Rural Training Center-Thailand: Technical Paper
ศูนย์ฝึกอบรมชนบท-ประเทศไทย: ทางเทคนิคกระดาษ

Check Dams

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Community-based environmental education for the self-sufficiency and sustainability of small rural family farms
ชุมชนตามสิ่งแวดล้อมศึกษาเพื่อการพึ่งตัวเองและยั่งยืนชนบทขนาดเล็กครอบครัวฟาร์ม

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INTRODUCTION

Build check dams to slow water movement in gullies and streams to reduce soil erosion. RTC-TH check dams are for small family farms in rural areas. The dams are made of locally available materials at low cost. Poor rural farmers can use these simple check dams to effectively manage gully erosion on their land. Over time, the check dams can capture enough soil to fill in gullies. Filled in gullies should be planted with Vetiver grass ("King Grass" or *Vetiveria zizanioides*) or bananas to anchor the soil. This creates a "natural" green water course that is very resistant to future soil erosion.

THE ACTION OF FLOWING WATER

Water always flows to the lowest point on the land. This often happens along a flow path and produces a stream channel or a gully. Flowing water wants to carry soil. The faster the flow, the more soil it can carry, and the larger the soil particles it can carry. Streams with muddy colored water means it carries soil (sediments). Slow move water tends to be less muddy or not muddy at all, and it cannot carry larger soil particles. Try to watch for the earliest signs of gully formation on slopes. Very small gullies are called "rills". Given enough water flow and time rills will deepen into gullies. Prevention could begin with planting Vetiever grass in the largest rills. These tend to form in the places where more water flows down the slope. The idea is to slow the water as much as possible. This greatly reduces its ability to carry soil particles. By slowing the water, you also increase the time for the water to soak into the ground.

Water velocity is controlled by the angle of the slope, the width of the stream, the stream depth, the alignment (e.g. .straight or curvy), and the amount of water in the stream. The summary table on the right shows the basic relationships of these variables.

Stream / Gully Feature	Water Flow Speed	
	Fast	Slow
Slope Angle	Steep	Flat
Width	Narrow	Wide
Depth	Deep	Shallow
Alignment	Straight	Curving
Water volume	Large	Small

The variable characteristics can cancel each other out or counterbalance each other. For example, a small volume of water in a wide, straight stream bed on a steep slope can flow slowly. This can all change when heavy rains increases the water volume in the same stream.

In the dry season, you can look for evidence of water flow in dry gullies and empty stream beds. If you see a mixture of various size rocks and soil particles in the bottom of the stream or gully, the water flow is sometimes fast or the amount of water is high. If the soil particles are small (e.g. sand, mud, or clay), the water flow is

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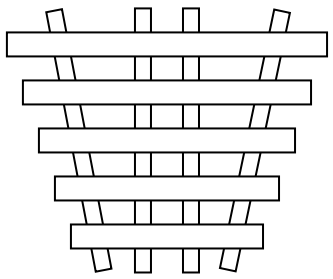
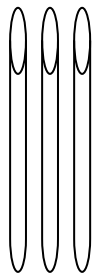
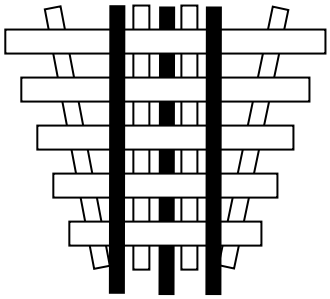
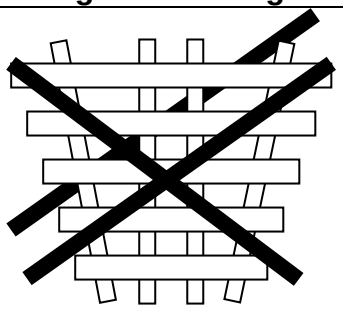
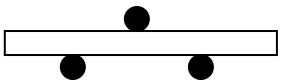
slow or the amount of water is small. Areas with mud cracks show you where ponds or puddles occur.

MAKING CHECK DAMS

In Thailand, bamboo is readily available on most family farms. Cut and split the bamboo into flat strips to weave a loose net / fence. Bamboo poles serve as stakes to hold the check dam in place.

	Net / Fence	Stakes
These guidelines are general. They can be adapted to the local situation as needed. Adjust the size to fit the gully. Larger check dams may require more stakes. The height and width depends on the dimensions of the gully or stream bed. Weave the bamboo strips in the Net / Fence into a "V" shape. Space the horizontal pieces so the spacing is closer at the bottom, wider at the top.		

STAKING THE CHECK DAM IN PLACE

	Vertical Staking	Diagonal Staking
Stakes hold the check dam in place. Vertical staking is the most common method. Two stakes are put on the downstream side of the net-fence; one stake on the upstream side. When the flow path is too narrow or the bottom of the flow path is rocky, use a diagonal staking method. Two stakes on the downstream side, one on the upstream side. Note: Use more stakes to securely fasten the check dam in place if you need them.		
	Front view	Front view
		
	Top view	Top View

ADDITIONAL PLANT DEBRIS

After the check dam is in place, put more plant debris behind the check dam (on the upslope side) at the bottom of the net-fence. This helps slow the water flowing through the bottom of the net-fence. During a rain storm, water may carry more plant debris downstream. These can be caught by the net-fence and further slow down the water flowing through the check dam. The plant debris acts as a filter to trap sediments (soil particles) behind the check dam.

