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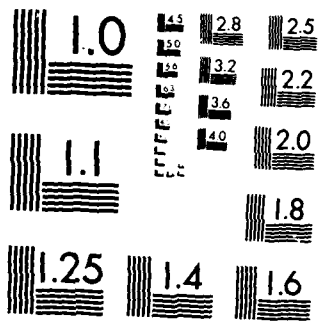

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TECHNICAL REPORT EL-86-44

POWER GRUBBERS

Section 8.2.3, US ARMY CORPS OF ENGINEERS WILDLIFE RESOURCES MANAGEMENT MANUAL

by

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			Equipment	Crawler tractors	
			Grubbing	Brush control	

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

An equipment report on power grubbers is provided as Section 8.2.3 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, maintenance, limitations, and availability.

Power grubbers are crawler tractors with specially designed blades that uproot trees and shrubs individually by cutting the roots underground and lifting or pushing over the plant. The grubber implement itself is a short, stout blade mounted between two heavy supports attached to a power source. Single-tree transplanter buckets are also used for grubbing. Management objectives for using power grubbers 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,

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and maintenance and safety requirements are given. Appropriate cautions and limitations are discussed.

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. Harold T. Wiedemann, Texas Agricultural Experiment Station, The Texas A&M University System, Vernon, Tex., is acknowledged for providing equipment information, photographs, and manuscript review. Information and photographs were also supplied by personnel from Hawk, Inc., Oswego, Ill.; Holt Machinery Company, San Antonio, Tex.; and Schutts Equipment Company, Birmingham, Mich. Review and comments were provided by Mr. 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 Information Products Division (IPD). Drawings were prepared by Mr. John R. Harris, Scientific Illustrations Section, IPD, 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.

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NOTE TO READER

This report is designated as Section 8.2.3 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.

POWER GRUBBERS

Section 8.2.3, US ARMY CORPS OF ENGINEERS
WILDLIFE RESOURCES MANAGEMENT MANUAL

Power grubbers are crawler tractors with specially designed blades that uproot trees and shrubs individually by cutting the roots underground and lifting or pushing over the plant. The grubber implement itself is a short, stout blade mounted between 2 heavy supports attached to a power source (Larson 1980). Power grubbers were first developed in 1939 and were attached to large tractors (Dickson et al. 1940); these units, referred to as high-energy grubbers, required tractors with a power rating in excess of 100 hp. Modifications in the 1970's resulted in the development of a low-energy grubber with a "shift-on-the-go" transmission and a hydraulically controlled articulating blade (Wiedemann 1982). Although specific blades have been developed for grubbing, single-tree transplanter buckets can also be used.

Grubbing creates less soil and vegetation disturbance than bulldozing and root plowing and is more economical in sparse to moderately dense brush. The technique effectively creates small clearings in brush-dominated areas when the scale of the operation precludes use of chains or cables. Managers have excellent control of the clearing size, clearing configuration, percent of brush cover removed, number of stems removed, and the specific trees to be removed. Therefore, grubbing can be used to selectively remove undesirable vegetation and increase habitat diversity.

Grubber blades have been used primarily in the Southwest to control multistem brush and tree species such as mesquite (*Prosopis glandulosa*), huisache (*Acacia farnesiana*), blackbrush (*A. rigidula*), and juniper (*Juniperus* spp.); they have also been used on oaks (*Quercus* spp.), cottonwoods (*Populus* spp.), and elms (*Ulmus* spp.) (Bontrager et al. 1979a,b; Meadors et al. 1973;

Wiedemann 1982; Wiedemann and Cross 1980, 1981; Wiedemann et al. 1977, 1979). Single-tree transplanter buckets have been used throughout the United States for removal of woody plants.

