 lb per link
Modifications	Swivels End ball (replaces 2nd tractor) Welded bars on links
Power requirements	
Two-tractor operation	190-290 hp
Tractor plus ball	260-290 hp

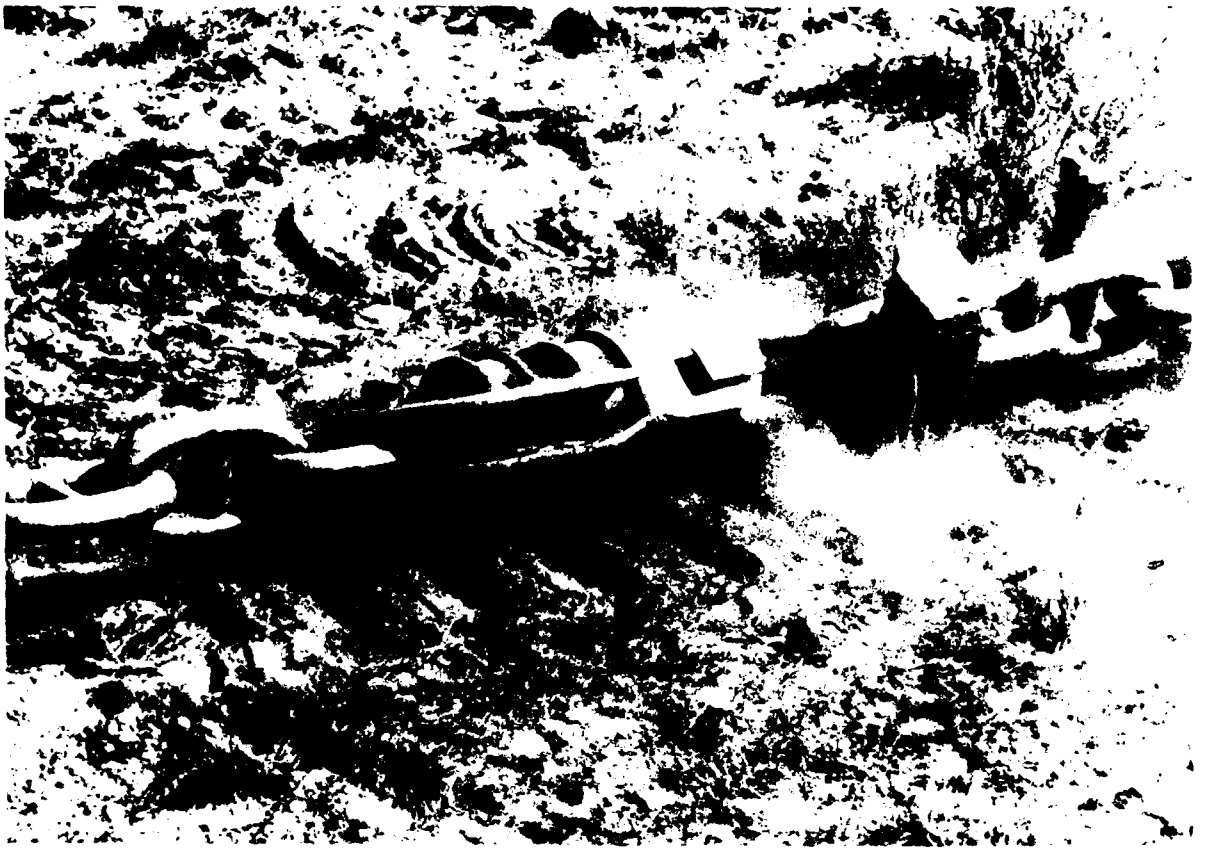


Figure 1. Close-up of chain, showing swivels and digger teeth (photo courtesy USDA Forest Service, Missoula, Montana)

OPERATION AND MAINTENANCE

Chaining should be done on the contour to reduce power requirements and to create furrows for slowing runoff and soil erosion (Vallentine 1971). Maximum contact between the chain and soil surface increases effectiveness. The chain should be pulled slowly between two crawler tractors or dozers in a J-, U-, or bow-shaped configuration to maintain chain-soil contact (Fig. 4). A bow-shaped chain configuration provides less efficient brush control at the chain's center. The area chained should be no greater than 33% to 50% of the chain length. Two passes of the chain from opposite directions are usually required for adequate brush control. Jensen (1983) recommended using a 15,000-lb chain, 250 ft long, pulled in a U-shaped pattern with a swath width of 50 to 70 ft. Scifres (1980) suggested a swath width of 85 to 150 ft using chains 150 to 300 ft long.