CHECK DAM INSPECTION / MAINTENANCE

Periodically inspect the check dams. Repair washed out check dams. A wash out means either water was moving too fast when it reached the check dam, or water undercut the check dam. Consider putting in more check dams upstream to slow the water more before it reaches the washed out check dam area. If a check

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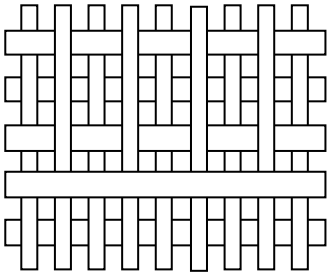
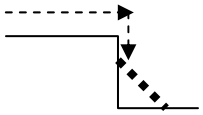
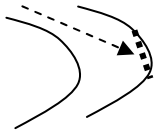
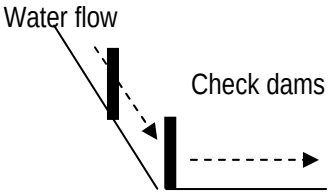
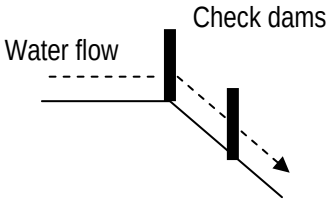
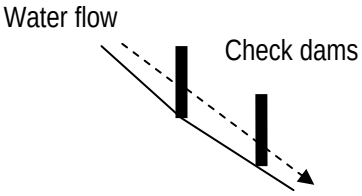
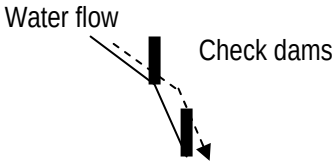
dam stops enough soil to fill in the gully behind the check dam, plant something in the flow path to anchor the soil. Then build more check dams above and below the filled in check dam.

PROTECTIVE NET – FENCES

	Construction	Placement
Use protective net-fences in places with vertical drops and at outside curves of gullies. Weave the bamboo tighter for the protective fence than the check dam net-fence. Weave the bamboo slats close together. It does not stop water. It absorbs the force of the water and reduces the force so it does not have enough power to remove soil.		Vertical Drops  Outside Curves 

CHECK DAM PLACEMENT

Put check dams in places where the water flows fast. The purpose of the check dam is to slow the water speed. The check dam is NOT intended to stop or hold the water.

	Changes in Gully Slope	
Slope angle is an important factor in water flow speed. Look for places where the slope of the flow path changes. The basic change is either from steep to flat (the water is slowing on the flat), or from flat to steep (the water is increasing speed). In some cases, a steep slope gets less steep (but not flat; the water is slowing, but can be slowed more). In other cases, a steep slope can get steeper (the water is speeding up and MUST be slowed). In all cases, place the check dam to help slow the water speed as much as possible.	Steep to Flat 	Flat to Steep 
	Steep to Less Steep 	Steep to Steeper 

Note: The distance of downstream check dams is based on the speed of the water. The second / third check dams are put at a point that the water speed begins to increase. This is easy to see when water is present. If not, look for evidence of erosion (loss of soil) or places where rocks are exposed. Any hollowed out depressions in the dry gully could indicate a high energy area that needs to be protected with check dams above and below that point. Put a protective net fence to break the force of water dropping from the high point into the depression.

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The stream width affects **water flow speed**. Water flows fastest in narrow streams; slower in wider streams.

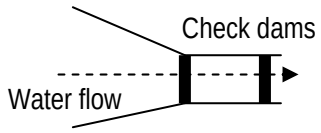
When the width gets narrower, the water is speeding up. Slow it down before it speeds up.

As a narrow stream gets wider, the water will slow down. Slow it down **before** the stream widens to slow the water even more. Do the same when a wide stream gets wider.

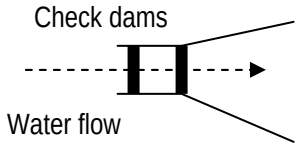
When a narrow stream get narrower, slow the water before and after the narrowing occurs.

Changes in Gully Width

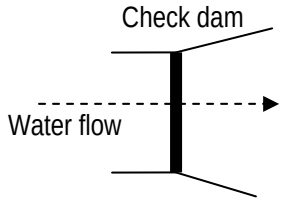
Wide to Narrow



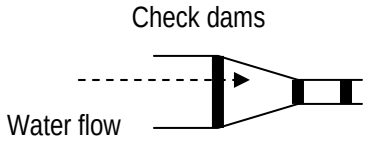
Narrow to Wide



Wide to Wider



Narrow to Narrower



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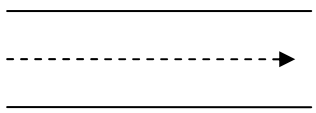
Water tends to flow faster in straight stream channels because it gains momentum in a straight run. Place the check dams at points of slope or width changes in the stream.

