FLIPBOOK

Dry Stone Measures (DSMs)

Good practices for utilizing and maintaining DSMs for increased resilience in Afar and Somali region

german cooperation
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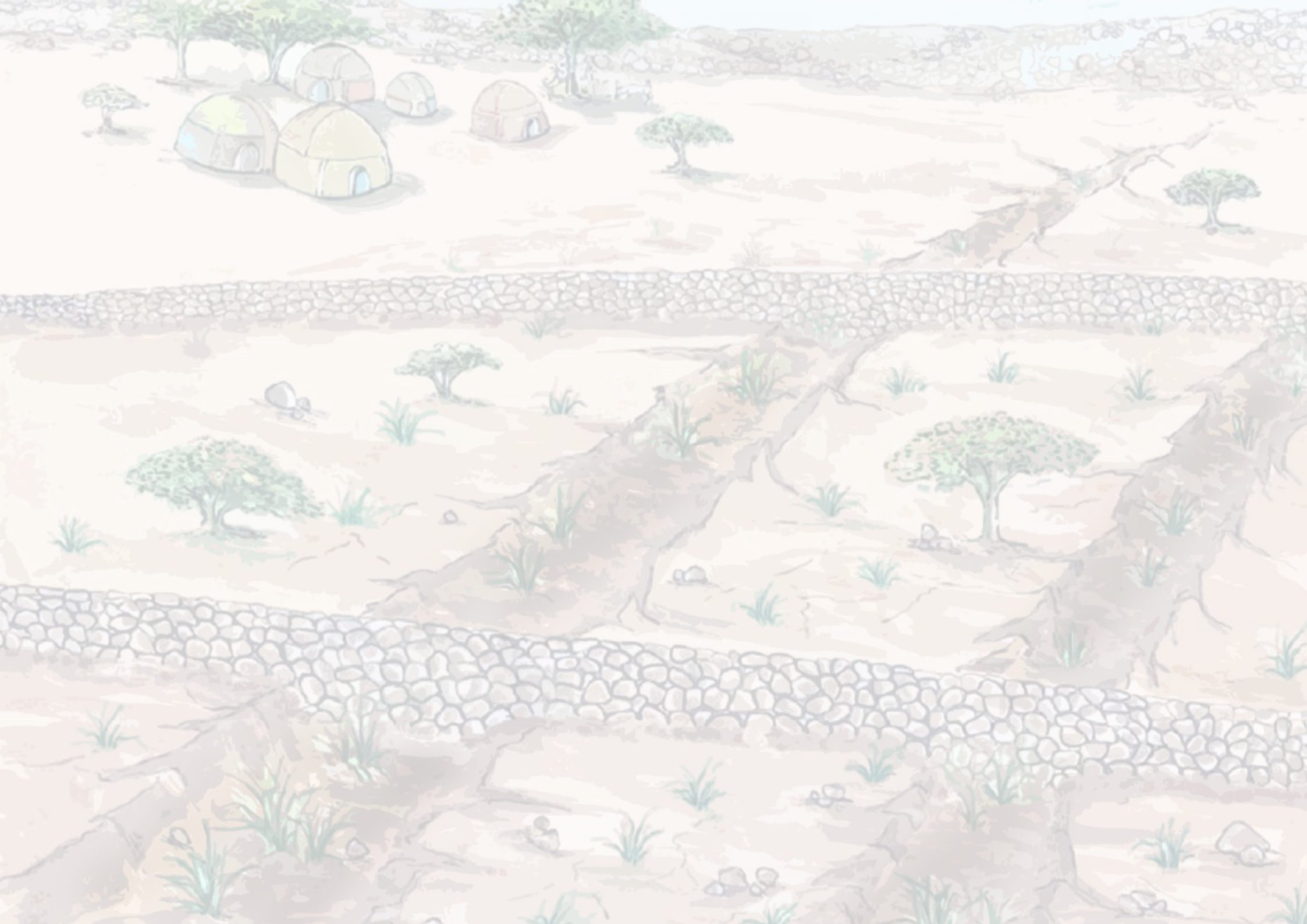
MINISTRY OF AGRICULTURE