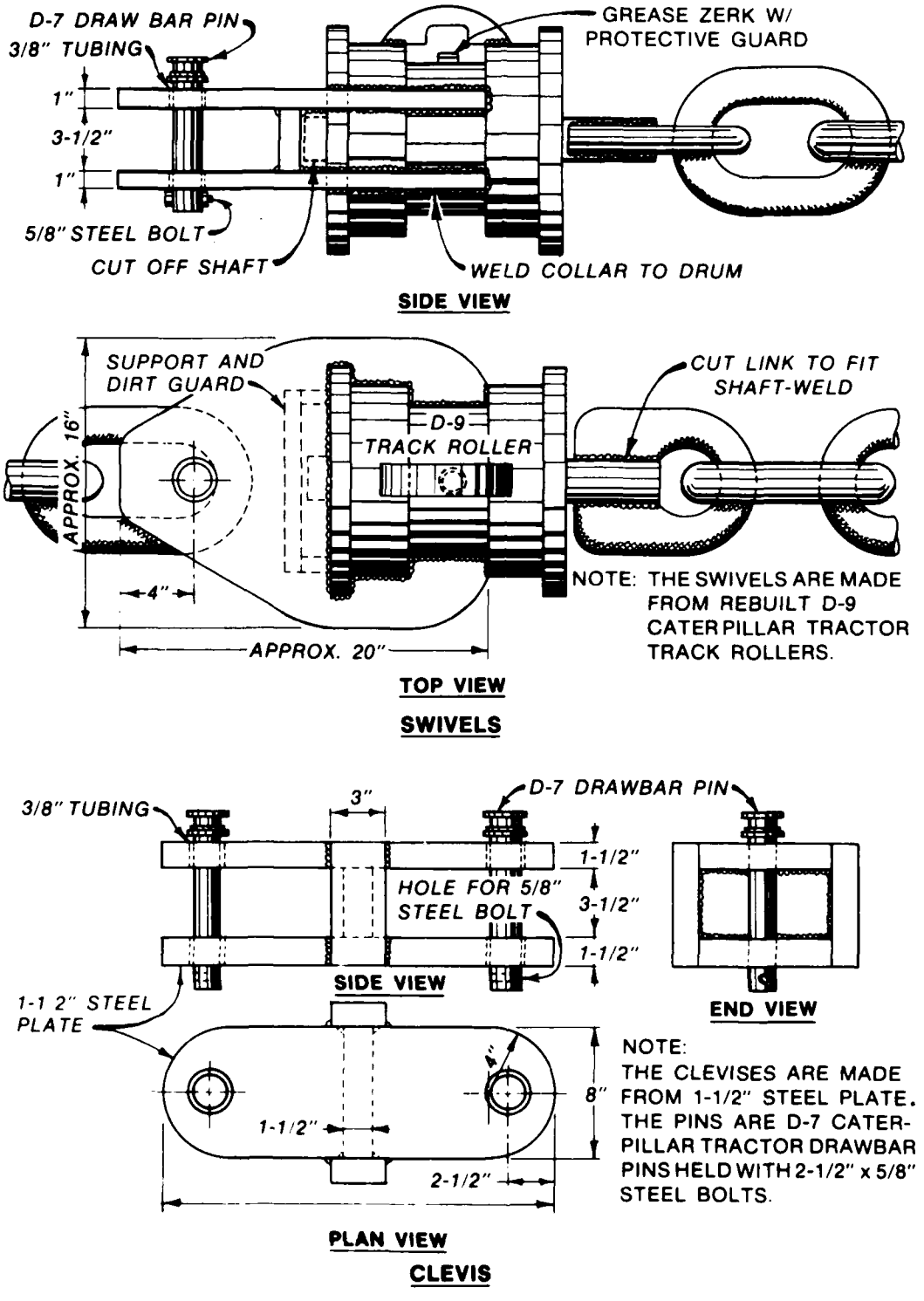


Figure 2. Design and assembly of swivels to allow rotation of chain (top), and clevis/connecting link used to attach chain to track vehicle (bottom) (adapted from specifications provided by F. R. Jensen, Dixie National Forest)

