

# INSTRUCTIONS FOR SOIL CONSERVATION PRACTICE IN SMALL-HOLDINGS AND HIGHLAND ALLOTMENTS

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## INTRODUCTION

**T**HE main objectives in teaching soil conservation practice to villagers and cultivators are :—

- (a) to prevent loss of soil caused by surface run-off ;
- (b) to store as much rain as possible by getting it into the ground instead of letting it run off ;
- (c) to conserve moisture and nutrients in the soil ;
- (d) to produce the maximum yield of both food crops and cash crops ;
- (e) to help each household to produce a full daily ration of nutritious food and a surplus which can be sold.

The best practices are :—

- (a) the terracing of fields with stone walls or grass banks ;
- (b) contour bunds ;
- (c) contour-ploughing and subsoiling ;
- (d) green manuring and mulching ;
- (e) intercultivation and basin-listing ;
- (f) avoiding bare fallow by sowing grass where land is to be rested or grazed ;
- (g) reserving very steep slopes for permanent crops, preferably forest ;
- (h) providing adequate drains to lead surplus water very slowly into the nearest main drainage channel.

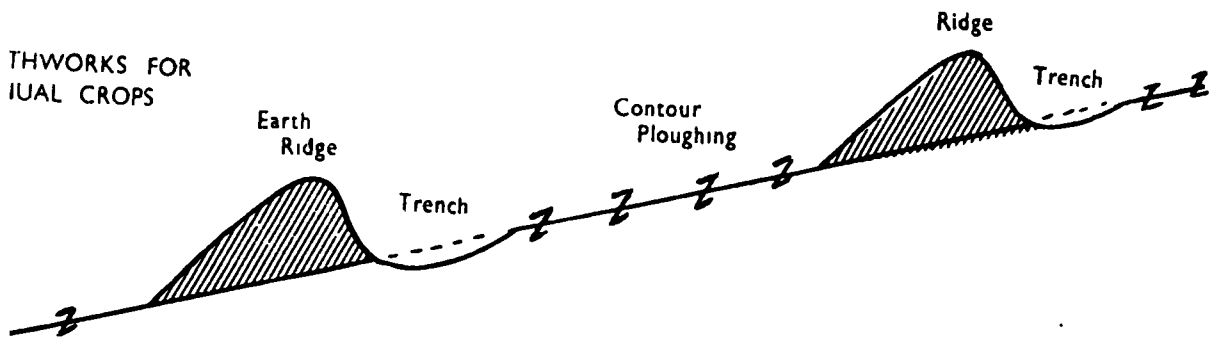
There is a common tendency to cut steep downhill drains on sloping holdings. This is a mistake and must be avoided (or corrected if they are already cut). The object should be to plan each holding so that the whole of the rain which falls on it is absorbed into the ground. The more prolonged the dry period the more essential does this become if allotment gardens and crops are to survive drought. Where the monsoon rainfall ordinarily exceeds 2 inches a day, however, it is not possible to stop and store all the rain, so drainage must be provided so that the surplus can escape without doing damage. Before digging any drains, however, the first essential is to have the whole of the land terraced except the actual house-site. The second is to keep the surface as absorptive as possible. Detailed instructions on all these points are given below.

## TERRACING

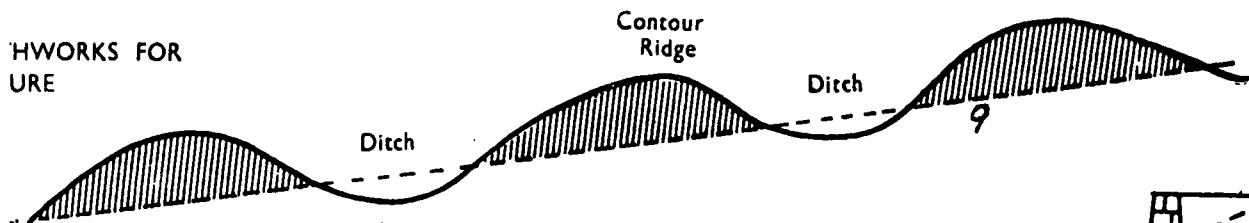
**For Land Already Planted with Trees.**—Where a plot already has coconut palms, rubber, citrus or cocoa bushes planted on sloping land, the crop as a whole should be examined, and weedy, inferior, diseased, or stag-headed plants cut out. The remaining good plants should each be given a terrace. Where stone is available, dry stone walling is best, but where stone is not available, an earth bank should be built and turfed with carpet grass or paspalum grass to bind the steep face. The lip of this terrace should be built truly on the contour, and the centre of the curve 8 to 10 feet downhill from the base of the tree. The finished

