NATURAL RESOURCES CONSERVATION SERVICE
PACIFIC ISLANDS AREA

CONSERVATION PRACTICE SPECIFICATION

GRAZING LAND MECHANICAL TREATMENT (548)

SCOPE

This document establishes the technical details, workmanship, and quality and extent of materials required to install the practice in accordance with the Conservation Practice Standard. The information shall be considered when preparing site-specific specifications for the practice.

The NRCS Pacific Islands Jobsheet for this practice shall be used to document the site-specific specifications for installing, operating, and maintaining the practice on a specific field or treatment unit. Other documents (worksheets, maps, drawings, and narrative statements in the conservation plan) may be used in addition to the Jobsheet to document site specifications or to plan or design the practice.

MECHANICAL TREATMENTS

Mechanical treatments such as contour furrowing, pitting, ripping, subsoiling, chiseling and land imprinting shall be designed and applied in a manner to accomplish the desired objectives and address the natural resource concerns. These treatments shall be limited to soils and slopes where surface disturbances will not result in unacceptable levels of soil erosion and/or sedimentation.

CONTOUR FURROWING

Contour furrowing is normally performed using an implement called a contour furrower.

Function: Contour furrowers break up compacted soil, forms furrows, dams the furrows at intervals, and can also broadcast seed. It can reclaim deteriorated rangelands, prevent soil erosion, and improve moisture conditions.

Description: The contour furrower normally has four basic components: two subsoilers, two pairs of offset disks, two four-blade paddlewheel dammers, and seed box spreaders. These components are attached to a wheeled frame that can be raised or lowered by a hydraulic cylinder. The depth of penetration, width of the furrows, and distance between check dams may be adjusted by altering the subsoiler height, disk angles, and paddlewheel trip mechanism, respectively.

Operation: With each pass the contour furrower builds a pair of furrows. The subsoilers break up surface compaction and hardpan and the disk pairs cut furrows in the ripped soil. The offset configuration of the disks builds banks on both sides of the furrow. Check dams are formed by pushing soil in front of a paddlewheel blade locked in place until released by a trip mechanism. The paddlewheel then rotates, locking the next blade in place and leaving a soil dam behind. Seed may be broadcast into the furrows from a seed box spreader mounted at the rear of the implement.

Capabilities: The contour furrower is well suited for watershed rehabilitation on fairly level land and on slopes up to 20 percent. However, it is best adapted to slopes of less than 10 percent where it improves infiltration and percolation in heavy, compacted soils. The check dams provide catch basins for runoff and make the exact following of contours less critical.

Application and Limitations: The contour furrower should not be operated in rocky soils because the disks may break. Wind or water may move uncovered broadcast seed.

The size and spacing of furrows should be computed so that their total water storage capacity will be sufficient to retard the runoff that occurs on the site during rainfall events up to a 10-year/24-hour frequency storm. A typical spacing is two to five feet apart and a depth of eight inches.

The furrows should be installed as close to the contour as possible. The object of this practice is to intercept down-slope flow of water and hold it for infiltration. If the furrows are not on the contour, accelerated erosion can occur.

PITTING

Several types of equipment can be used for pitting. Pitting disk plows have been the most commonly used type of equipment. Lister bottoms and rotary-drum pitters have also been used for pitting.

Function: Pitting disk plows create long, narrow pits or catch basins that accumulate rain and hold runoff. The increased availability of water in and around the pits stimulates plant growth and helps establish seedlings.

Description: Pitting disk plows are mainly modified one-way disk plows. The standard disks are simply replaced with cut-out disks. Broadcast seeders may be mounted on these plows.

Operation: The cut-out disks only contact the ground during part of each revolution, leaving alternate strips of plowed ground and undisturbed soil. Seed is often broadcast around the pits. Pitting the higher areas of a watershed will trap runoff on the slopes for increased forage production and reduced erosion.

Capabilities: Pitting disk plows scarify the ground surface so that runoff may be trapped. The moisture that is retained contributes to increased plant growth and seedling survival and reduces erosion.

Application and Limitations: Pitting should be applied on fine and medium textured soils with few stones in the upper profile.

Pitting disk plows are not effective in dense sod. Pits formed in sandy soil may fill in rapidly. Broadcast seeding does not allow precise seed placement. Seed that falls into the pits may be covered too deeply to survive.

Generally, pitting is most effective on slopes less than 10 percent. However, pitting may have some positive effect on slopes as steep as 30 percent.

