Silt fence to trap sediment in areas where serious erosion occur in the Limpopo Province (South Africa) (Heinrich van Heerden)

Silt fences to trap sediment in areas affected by gully erosion (南非)

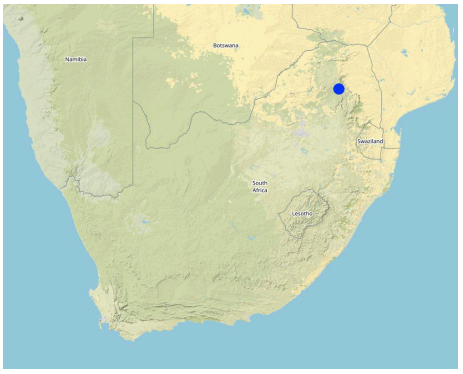
Silt fences

描述

Silt fences together with brush packing were introduced to reduce sediment transport and restoration of gully erosion in the Potlake nature reserve, Limpopo Province, South Africa.

Silt fences, together with brush packing were introduced in the Potlake Game Reserve (2817 ha) in the Limpopo Province of South Africa to rehabilitate areas affected by serious rill and gully erosion. Due to overgrazing on highly erodible soils, gully headcuts are actively migrating upstream. Implementation of the technology leads to enhanced vegetation cover and reduced sediment transport in the gullies. Silt fences are temporary structures and are therefore placed closer together than permanent structures. The placing is such that the silt from the downstream structure builds up against the upstream structure to delay the perishing of the restoration materials. Vegetation must be established in the gully (donga) as soon as possible so that, when the materials decay after about ten years, the area will be restored. Altitudes vary from 1 174 m to 780 m above sea level. The reserve is located in a summer rainfall region and receives an average annual rainfall of 438 mm per year. Clayey duplex soils are prone to both natural and man-induced erosion. The vegetation comprises Central Bushveld vegetation units of the Savanna Biome. Savanna is characterized by a herbaceous layer (usually dominated by grasses) with a woody component. In Southern Africa, Bushveld is an apt description of the vegetation structure, as the vegetation most often does not comprise distinct shrub and tree layers. Instead, the shrubs and trees occur in a matrix with a grass-dominated herb layer. A number of large gullies exist along drainage lines on highly erodible soils. Some of the gullies are up to 1.5 m deep and 5 m wide. A total of around 200 m of silt fences were erected at selected sites in the reserve to retain sediment and to establish vegetation. The following steps were followed in the establishment of the silt fences:
1. Identification of priority sites to erect the silt fences - using Google Earth imagery and field surveys.
2. Acquisition of restoration material and training of local community members on the implementation of the technology (training by Mr. Buckle at that stage from the Department).
3. Levelling of the area where fences would be erected.
4. Construction of fences.
5. Brush packing (upstream of fence) stone packing (downstream in the gully).

地点



地点: Potlake nature reserve, Limpopo Province, 南非

分析的技术场所数量: 100-1000个场所

选定地点的地理参考
- 29.93755, -24.26002

技术传播: 均匀地分布在一个区域 (approx. 1-10 平方千米)

在永久保护区？: 是

实施日期: 不到10年前 最近

介绍类型
- 通过土地使用者的创新
- 作为传统系统的一部分 > 50 年
- 在实 /研究期间
- ☑ 通过 外部干

Workers busy erecting silt fences (Heinrich van Heerden)

Completed silt fence (Heinrich van Heerden)

技术分类

主要目的

- [ ] 改良生产
- [x] 减少、 防、恢复土地退化
- [x] 保护生态系统
- [x] 结合其他技术保护流域/下游区域
- [ ] 保持/提 生物多样性
- [ ] 降低灾害 险
- [ ] 适应气候变化/极端天气及其影响
- [ ] 减缓气候变化及其影响
- [ ] 创造有益的经济影响
- [ ] 创造有益的社会影响