## ON GENTLE SLOPES

THWORKS FOR  
UAL CROPS

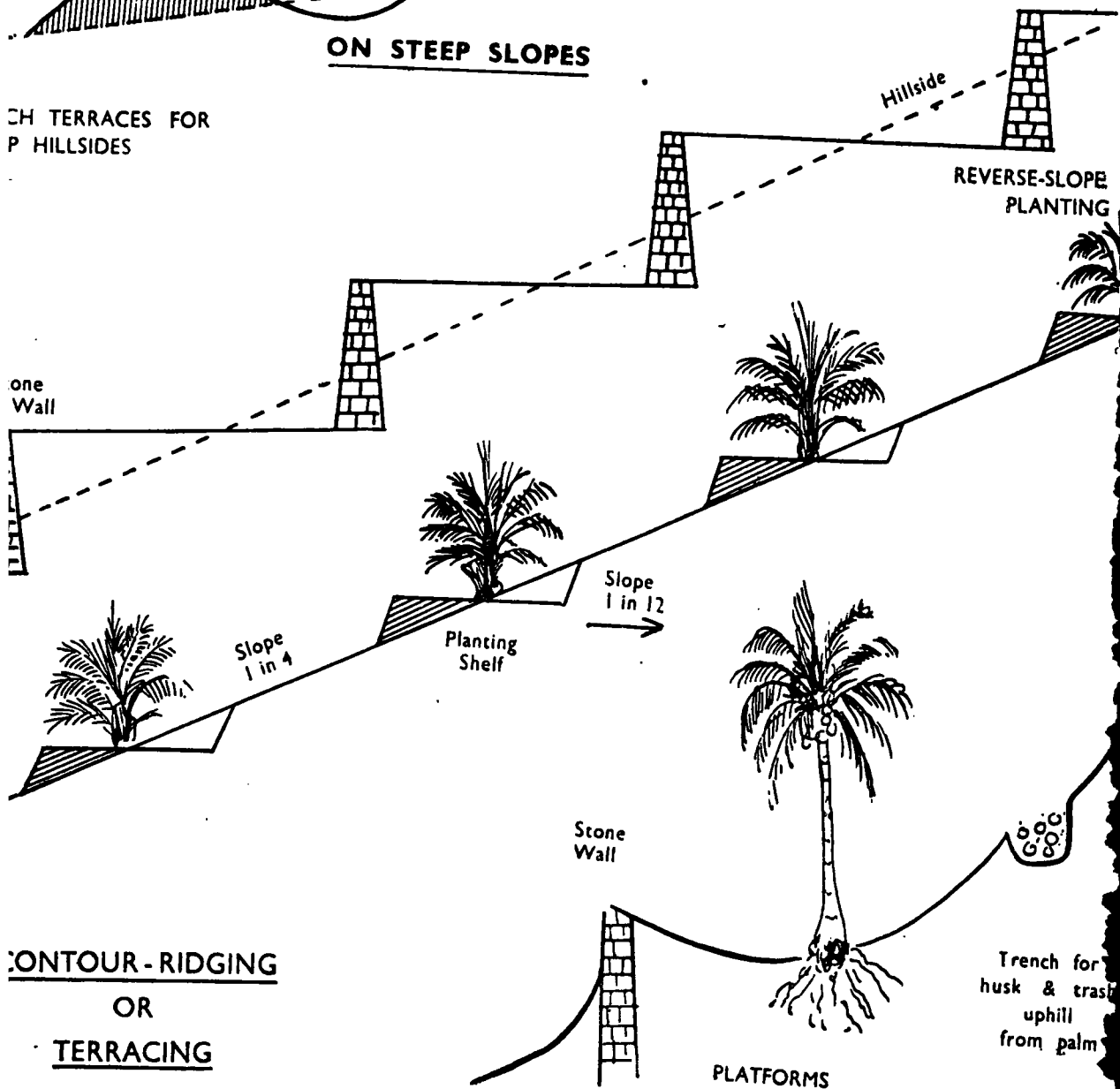


THWORKS FOR  
URE



## ON STEEP SLOPES

CH TERRACES FOR  
P HILLSIDES



CONTOUR - RIDGING  
OR  
TERRACING

terrace for each tree should be back-sloped into the hill so that surface run-off is ponded back around the tree. The absorption of run-off will be enhanced by digging a 2-foot deep contour trench, 10 feet long, at a point 10 feet uphill from each tree or each alternate tree, and filling this trench with husks or any other spongy material which may be available nearby. These trenches should have shallow leader drains running slightly uphill and with their ends overlapping thus preventing run-off from scouring runnels in the space between the trees.

In old and irregular coconut or cocoa crops which have trees widely spaced it may be possible to make terraces in the spaces between trees and use them for field crops.

**For Land not yet Planted.**—Starting with the highest ground in each holding, all land not actually occupied by buildings or trees must be completely terraced, so that each terrace is dead level. The steeper the slope, the closer must be the terrace walls and the narrower the fields between the terraces. Approximate spacing for complete bench-terracing should be :—

| Drop in feet<br>per 100 feet. | Slope as a<br>gradient. | Vertical drop from<br>terrace to terrace. | Horizontal width of<br>field. |         |
|-------------------------------|-------------------------|---|-------------------------------|---------|
|                               |                         |   | Average                       | Maximum |