The pits should be up to 3 to 4 feet apart and a minimum of 6 inches deep. Pits can be as long as 3 to 5 feet.

RIPPING

Ripping can be performed using an implement called a ripper.

Function: Rippers shatter and fracture rock and compacted soil. They penetrate deeply to improve drainage and infiltration. They are most often considered a basic construction implement used to prepare material for loading and hauling.

Description: Rippers are large shanks attached to a tool bar or special hitch mounted to a tractor, loader, or motor grader.

Operation: Rippers move through the ground, creating very deep, narrow furrows. They can break rock and hard soil into sizes suitable for loading and hauling.

Capabilities: Rippers can break up compacted soils and surface crusts, thereby improving water infiltration and root penetration into the soil. Ripping compacted soil before planting enhances plant survival. Rippers can penetrate the soil to a depth of 7 feet.

Application and Limitations: Ripping is not well suited to steep slopes or soils over bedrock. Do not use on slopes that exceed 20 percent. If the furrows fill in quickly, sustained increases in forage production will not be realized. Rippers do not form adequate seedbeds. They leave the material in large chunks and pull up large rocks. The soils should be reworked with a chisel plow or disk plow to break up the large pieces before planting.

Ripping will be performed on the contour wherever the terrain permits. In areas of complex topography, it can be performed across the predominant slope.

SUBSOILING

Subsoiling can be performed using an implement called a subsoiler. Grazing Land Mechanical Treatment

Function: Subsoilers penetrate deep into the soil to fracture compacted layers (or hardpan) for better drainage and root development. Subsoilers also effectively lift the deep soil and mix it with the surface soil and incorporate amendments into the soil.

Description: Subsoilers are large, stout shanks attached solidly to a toolbar or frame with shear bolts. The shanks are curved and have replaceable tips. The subsoilers are raised and lowered hydraulically. Some models have power-take-off (PTO)-driven vibrating devices.

Operation: Subsoilers are pulled through the soil at the desired depth. Best results are obtained when the soil is dry. Subsoiling should be performed on the contour to minimize the erosion hazard.

Capabilities: Subsoilers fracture hardpan and stimulate increased growth. Subsoiling makes more moisture and nutrients available to plant roots.

Application and Limitations: Subsoilers are effective only when furrows last and where hardpan restricts plant growth. Subsoilers also have high power requirements.

CHISELING

Chiseling refers to soil ripping operations to depths less than 16 inches. Chiseling can be performed using a chisel plow.

Function: Chisel plows break up compacted surface soil and increase water infiltration. They can also be used to incorporate soil amendments. Chisel plows are often used in rocky areas.

Description: Chisel plows have curved shanks mounted along frame member or toolbars with spring-loaded clamps. A wide variety of chisel teeth, sweeps, and shovels may be attached to the tips of the shanks for various tillage needs. The spring clamps enable each shank to clear obstacles independently. Chisel plow frames have from two to six cross members. They may be mounted on a tractor or pulled behind them. Plowing depth is controlled hydraulically.

Operation: Chisel plows are simply pulled through the soil. The action of the shanks scarifies the ground and opens it up. The narrow furrows trap moisture and reduce wind erosion. Chisel points, shovels, and sweeps can destroy plant roots and loosen the soil from underneath.

Capabilities: Chisel plows can be used on to rocky land because the narrow, flexible shanks and independent spring action allow the tips to bypass surface of subsurface rocks. Durable, reversible chisel plows prepare excellent seedbeds for broadcast seeding. They can effectively mix amendment with the soil.

The use of a parabolic chisel will decrease draft (horsepower) requirements, increase upward lift on soil, and give better penetration on very hard soils.

Smooth, sealed soil surfaces with low infiltration rates are transformed into micro-rough, macro-porous surfaces able to rapidly exchange rainwater and displace soil aeration across the air-earth interface.

Application and Limitations: Rocky soils cause excessive wear on the plow tips. Rocks may be moved to the surface by the action of chisel plows and may interfere with secondary tillage implements or drills.

Chiseling should be performed on the contour wherever the terrain permits. In areas of complex topography, chiseling operations will be across the predominant slope. Do not use on slopes that exceed 20 percent.

The depth and spacing of the chisels shall penetrate through the restrictive layer and shatter this layer over 70 percent of the area between implement penetration points.

Maximum spacing of chisel shanks shall be 30 inches.