DESCRIPTION

Grubber blades and single-tree transplanter buckets are designed to be used on rubber-tired tractors, front-end loaders, and crawler tractors. Rubber-tired vehicles are a new modification that use foam-filled tires (Wiedemann 1982). Grubber blades can be mounted directly on standard dozer blades, front-mounted C-frames, or bucket loader frames. The blade is usually 24 to 48 in. wide (H. T. Wiedemann, Texas Agricultural Experiment Station, pers. commun., 1984), extends 12 in. below the level of the dozer blade (if attached directly to the blade), and has hydraulic arms that rotate the blade in a 70-deg arc (Fig. 1). Grubbers with hydraulic blades can remove trees with diameters 33% greater than trees removed by grubbers without hydraulic blades. Single-tree transplanter buckets are 30 to 60 in. wide, 36 in. deep, and come to an extended point in the center (Fig. 2). Bucket lifting capacities range between 1000 and 5000 lb, depending on the bucket size and tractor horsepower (see Table 1 for further specifications).

Table 1. Specifications for power grubbers and single-tree transplanters

Feature	Grubber Blade, Holt Machinery	Transplanter Bucket	
		Hawk, Inc.	Schutts Equipment
Blade/bucket width	24-48 in.	30-48 in.	16, 18, 24, 30, 36, 48, 60 in.
Maximum tree diameter that can be treated	12-48 in.	8-36 in.	
Minimum treatment rate	0.2-0.5 min/ tree	2 min/ tree	2 min/tree
Power requirements	65-180 hp	30-65 hp	20-70 hp

OPERATION

Low-energy grubbers require tractors with power ratings of 65 hp (Bontrager et al. 1979a). Single-tree transplanter buckets require a tractor with a power rating of 30 to 45 hp (small buckets) to 45 to 65 hp (large buckets)