| 1 ft. to 3 ft.                | ... 1/100 to 1/33       | ... 2 ft.                                 | ... 70                        | ... 80  |
| 4 ft. to 5 ft.                | ... 1/25 to 1/20        | ... 2 ft.                                 | ... 60                        | ... 70  |
| 6 ft.                         | ... 1/17                | ... 6 ft.                                 | ... 60                        | ... 70  |
| 7 ft.                         | ... 1/14                | ... 5 ft.                                 | ... 55                        | ... 60  |
| 8 ft.                         | ... 1/12                | ... 4½ ft.                                | ... 50                        | ... 55  |
| 10 ft.                        | ... 1/10                | ... 4¾ ft.                                | ... 45                        | ... 50  |
| 12 ft.                        | ... 1/8½                | ... 5½ ft.                                | ... 40                        | ... 45  |
| 15 ft.                        | ... 1/6½                | ... 6½ ft.                                | ... 35                        | ... 40  |
| 20 ft.                        | ... 1/5                 | ... 8 ft.                                 | ... 30                        | ... 35  |

Wherever stone is available, terrace walls should be built of loose rubble masonry, with a batter of 1 in 3½ (*i.e.*, the face of the wall should be sloped 1 inward for every 3½ upward).

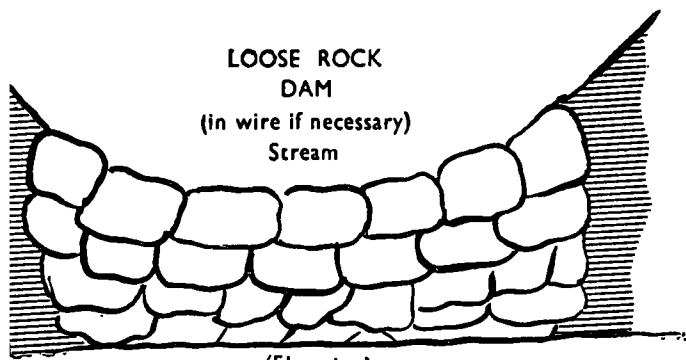
Where stone is not available, earth terraces should be made with a slope of 1 in 1, and this face must be kept under grass always.