LAND IMPRINTING

Land imprinting refers to a no-till process of imprinting the soil surface with a series of micro basins or mini watersheds. A typical basin is 6 to 10 inches in depth and of various shapes. Land imprinting may be accomplished by use of a land imprinter drum or roller.

Function: Land imprinters create a series of geometric patterns on the ground surface to control erosion and direct infiltration. This is accomplished without tillage so that the soil structure and profile is preserved and available mulch material is retained near the surface. The imprinting treatment produces an excellent, rainwater-irrigated seedbed for establishing broadcast seed or rejuvenating favorable forage grasses.

Description: Land imprinters are essentially towed rolling drums mounted on an axle. The drums can be weighted by filling them with water. A rotary spreader and hanging drag chains can be mounted on the rear of the imprinter frame for broadcast seeding.

Imprinter drums can be fabricated in almost any size ranging from those requiring the power of large crawler tractors down to small rollers that can be operated by a garden tractor or hand pushed. Angle-leg length can vary from 2 to 10 inches although the 6-inch size is typical of the imprinters being designed, fabricated, and used today.

Hand- and foot-operated imprinters of several designs are also available. Typically they have a single angular imprinting tooth with either a 45o or 90o tip which is forced into the soil through the combined forces applied by the hands on a T-handle and one foot in a D-shaped stirrup.

Operation: The land imprinter is pulled over the area to be treated. The device crushes and chops brush, mixes and imbeds surface debris or seed, and forms stable, complex impressions in the ground. The resulting closed, V-shaped furrows can collect up to 2 inches of rainfall and disperse concentrated runoff. The slight firming action of the treatment helps prevent splash and sheet erosion. The rotary spreader distributes seed over both treated and untreated ground. In this manner, some of the seed is imbedded on the return pass, while the rest is collected in grooves of the imprinted pattern where the rainfall and runoff is directed. The moist, mulch-lined furrows also provide a suitable micro-habitat for soil organisms.

Capabilities: Smooth, sealed soil surfaces with low infiltration rates can be transformed with microrough, macroporous surfaces able to rapidly exchange rainwater and displace soil across the air-earth interface.

The land imprinter can operate satisfactorily on rough, rocky, or brush-covered terrain and on most soil conditions. It can treat slopes up to 45 percent. The land imprinter is a versatile and valuable tool for plant establishment, erosion control, and disturbed land rehabilitation.

Application and Limitations: The land imprinter is not capable of treating dense stands or sprouting brush. Prior treatment is recommended for stems of 3-inches in diameter.

Land imprinters can be used on uncompacted soils of most textures. Compacted soils may need to be chiseled or subsoiled before land imprinting. Ripper shanks have also been attached to the imprinter frame to loosen extremely hard, dry soils enough to obtain adequate penetration of imprinting teeth.

Where deep, compacted soil has occurred, deep ripping should be carried out initially with heavy-duty equipment (see prior section on ripping).

Repeated treatment may be necessary if the impressions wear down.

AFTER TREATMENT REST PERIOD AND GRAZING

Adequate rest from grazing shall be applied to ensure desired plant responses from this treatment.

Grazing Land Mechanical Treatment is considered a facilitative practice in the PIA. At least one year of Prescribed Grazing (528) must also be planned as an accompanying management practice following the completion of the treatment(s) to ensure adequate establishment and recovery of desired forage species. The deferment period may need to be extended beyond the minimum because of drought after treatment, low vigor of the forage species, or other abnormal conditions. The client should be encouraged to extend the deferment period beyond the original dates when the conditions dictates. The Prescribed Grazing plan must identify important management considerations including minimum height and stage of growth the stand much reach before grazing may commence, the recommended degree of grazing utilization and forage plant stubble height, the minimum height the forage plants must attain before grazing resumes, and estimated required deferment periods for adequate plant recovery. See the Prescribed Grazing (528) practice standard and specification for details.

NRCS Financial Assistance Programs: Whenever a cooperator enters into a contract with the NRCS, no less than one year and no greater than three years of Prescribed Grazing (528) must be planned. If revegetation is needed, Range Planting (550) or Forage and Biomass Planting (512) must also be planned. Consult the practice specifications (as applicable) for details and procedures for developing a revegetation plan following Grazing Land Mechanical Treatment. Refer to the Prescribed Grazing (528) practice specification for details on developing grazing plans following Grazing Land Mechanical Treatment.