土地利用

同一土地单元内混合使用的土地 否

其它 - 具体说明: Protected area
注释: Potlake nature reserve

供水

- [x] 雨养
- [ ] 混合雨水灌溉
- [ ] 充分灌溉

土地退化相关的目的

- [ ] 防止土地退化
- [x] 减少土地退化
- [x] 修复/恢复严重退化的土地
- [ ] 适应土地退化
- [ ] 不适用

解决的退化问题

土壤水蚀 - Wt 表土流失地表侵蚀，Wg 冲沟侵蚀

SLM组

- 改良的地 /植被覆盖
- 横坡措施

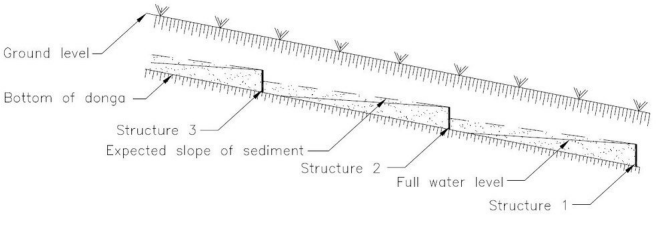
SLM措施

结构措施 - S6 墙、障碍物、栅栏、围墙

技术图纸

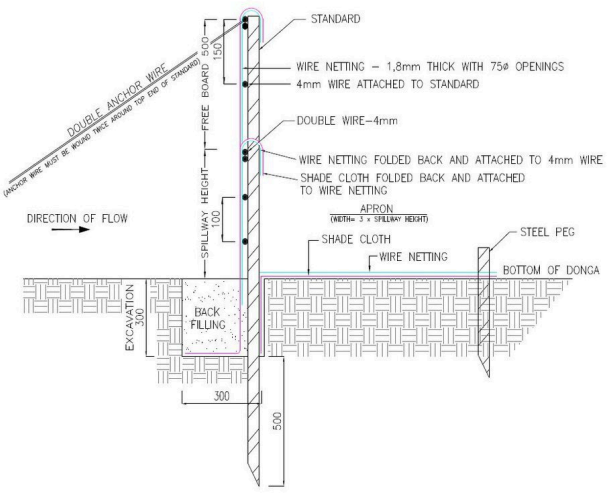
技术规范

Silt fences are temporary structures and are therefore placed closer together than permanent structures. The placing is such that the silt from the downstream structure builds up against the upstream structure to delay the perishing of the restoration materials. Vegetation must be established in the gully (donga) as soon as possible so that, when the materials decay after about ten years, the area will be restored.



Author: Jan van Heerden

1. Dig a pit trench 300 mm × 300 mm from peg to peg over the entire width of the gully.
2. Drive iron standards (iron pole) in on the sides of the spillway length followed by more standards around 1.5 meters apart - ensure equal spacing between standards (standards must be driven in at least 500 mm deep - ensure that eyes (holes in standards) point upstream and that poles are in line with the others. Place apron on the ground from the excavation downstream. The width of the material must be three times the height of the overflow height and it must be at least 500 mm longer on both sides than the spillway length.
3. Span a 4 mm wire between the spillway poles on the total height of the structure. Tighten only manually and fasten on both sides of the two standards.
4. Drive in two anchor poles in line with the structure on both sides of the donga wall.
5. Saw off or cut heads of standards on the height of the structure's height. Place anchor wires between two outer poles and anchor poles and tighten.
6. Thread 4 mm wire through on spillway height from side to side and bind to the two poles anchored to the anchor poles.
7. Also place wire between the spillway width poles and the end pole on the structure height and tighten.
8. Span wires from the spillway height wire on 100 mm to 150 mm distances apart, downwards until the last wire is at least 100 mm below the surface.
9. Place netting material (course plastic grid placed behind the filter material) on upstream side of the poles into the excavated pit trench and cut according to shape of the structure.
10. Place filter material flat in the pit trench and in front of the netting material on the upstream side of the poles and cut according to the shape of the structure. Tie the material to the structure with binding wire and fill the pit trench with soil.
11. Place netting material on the apron and tie it to the structure with binding wire and drive in T pegs at strategic places on downstream side.
12. The construction of the drop inlet is built in the same way as a weir structure as close as possible to the head of the donga. The gap between the structure and the donga head is filled with soil and must be filled again after the first rains. The spillway is made ±100 mm higher than the normal ground surface. The structure can be built to a maximum of 1 000 mm from the gully floor to the ground level.
13. Brush packing in front of the silt fence and stone packing downstream of the apron in the gully.
14. In order for silt fences to function more efficiently, it is recommended that that portion of the veld is fenced and withdrawn from grazing. Sowing of grasses or planting of common reed or vetiver grass can speed up the repair process considerably.



Author: Jan van Heerden

技术建立与维护 活动、投入和费用

投入和成本的计算

- 计算的成本为 每个技术单元的单位 **silt fence** volume, length: **6 to 8 meters**)
- 成本计算使用的货币 **Rand**
- 汇率 换算为美元 1 美元 = 16.0 Rand
- 雇用劳工的每日平均工资成本 R200

影响成本的最重要因素

1. Timing - during the raining season these areas could be inaccessible due to clayey soils and water in gullies. 2, Availability of labour.