**Excessively Steep Slopes.**—For all slopes over 1 in 5 every effort must be made to stop further cultivation and bring this land under afforestation. If cultivation cannot be avoided, stone walling must be insisted on and the following dimensions observed :—

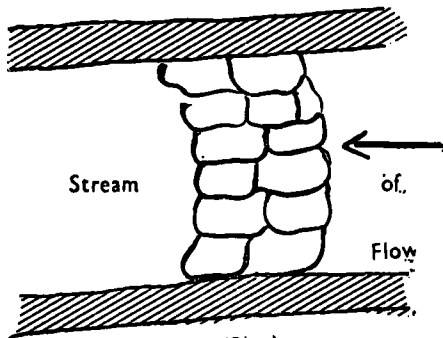
| Drop in feet<br>per 100 feet. | Slope as a<br>gradient | Vertical drop from<br>terrace to terrace. | Horizontal width of<br>field. |         |
|-------------------------------|------------------------|---|-------------------------------|---------|
|                               |                        |   | Average                       | Maximum |
| 25 ft.                        | ... 1/4                | ... 8 ft.                                 | ... 25                        | ... 30  |
| 33 ft.                        | ... 1/3                | ... 10 ft.                                | ... 20                        | ... 25  |
| 50 ft.                        | ... 1/2                | ... 10 ft.                                | ... 15                        | ... 20  |
| 100 ft.                       | ... 1/1                | ... 12 ft.                                | ... 10                        | ... 15  |

**Shelves for Tree Crops without Intercultivation or Field Crops.**—For rubber, cocoa, coconut and forest trees it is not necessary to trench the whole slope completely, but every effort should be made before planting to dig shelves 2½ to 4 feet wide, strictly on the contour and spaced suitably for the crops, *e.g.*, 20 feet for rubber, 24 to 28 feet for coconut. These shelves will be back-sloped into the hill so that the front lip of the shelf after the earth has settled is 6 inches above the back. Steps must also be taken early to get a cover crop established on such ground.

LOOSE ROCK  
DAM  
(in wire if necessary)  
Stream

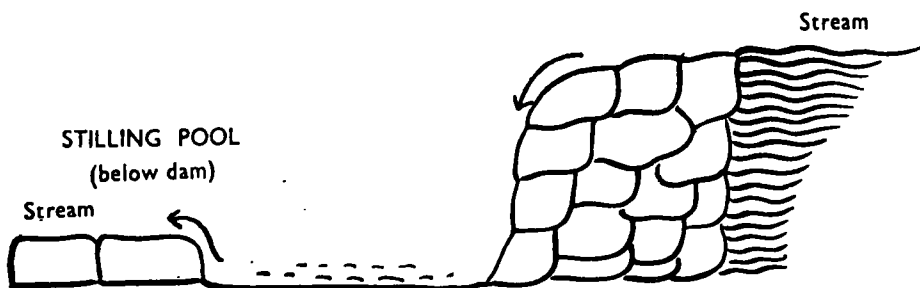


(Elevation)