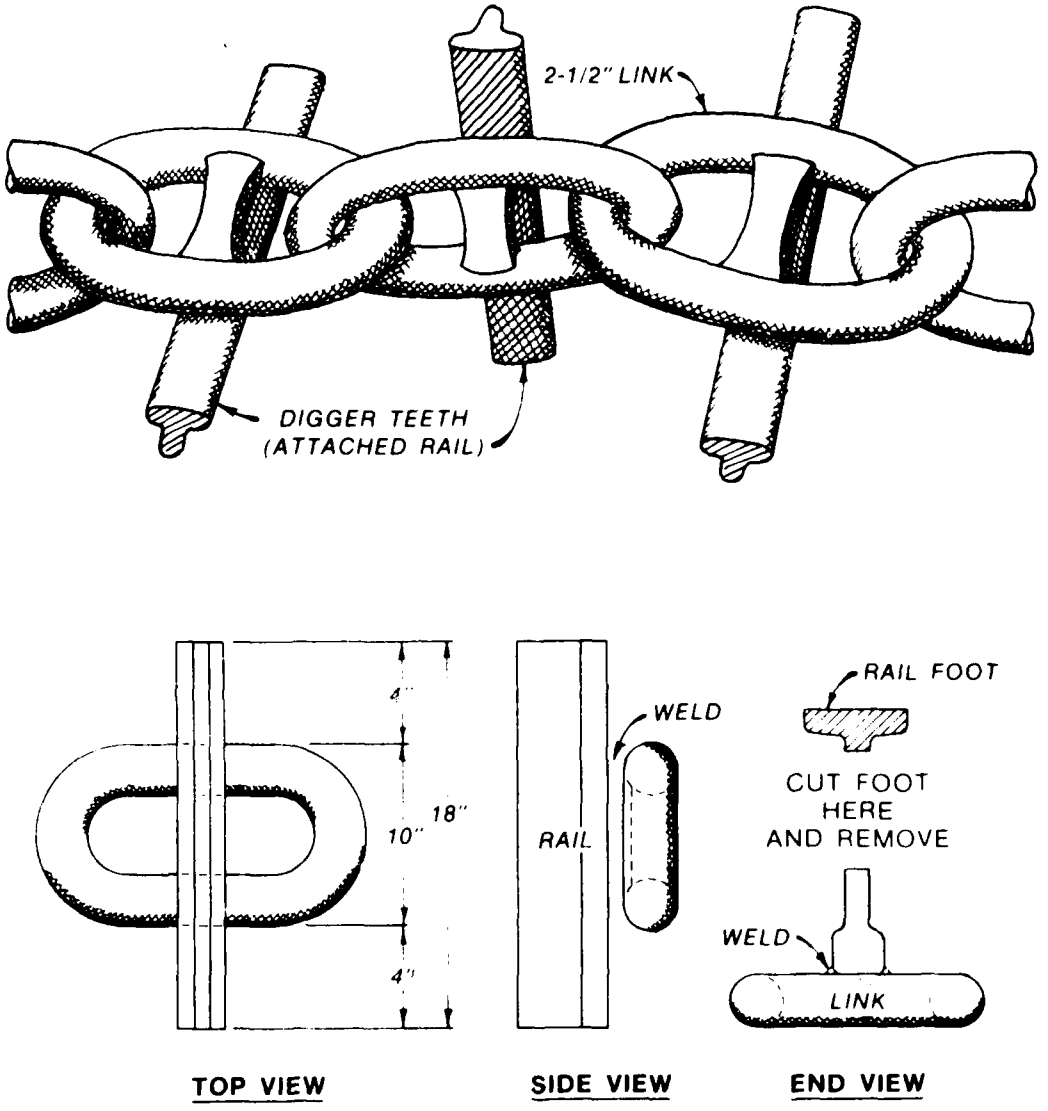


Figure 3. Specifications for attaching railroad rails to chains to improve soil scarification (information courtesy of F. R. Jensen, Dixie National Forest)

Figure 4. Chaining operation using two dozers (photo courtesy USDA Forest Service, Missoula, Montana)

Cables should be pulled rapidly in a bow-shaped configuration to produce a whip action to knock down brush. Two or 3 cables pulled between 2 tractors are sometimes recommended to increase the whip action. Between 15 and 40 acres can be treated in an hour using one pass of a cable or chain. Approximately 0.5 to 1.5 acres can be treated in an hour using a ball and chain on steep slopes (Larson 1980).

Although the chaining or cabling operation can be accomplished with a minimum of one person per tractor, additional personnel can be helpful in transporting and setting up equipment. General heavy equipment safety requirements should be followed, and extra personnel should stand clear of the chain or cable when in use to avoid being struck by flying debris. There are no special storage or maintenance requirements for chains and cables. Welds, links, and swivels should be checked for breakage and wear after each use. Swivels should be greased periodically.

LIMITATIONS

Chaining and cabling cannot control root-sprouting species or plants with flexible stems such as young shrubs and trees. Power requirements are high, and chaining usually requires 2 passes to be effective. This method is usually not appropriate on slopes greater than 30% unless a weighted ball is used. Chaining cannot be done on slopes exceeding 50%. Treating areas with shallow soils and rock outcrops will increase the operation time, often results in more breakdowns, may not give adequate vegetation regrowth for the cost, and can increase the erosion hazard. Brush stands and clearings should be interspersed if wildlife use is a primary or secondary objective. Extensive chaining and cabling can be detrimental to wildlife when the operation results in a grass or forb monoculture.

AVAILABILITY

Chains and cables are available from marine and navy surplus shops and from logging suppliers. More information is supplied by the following agencies:

USDA Forest Service
Equipment Development Center
Bldg. 1, Fort Missoula
Missoula, Montana 59801

Bureau of Land Management
Regional Offices

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