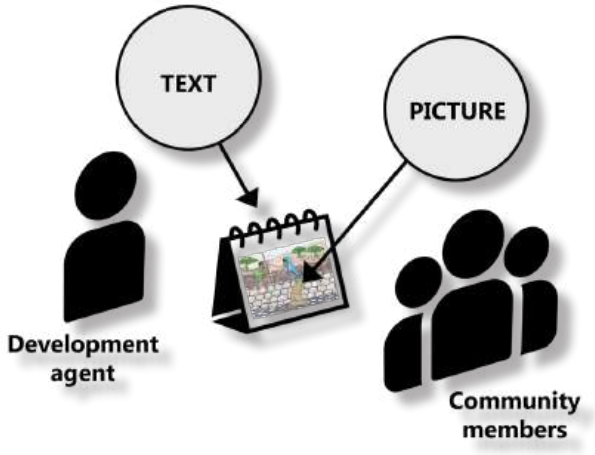


Introduction /how it works

This flipbook is developed as a tool for DAs to introduce the Dry Stone Measures (DSMs) to communities. The flipbook is set-up in three sections and can be used along with the Construction Guidelines.

- Section 1 introduces the DSM
- Section 2 explains how the DSM can be utilized and how the benefits of the DSM can be used.
- Section 3 explains the different forms of maintenance that should be considered to ensure the lifespan of the DSM.

The facilitator shows the illustration to the community members and can use the description on the other side to facilitate the discussion.



What are the Dry Stone Measures?

Dry-Stone-Measures (DSM) are semi-permeable rows of natural stones, which can be easily found in the local environment. They are constructed withouth the use of cement and have a height of not more that 1.2 m. A dry-stone structure is built in a right angle to the water flow forming a horizontal line across a gully, slowing, and spreading surface water flow and increasing uphill sediment with organic matter. They are often used in cascades of multiple DSM rows and/or other measures. DSM generally cover a smaller area than Water-Spreading-Weir (WSW), yet if part of a cascade, it can further improve the effect of WSWs.

What are the Dry Stone Measures?

What do the Dry Stone Measures do?

Dry-Stone-Measures (DSM) spread and slow down the water flow and facilitate sedimentation behind the structure. In doing so, they reduce and prevent gully erosion over large areas of land. Simultaneously, the sedimentation above the DSM creates newly fertile soils above the structure allowing increased food and fodder production. Water infiltration increases in the area below the DSM, contributing to increase water availability for crop and fodder production. Thus, DSM reduce soil degradation, reduce surface run-off, increase vegetation and recharge groundwater levels.

DSM function best in combination with biological protection such as the plantation of local grasses or drought tolerant acacia species and are often necessary to complement the effects of WSWs.. The DSM help to strengthen the lifespan of the WSWs by reducing the floods that come in from the tributaries. DMS can also be implemented as individual technologies, separately from WSWs.

The main function of the DSM is the reduction and prevention of gully erosion. Planting of crops is only applied if sufficient moisture is available in the soil. Also, when compared to the WSWs, the cultivable area influenced by the structure is smaller.

What do the Dry Stone Measures do?

Where the Dry Stone Measures are located?

Dry-Stone-Measures (DSM) are generally best suited in drier areas and terrains with slight lateral slopes, forming a horizontal line along the riverbed or in small gullies. Therefore, they can be located in areas where degradation is on an early stage (decreasing yields, biomass and biodiversity). They can be in areas where gully erosion is not deeper than 1.2 meters and not too wide. Therefore, they are a technology which follows a catchment approach and can either span a whole valley or can be constructed in small gullies. Moreover, they can be constructed in combination with a Water Spreading Weir.

Where the Dry Stone Measures are located?

1. Biological protection

Dry-Stone-Measures (DSM) implementations work best in combination with biological protection measures. After the first rains, changes will take place fast around the dry-stone structure. For instance, sedimentation will accumulate upstream the structure and water will flood the areas upstream and downstream the structure. Biological protection is the cheapest and more sustainable way of firming the structure and making use of the infiltrated water, fertile sediment accumulated and the strengthened root zone. Also the combination with biological protection strengthens the protection against wind erosion. Examples of Biological protection measures are area enclosure and the planting of trees, (local) grass, vegetables and nitrogen fixing plants. Biological protection measures should always be combined with physical maintenance actions.