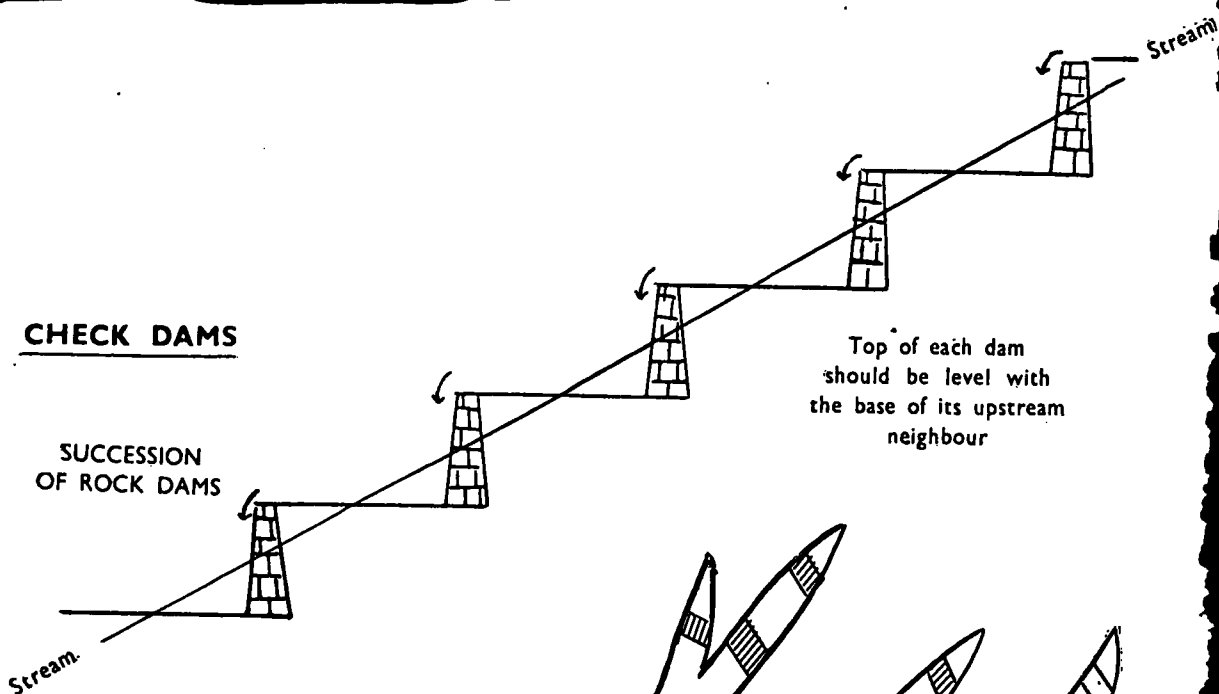
(Plan)

STILLING POOL  
(below dam)



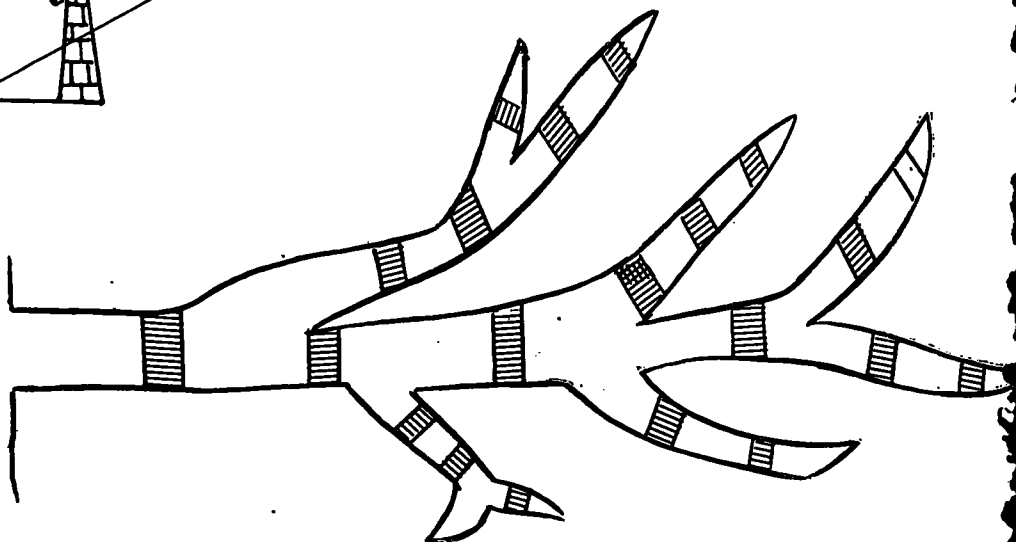
### CHECK DAMS

SUCCESION  
OF ROCK DAMS



Top of each dam  
should be level with  
the base of its upstream  
neighbour

SITING  
OF  
CHECK DAMS  
IN  
STREAM BEDS



If it is desired to provide side drainage for the gradual removal of surplus water, these shelves can be given a side grade of 1 in 120 or 1 in 200 and the shelf widened into square platforms at appropriate distances for each plant.