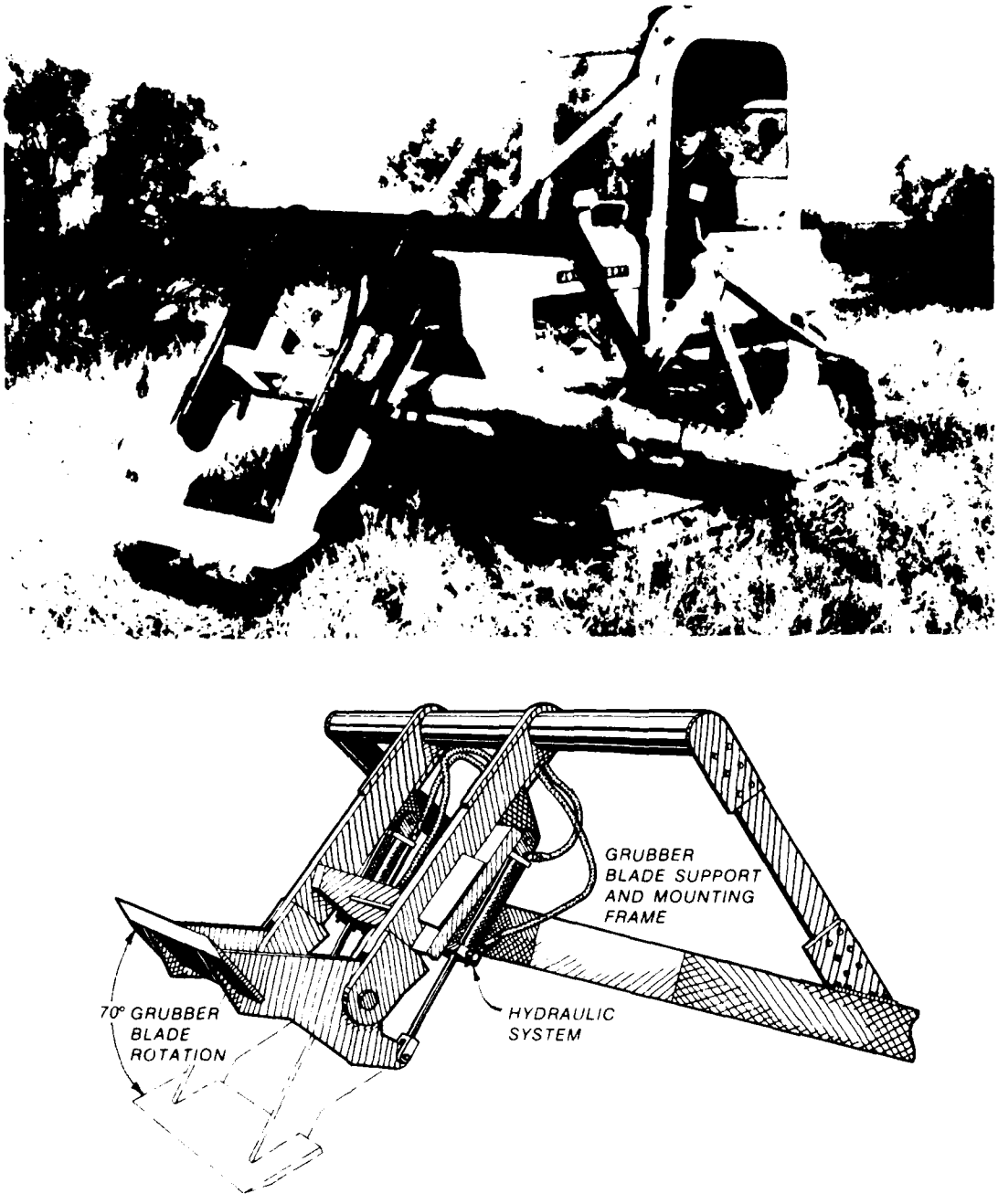

Figure 1. Power grubber attached to tracked vehicle (top), and illustration of hydraulic arms with blade at extended positions (bottom). (Photo courtesy of H. T. Wiedemann, Texas Agricultural Experiment Station)