技术建立活动

1. Preparation of the site to be restored (时间/ 率Winter (outside raining season))
2. Installation of silt fences followed by brush and stone packing (时间/ 率Winter)

技术建立的投入和成本 (per silt fence)

对投入进行具体说明	单位	数量	单位成本 (Rand)	每项投入的总成本 (Rand)	土地使用者承担的成本%
劳动力					
Unskilled labour (including transport)	Per day	6.0	280.0	1680.0	
设备					
Power tools - electric power generator, angle grinder, hammer drill,	Per day	3.0	500.0	1500.0	
Measuring tape, wire tensioning tool, pole driver, heavy and light hammers, pick, spade, pliers and scissors	Per day	10.0	20.0	200.0	
施工材料					
4mm wire	Per meter	100.0	15.0	1500.0	
Standards	Per piece	6.0	90.0	540.0	

Netting	Per meter	15.0	90.0	1350.0	
Anchor poles	Per piece	6.0	10.0	60.0	
T pegs	Per piece	20.0	20.0	400.0	
Binding wire	Per kg	5.0	40.0	200.0	
Filter material (UV treated shade cloth - 80%)	Per meter	86.0	20.0	1720.0	
技术建立所需总成本				**9'150.0**	
技术建立总成本 美元				*571.88*	

技术维护活动

1. Repair of fences after floods (时间/ 率After flooding event)

技术维护的投入和成本 (per silt fence)

对投入进行具体说明	单位	数量	单位成本 (Rand)	每项投入的总成本 (Rand)	土地使用者承担的成本%
劳动力					
Repair of fences	Per day	2.0	280.0	560.0	
设备					
Pliers, hammers, wire tensioning tool, pick, spade, pliers and scissors	Per day	5.0	20.0	100.0	
施工材料					
Binding wire and filter material	Per meter	4.0	150.0	600.0	
技术维护所需总成本				**1'260.0**	
技术维护总成本 美元				*78.75*	

自然环境

年平均降雨量
- < 250毫米
- ☑ 251-500毫米
- 501-750毫米
- 751-1,000毫米
- 1,001-1,500毫米
- 1,501-2,000毫米
- 2,001-3,000毫米
- 3,001-4,000毫米
- > 4,000毫米

农业气候带
- 潮湿的
- 半湿润
- ☑ 半干旱
- 干旱

关于气候的规范
以毫米为单位计算的年平均降雨量 438.0

斜坡
- 水平 0-2%
- ☑ 缓降 3-5%
- 平缓 6-10%
- 滚坡 11-15%
- 崎岖 16-30%
- 陡峭 31-60%
- 非常陡峭 >60%

地形
- 高原
- 山脊
- 山坡
- 山地斜坡
- 坡
- ☑ 谷底

海拔
- 0-100 m a.s.l.
- 101-500 m a.s.l.
- 501-1,000 m a.s.l.
- ☑ 1,001-1,500 m a.s.l.
- 1,501-2,000 m a.s.l.
- 2,001-2,500 m a.s.l.
- 2,501-3,000 m a.s.l.
- 3,001-4,000 m a.s.l.
- > 4,000 m a.s.l.