**Lay-out and Payment.**—No ground steeper than 1 in 5 should be given out to individual small-holders but should be kept under jungle or firewood plantation. Permits for new planting should be refused for land steeper than 1 in 3 for big estates. In the case of small-holders with no other land this figure can be reduced to 1 in 2½. This forms a departure from the previous Survey Department convention that land of slope steeper than 1 in 1 or 45 degrees should be withheld from allotment. Steep nala beds and stream channels likely to erode badly if cleared for cultivation should be kept as stream-side forest reserves.

Whether payments by Government are made as grants-in-aid or on a pay-roll, the work must be pegged out in detail, and fully explained by the Government staff before earthwork begins. Where no funds have been allotted, every effort must be made to get the work done voluntarily by each owner or allottee.

Where an isolated hillock is included in the estate this should be ringed round completely with a true contour ridge fixed at such a level that it will contain 1½ to 2 acres in the hill top terrace. The next terrace below will be spaced according to the above schedule.

**Subsoiling.**—When terracing is done by bull-dozer or tractor, the machine before leaving a terrace should go over the whole of it with a subsoiler, ripper, or rooter. The purpose of these attachments is to break up the subsoil to a depth of 16-18 inches but without turning the top soil over as in ploughing. The aim is to make the land as fully absorptive as possible.

Where no machines are available for subsoiling the only alternative is to encourage each holder to go in for deep digging instead. The growing of green manures, mulching into the soil every scrap of vegetable matter, and the maintenance of compost pits for manuring are all important contributions to making crop land more absorptive. "Basin Listing" is the cutting of a close pattern of "bath tub" hollows along each contour, the crop being planted on the intervening ridges.

**Use of Terrace Wall or Outer Slope.**—The wall space can be used for fruit plants which can be planted along the top of the stone wall or on the face of the earth slope. Steep earth faces must be kept under thick grass, preferably carpet grass or paspalum. If guinea or other tufted grass is used it must be kept up as a solid contour row and not left as isolated tufts.

**Repair and Upkeep.**—Grassed bank slopes must be kept free of weeds; any erosion rills which may develop must be repaired and grassed before the next storm. It must be made very clear to all small-holders or allottees who receive help from Government funds for improving their holding, that they are under an obligation to keep terraces, drains, checkdams, etc., in good repair subsequently, and without any further payment from Government.

**Drains and Checkdams.**—If as a result of the above operations it is found at the end of a monsoon period that flooding has caused damage to the property, a system of side drains should be aligned with a maximum slope of 1 in 100 along the hill side to join the nearest natural down-hill drainage channel.

Wherever natural drainage channels show any sign of cutting or gullying, rock rubble checkdams should be built in the channel bed at frequent intervals. These dams may be constructed of interlocked slabs of rock, but rock rubble may need to be secured in a bolster of wire-netting.

The objects of these checkdams are :—

- (i) to keep the flow in the natural channel ;
- (ii) to slow up the pace of run-off without actual ponding back ;
- (iii) to prevent natural channels from deepening or widening further.

Where drains have already been cut on too steep a lay-out (less than 1 in 80) they should be blocked off by cross walls of earth to form a series of contour ditches, so that the maximum amount of run-off is caught and held in them until absorbed into the ground. Wherever possible wet vegetable plots should be established by ponding with earthwork where surplus drainage from a well or from checkdams provides enough moisture to make this worthwhile.

**Contour Ridging in Land intended for Grazing.**—For land which is alternated as grass “ley” between field crops, the whole should be laid out with broad-based terraces 18 to 20 feet from ridge to ridge, with a shallow saucer-shaped channel on the uphill side. Ridges must be marked out truly on the contour and the area must not be opened to grazing until a good grass sward has been established by sowing a good pasture grass. It is useless to depend upon weeds to stock a grass ley, for such a plant cover does not survive even a short drought and soon fails as a source of fodder. When the ground gets hardened by heavy grazing it should be subsoiled or contour ploughed and resown during a period when it can be kept closed.