1. What do you see?

2. Fencing

i. Traditional fencing

The area surrounding the Dry-Stone-Measures (DSM) should be fenced to avoid uncontrolled livestock grazing, allow vegetation to establish and grow and for cropping. Generally the traditional fencing will only be applied when gully is within existing cropland and the DSM is built on the cropland. When the enclosed area is intended to be used to establish a crop or plantation that after a few years can survive without protection (for instance, tree nurseries), temporary enclosures, such as, traditional fencing with dead branches, are necessary. Therefore, the enclosed area can be fenced, collecting thorny branches and deadwood in the surroundings of the DSM. The branches can be placed along the protected area. If more branches are needed, only thorny branches from dead trees should be cut. Branches of living trees should not be cut to avoid deforestation in the area. It is important to select the right species and the right branches in order to avoid destruction of the trees.

ii. Live fencing

The area surrounding the Dry-Stone-Measures (DSM) should be fenced to avoid uncontrolled livestock grazing, allow vegetation to establish and grow and for cropping. When the enclosed area is intended to be used to be cropped in any way, permanent enclosures are more suitable. Therefore, the area surrounding the DSM can be fenced by planting local trees and shrubs such as Ziziphus (Ziziphus spina christi), Jatropha and other thorny shrubs. This practice also helps to avoid deforestation. The trees and shrubs should be planted at the beginning of the rainy season or year-round at irrigation sites. Moreover, their seedlings should be protected during the first three years to allow the seedlings to mature sufficiently.

2. What do you see?

3. Local grasses planted in the enclosed area

After the first rainy season, the land around the Dry-Stone Measures (DSM) should be cultivated to avoid the spread of invasive species. The enclosed area Pacould be kept for future grazing when dry soils in the surrounding area do not provide fresh grasses anymore. Local grass varieties can be grown in the area for a cut & carry system to feed animals in the homesteads. First asses whether the seedbank (in the soil) is sufficient, if not over sowing with local grasses is recommended. When local grasses are cropped in the enclosed area, the seeds must be sown at the beginning until mid of the rainy season. During the first 3-4 months, the grasses establish. Local grasses can be harvested every 6-8 months. The roots of the local grasses make it suitable for erosion control and improve soil structure.

Keep in mind the soils upstream of the DSM will likely not have sufficient moisture to support the growth of the plants in the first 30 – 45 days after planting.

3. What do you see?

4. Grass can be cropped in strips

After the first rainy season, the land around the Dry-Stone-Measures (DSM) should be cultivated to avoid the spread of invasive species. Grass strips of 1 meter can be cropped around the dry-stone-structure and be used in a cut & carry system. Grass strips stabilise the structure thus, reducing the need for maintenance. Moreover, grass strips can also provide additional fodder for animals. Grass species that can be planted in strips are Indigenous grass species (Melif, Durfu, Sardo and Afaramo) or suitable grass species for strips (Rhodes, Andropogon, Buffel, Panicum and Vetiver). If the availability of moisture in the soil allows, elephant grass (Pennisetum purpureum) and legume lines of shrubs such as Pigeon pea or Acacia saligna can be planted in dense rows between the strips to increase fodder production. The grasses should be planted at the beginning of the rainy season and should be exempt from grazing during the first year of establishment. Also it is important to include (small) physical structures to help hold the water and initiate the root zone. Options are a small trench, zai pit, planting pit or half moon.

Keep in mind the soils upstream of the DSM will likely not have sufficient moisture to support the growth of the plants in the first 30 – 45 days after planting.

4. What do you see?

5. Grass seed production

In the enclosed area of a Dry-Stone-Measures (DSM), grass seeds can be planted for improving fodder or for its sorting and afterwards selling. Collecting indigenous grass seeds serves to provide seeds to regenerate degraded pastures, where indigenous forage grasses have been severely depleted through overgrazing, with desirable forage grasses. This restores a diverse, healthy, and productive vegetation and improves fodder quality and quantity for either reseeding and control grazing or for grass seed production with the potential of selling seed. The seeds need to be harvested at maturity time. Depending on the grass species, this time can vary from the middle of the rainy season until the early beginning of the dry season. To increase productivity, selecting indigenous grass species is best. It is recommended to apply regular weeding to ensure good grass performance. Suitable grass species are Melif, Durfu, Sardo or Afaramo. These are lowland species suitable for fodder.

Keep in mind the soils upstream of the DSM will likely not have sufficient moisture to support the growth of the plants in the first 30 – 45 days after planting and additional measures might be needed to ensure the availability of moisture.