.....应用的技术
- 凸形情况
- ☑ 凹陷情况
- 不相关

土壤深度
- 非常浅 0-20厘米
- 浅 21-50厘米
- ☑ 中等深度 51-80厘米
- 深 81-120厘米
- 非常深 > 120厘米

土壤质地（表土）
- 粗粒/轻 砂质
- ☑ 中粒 壤土、粉土
- 细粒/重质 粘土

土壤质地（地表以下>20厘米）
- 粗粒/轻 砂质
- 中粒 壤土、粉土
- ☑ 细粒/重质 粘土

表土有机质含量
- 高 >3%
- ☑ 中 1-3%
- 低 <1%

地下水位
- 表 上
- < 5米
- ☑ 5-50米
- > 50米

地表水的可用性
- 过量
- 好
- ☑ 中等
- 匮乏/没有

水质（未处理）
- ☑ 良好 用水
- 不良 用水 需要处理
- 仅供农业使用 灌溉
- 不可用

水质请参考 地下水

盐度是个问题吗？
- 是
- ☑ 否

洪水发生
- ☑ 是
- 否

物种多样性
- ☑
- 中等
- 低

栖息地多样性
- ☑
- 中等
- 低

应用该技术的土地使用者的特征

市场定位
- 生计 自给
- 混合 生计/商业
- ☑ 商业/市场

非农收入
- 低于全部收入的10%
- ☑ 收入的10-50%
- > 收入的50%

相对财富水平
- 非常贫瘠
- ☑ 贫瘠
- 平均水平

机械化水平
- 手工作业
- 畜力牵引
- ☑ 机械化/电动

- [ ] 丰富
- [ ] 非常丰富

定栖或游牧
- [ ] 定栖的
- [ ] 半游牧的
- [ ] 游牧的
- [x] Tourists

个人或集体
- [ ] 个人/家庭
- [ ] 团体/社区
- [ ] 合作社
- [x] 员工 公司、政府

性别
- [x] 女人
- [x] 男人

年龄
- [ ] 儿童
- [x] 青年人
- [x] 中年人
- [x] 老年人

每户使用面积
- [ ] < 0.5 公
- [ ] 0.5-1 公
- [ ] 1-2 公
- [ ] 2-5公
- [x] 5-15公
- [ ] 15-50公
- [ ] 50-100公
- [ ] 100-500公
- [ ] 500-1,000公
- [ ] 1,000-10,000公
- [ ] > 10,000公

规模
- [x] 小规模的
- [ ] 中等规模的
- [ ] 大规模的

土地所有权
- [x] 州
- [ ] 公司
- [ ] 社区/村庄
- [ ] 团体
- [ ] 个人 未命名
- [ ] 个人 有命名

土地使用权
- [ ] 自由进入 无组织
- [ ] 社区 有组织
- [ ] 租赁
- [ ] 个人
- [x] State land

用水权
- [ ] 自由进入 无组织
- [ ] 社区 有组织
- [ ] 租赁
- [ ] 个人
- [x] State land

进入服务和基础设施的通道

健康	贫瘠 ✓	好
教育	贫瘠 ✓	好
技术援助	贫瘠 ✓	好
就业 例如非农	贫瘠 ✓	好
市场	贫瘠 ✓	好
能源	贫瘠 ✓	好
道路和交通	贫瘠 ✓	好
用水和卫生设施	贫瘠 ✓	好
金融服务	贫瘠 ✓	好

影响

社会经济影响

Job creation	None ✓	None

社会文化影响

生态影响

土壤水分	降低 ✓	增加
土壤覆盖层	减少 ✓	改良
土壤流失	增加 ✓	降低
土壤堆积	降低 ✓	增加

场外影响

下游淤积	增加 ✓	降低

成本效益分析

与技术建立成本相比的效益

短期回报	非常消极 ✓	非常积极
长期回报	非常消极 ✓	非常积极

与技术维护成本相比的效益

短期回报	非常消极 ✓	非常积极
长期回报	非常消极 ✓	非常积极

气候变化

气候有关的极端情况（灾害）

局地雷暴	非常不好 ✓	非常好
山洪暴发	非常不好 ✓	非常好

采用和适应

采用该技术的地区内土地使用者的百分比
- [ ] 单例/实
- [ ] 1-10%
- [x] 11-50%
- [ ] > 50%

在所有采用这种技术的人当中，有多少人在没有获得物质奖励的情况下采用了这种技术?
- [x] 0-10%
- [ ] 11-50%
- [ ] 51-90%
- [ ] 91-100%

最近是否对该技术进行了修改以适应不断变化的条件？

- [ ] 是
- [x] 否

什么样的变化条件？

- [ ] 气候变化/极端气候
- [ ] 不断变化的市场
- [ ] 劳动力可用性 例如 由于迁移

结论和吸取的教训

长处: 土地使用者的观点

- Very important to stabilise landscapes.
- Helps to improve the habitat for wildlife, biodiversity in the protected area.

长处: 编制者或其他关键资源人员的观点

- Helps to improve the habitat for wildlife, biodiversity in the protected area.

弱点/缺点/风险: 土地使用者的观点如何克服

- Sensitive to floods Timing of construction crucial - ready before the floods occur

弱点/缺点/风险: 编制者或其他关键资源人员的观点如何克服

- Same as above

参考文献

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WOCAT数据库中的完整描述
https://qcat.wocat.net/zh/wocat/technologies/view/technologies_6174/

链接的SLM数据
Approaches: Working for Water https://qcat.wocat.net/zh/wocat/approaches/view/approaches_2338/

文件编制者

机构

- 不适用

目

- Working for Water (Natural Resource Management Programmes – DEA, South Africa)?

主要参考文献

- Combating erosion with silt fences, Jan van Heerden, 2006, ISBN 1-919849-76-9: https://www.arc.agric.za/arc-iae/Documents/Publication%20List%20and%20Orderform.pdf
- Five-year strategic plan for the Potlake Nature Reserve, Limpopo Province, South Africa: LEDET - no cost