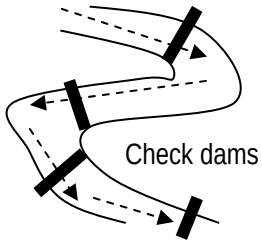
Curving channels slow down water flow, but the force of the water on the outside curve (A) tends to have power to remove soil. This is because water wants to move in a straight line. It changes direction when it hits the stream bank. Protect this bank. Put a check dam to slow the water before the curve. Put a bamboo protective net-fence at the outside stream bank in the curve.

The inside curve is where the water moves slower (B). Sand and soil tend to build up here. Putting a check dam before the curve the water and gets sand and soil to drop out earlier. This minimizes the build up at the inside curve. The water deflected from the outside curve begins to pick up speed. Slow it with a check dam after the inside curve. This will also help trap soil removed from bank on the outside of the curve.

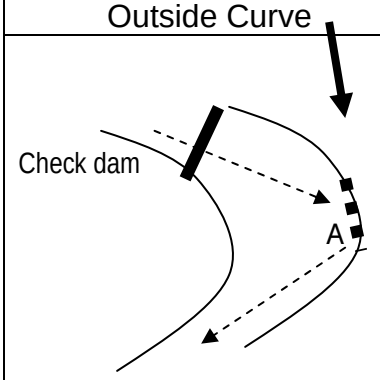
Straight Stream Channels



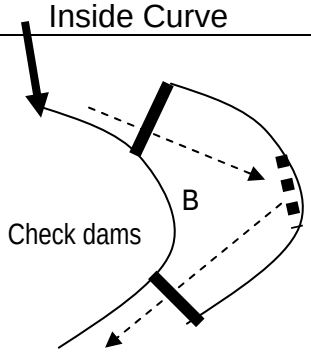
Curving Stream Channels



Outside Curve



Inside Curve



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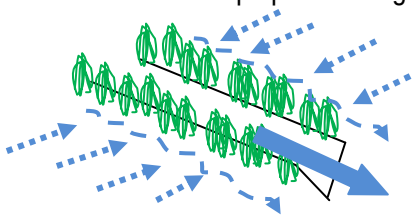
ADDITIONAL PLANTING

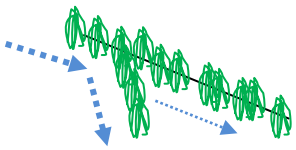
Once the check dams are in place, plant King grass along the gully to anchor the soil at the edge of the gully to reinforce the embankment. The barrier belt of grass will also help limit the flow of water into the gully. If less water enters the gully, gully erosion rates can be slowed significantly.

After planting the grass barrier on both sides of the gully, plant grass in lateral diversionary strips to divert water away from the gully. These strips can be 20-30 cm long. The idea is to divert the water into a tree well, contoured crop row or swale for soil moisture storage.

Grass barrier strips parallel to gully



Lateral diversionary grass strips



If a check dam traps enough sediment to begin filling a gully, use plants to anchor the soil filling in behind the check dam. This will create a green flow path. Remember, water came here in the first place because it was the path of least resistance. Leave the area as a green flow path.

MONITORING SOIL EROSION

Over time, some of the check dams may begin to collect soil behind them. This is the start of the gully filling process to recover your land. Plant grasses with long / deep root systems in the accumulated soil. Then build new check dams above and below slope from the filled in check dam. Gradually you will fill in the rest of the gully.

As the gully fills in, planting the filled in gully makes it a vegetated flow path. The fact that a gully formed here means it is a natural low spot in the land. Water will always tend to flow toward this area. A vegetated flow path helps to prevent future soil erosion. But if a large amount of water is suddenly flowing in this area (due to a flashflood or torrential rain), the velocity of the flow could be great enough to cause serious soil erosion. To prevent this, be prepared to set up temporary check dams or place sand bags in the flow path to slow the water velocity.

Erosion is a natural ongoing process. It cannot be stopped. It is part of the dynamic natural balancing force of nature. But we can manage soil erosion to an acceptable degree in some cases. The key is to learn to live in harmony with nature.

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Check Dam Photo Album from Summer 1999 Volunteer Project in Ban Tha Ko

This was the summer project that gave rise to the birth of the RTC-TH. One part of the project was teaching farmers to build check dams to manage soil erosion. In the example of Check Dam #4, the initial gully was 1.1 m deep. In just 1 month, the check dam trapped enough sediment to reduce the gully depth to 0.3 m. In another month and a half, the gully depth was reduced to only 0.1 m. Check dams work.

Installing a simple bamboo check dam.

Check dam #4 gully depth 1.1 m below check dam.

Check dam #4 gully depth 0.3m above check dam

Planting King grass barrier strip along a gully.

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