5. What do you see?

6. Trees

In the enclosed area of a DSM or as live fencing, local tree species can be planted. For instance, Pigeon pea can be planted in the surroundings of the Dry-Stone-Measures (DSM). Hiddayito, Medira, Keselto and Uddayito can be planted above and below the DSM structure. Also other drought tolerant multipurpose trees can be planted. The branches of the trees can be used as animal fodder, and the plants can be used for animal consumption. Furthermore the trees can be used as biological protection against erosion and for legumes purpose to increase soil fertility and as construction material. However care has to be taken when the location is chosen as the roots should not be allowed to destroy DSM. As a rule of thumb the distance between the DSM and the tree should be based on the expected canopy of the tree, when full grown.

Keep in mind the soils upstream of the DSM will likely not have sufficient moisture to support the growth of the plants in the first 30 – 45 days after planting and additional measures might be needed to ensure the availability of moisture.

6. What do you see?

7. How to organise maintenance?

During the community awareness and construction phases, a maintenance committee for the DSM should have been organised among community members. The DA should be part of the maintenance committee. The maintenance committee could be a permanent group of community members or based on a rotating system. Before the maintenance tasks start, the rules and proceedings for maintaining the dry-stones should have already been decided and incorporated in the by-laws. If the maintenance system or organisation is not practical, it can be changed with the community's agreement. DSM generally need more maintenance in their early stages, soon after construction. Maintenance of the existing structures can only be done during the dry season. If a DSM breaks during the first rainy season, repairs might cause focused severe erosion. After sedimentation has taken place, these risks are minimized. Physical maintenance tasks should be combined with biological protection measures to reach all benefits the structure provides.

7. What do you see?

8. Assessment of the structure after heavy rainfall events

After each heavy rainfall or flood event, the maintenance committee should check the structure. Any structure damage or weakness should be identified. Once identified, maintenance should be done immediately to avoid further damage. Maintenance of this type is very easy due to the local availability of materials that are laid naturally without the need to use cement or other relatively costly inputs. Follow the construction guidelines when fixing the structure, including setting out and dimensions, use of materials, and the use of large and small stones. Maintenance of the existing structures can only be done during the dry season. If a DSM breaks during the first rainy season, repairs might cause focused severe erosion. After sedimentation has taken place, these risks are minimized.

8. What do you see?

9. Regular maintenance

The maintenance committee will do regular maintenance. Regular maintenance includes the removal of big branches carried down by rainwater or the removal of waste. This task should be done immediately after a rainfall event to avid further structural damage.

9. What do you see?

10. Maintenance of the structure

The maintenance committee will do the maintenance of the structure. This maintenance work consists of putting back the stones that have been moved or carried away by heavy rain. If these tasks are not completed immediately after the rainfall event, the structure can be weakened and prone to losing more stones with the next rains. Follow the construction guidelines when fixing the structure, such as: the setting out, the dimensions of the basis and the layering of the stones. Remember to place the stones with firmness and stability and to covering the bottom whole structure line with a layer of large and flat stones. The Presponsible experts from the Woreda office can provide support regarding technical advice and materials if needed.

10. What do you see?

11. Measures after overflowing – increasing the height

After overflowing of the structure during a rainfall event, the maintenance committee should do on-site maintenance work. This will mainly consist of increasing the structure height by using stones that can be found in the structure's surroundings. Also, if needed, another layer of stones could be added to increase the height. The construction guidelines should be followed when fixing the structure. Remember to place the stones with firmness and stability and to covering the bottom whole structure line with a layer of large and flat stones. The responsible experts from the Woreda office can provide support regarding technical advice and materials if needed.

11. What do you see?

12. Additional upstream DSM construction after overflowing

After overflowing of the structure during a rainfall event, upstream measures can be taken for example if the gully is not yet fully rehabilitated. This implies the construction of another DSM higher up the slope. The responsible experts from the Woreda office must provide with advice regarding suitable locations to place the new structure, as well as with construction technical advice and materials. The construction guidelines should be followed when fixing the structure. Remember to place the stones with firmness and stability and to covering the bottom whole structure line with a layer of large and flat stones. The responsible experts from the Woreda office can provide support regarding technical advice and materials if needed.

12. What do you see?

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