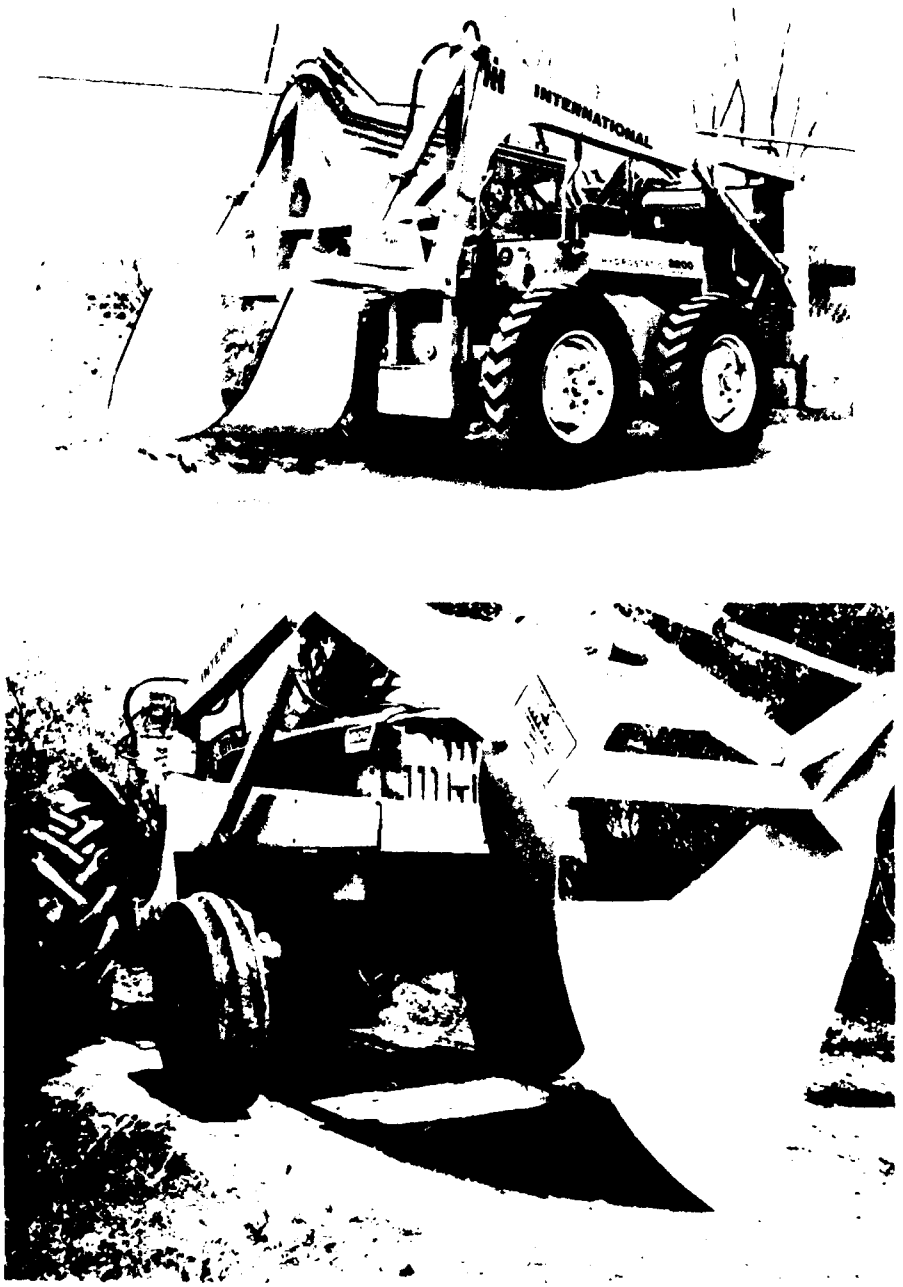

Figure 2. Single-tree transplanter buckets. (Photos courtesy of Hawk, Inc. [top] and Schutts Equipment [bottom])

(Hawk, Inc. 1983). Power sources should be driven only by experienced tractor operators.

Operation speed varies with topography, soil conditions, species to be treated, density of plants, and equipment being used. Treatment rates vary between 1.5 and 15 acres per hour (Wiedemann 1982, Wiedemann and Cross 1981). Grubbers have been used on plants with stem diameters of 4 to 13 in.; however, plants over 22 in. in diameter have been removed (Bontrager et al. 1979a; Wiedemann and Cross 1980; Wiedemann et al. 1977, 1979). Trees 4 to 48 in. in diameter can be uprooted with 100- to 200-hp crawler tractors on a sustained basis (Wiedemann, pers. commun., 1984). Small transplanter buckets can remove trees up to 8 in. in diameter, and large buckets can remove trees up to 36 in. in diameter (Hawk, Inc., pers. commun., 1983). Areas may need to be regrubbed after several growing seasons (Wiedemann and Cross 1981); however, a prescribed burning program may be a more efficient way to maintain these clearings (Bontrager et al. 1979a).

MAINTENANCE

Tractors should be maintained following manufacturers' specifications, and grubber blades should be inspected daily for broken or cracked parts and blade sharpness. Blade grinding or replacement will be necessary periodically. Frames, hydraulic assemblies, attachments, and pins and bushings should be inspected monthly. All repairs should be timely.

LIMITATIONS

Because individual tree uprooting is time consuming, grubbers are not suited for use on dense stands of vegetation. Grubbing is also not economical for nonsprouting species where effective control can be accomplished without cutting the roots (Larson 1980). Grubbers should not be operated on slopes greater than 18%. Grubbing time is reduced by wet clay soils and rocky sites, and uprooting should be discontinued when sites are too dry for blades to enter the soil effectively (Wiedemann and Cross 1981). Soil and vegetation disturbance is greater when using crawler tractors compared to rubber-tired tractors. Rubber-tired tractors are also more fuel efficient and initial costs are lower, but they are not as durable on rough sites (Wiedemann 1982).

AVAILABILITY

Grubber blades or single-tree transplanting buckets are available from the following sources:

Hawk, Inc.
Route 71
Oswego, Illinois 60543

Schutts Equipment Company
P. O. Box 412
Birmingham, Michigan 48092

Holt Machinery Company
P. O. Box 658
San Antonio, Texas 78243

Grubbers may also be fabricated by equipment dealers or local machine shops. Drawings and information are available from:

Texas Agricultural Experiment Station
Texas A&M University
Box 1648
Vernon, Texas 76384

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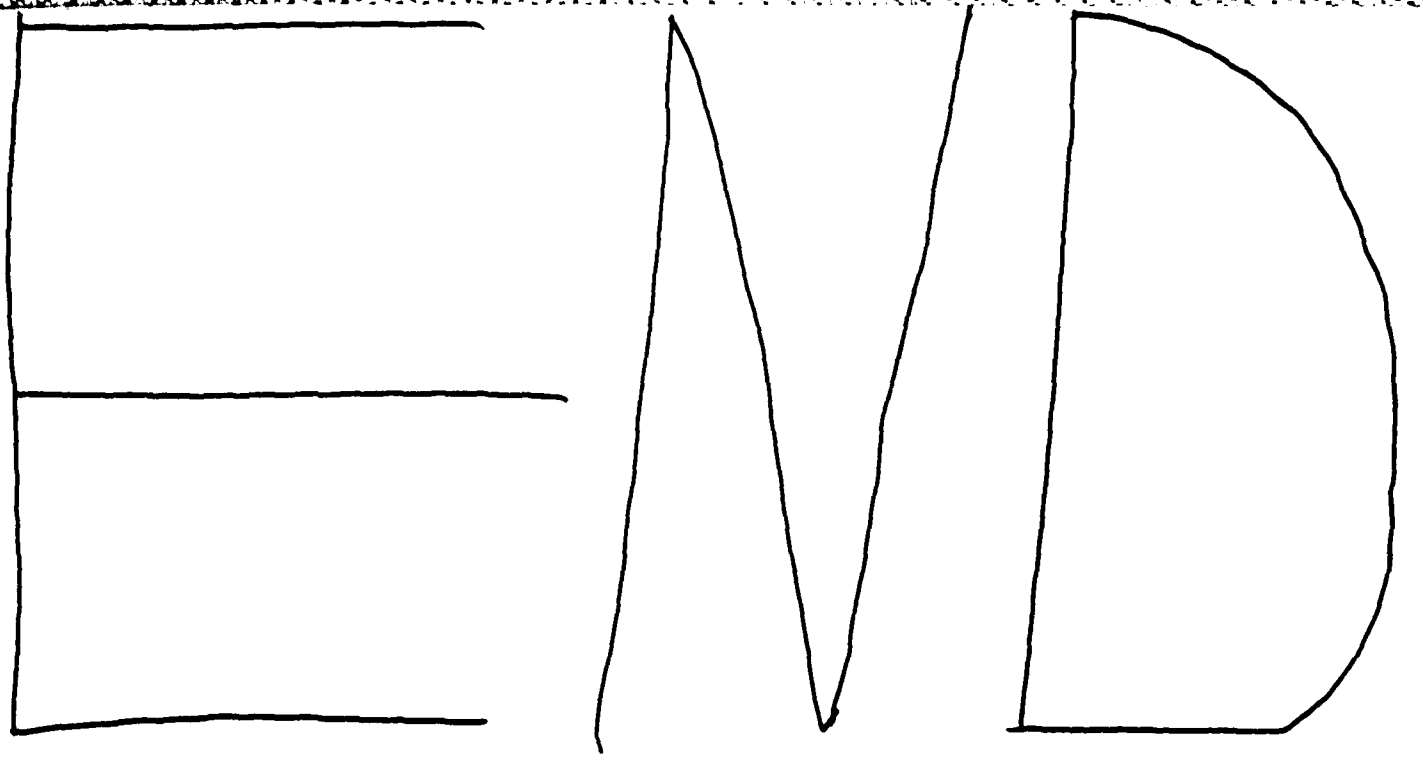

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