The land user, Mr. Rafael Medina, drying cacao beens by spreading them manually under the sun in a greenhouse. (Hanspeter Liniger)

Agroforestry system of cacao and gallery forest (哥伦比亚)

cacao

描

Agroforestry system of cacao crop under gallery forest shadow as family agriculture. It is located at the Pozetas Stream, in the Cusiana River Basin, Floodable Savannas of the Colombian Orinoco.

The agroforestry system of cacao crop planted under gallery forest is a private farmer initiative for family agriculture. The Crop is located in the gallery forest of Pozetas Stream, in the Cusiana River Basin. It is at the beginning of the Orinoco Floodable Savanas (250m a.s.l.). Municipality of Tauramena (Casanare), Colombia.

The cacao growths in an area of 4 hectares, being considered small farming, according to the Orinoco Regional scale. The cacao density is 1080 plants/hectare and the distance between plants is 3m. In this area, after tree thinning, the forest occupies 30% approximately. Some of the common tree species are Cedrus spp., Ficus spp. and Anadenanthera peregrina, among others.

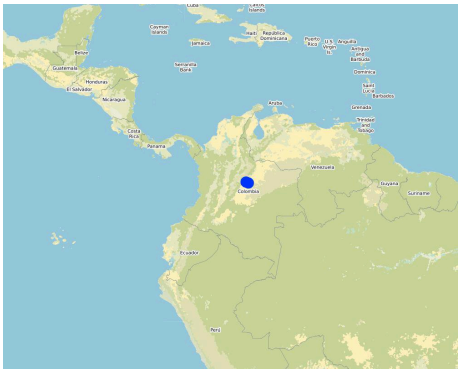
The purpose of the technology is to use the gallery forest land in a productive way to generate income for the family, while keeping part of the forest. As cacao needs some shadow, specially in early growth stage, it is planted under the forest creating the agroforestry system.

Cacao seed germination and seedling preparation, gallery forest thinning and soil improvement with lime and organic fertilizer (rice husk), and finally planting, are the main establishment activities. Then the maintenance activities include cutting weeds, trimming cacao trees and fertilization every 2-3 months.

The cacao crop has produced fruits since the sixth year of being planted (2010) and is harvested every two weeks. It presents two yield peaks, the first one is in May-June and the second one in October-November. However it produces fruits along the year.

This technology provides additional income to the family, while conserving part of the original gallery forest. The more complex and diverse production system might favored pollination and crop health. The technology compared with other land uses around it such as oil palm tree and rice is more sustainable and it is something the land users prefer. They also like the value added to the cacao beens by processing their self the cacao beens to produce hand made 100% cacao bars for drinking chocolate.

地



地点: Municipality of Tauramena, Rural District of Iquia, Casanare, 哥伦比亚

分析的技术场所数量: 单一场所

选定地点的地理参考

- -72.79953, 5.0246
- -72.59508, 4.94637

技术传播: 均匀地分布在一个区域 (0.04 km²)

在永久保护区？: 否

实施日期: 2010

介绍类型

- [x] 土地使 创新
- [ ] 作为传 ≥50 年分
- [ ] 在实 / 期
- [ ] 外 干

Cacao fruits collection (Ana Silvia Martinez)

Agroforestry system of cacao and gallery forest along Pozetas Stream in the floodable savannas of the Colombian Orinoco. (Luisa F. Vega)

技术分

主要目的

- [ ] 改 产
- [ ] 减少、 、恢复土地 化
- [ ] 保护 态
- [ ] 合其他技术保护 /下域 区域
- [ ] 保持/提 多样性
- [ ] 低 害
- [x] 应 候变化 天 及其影响
- [ ] 减 候变化及其影响
- [x] 创 有 影响
- [ ] 创 有 会影响

土地利用

同一土地单元内 合使 是地农林业

农田

- 乔木与 木 可可植

作制度:否吗
作制度:否吗

森林/林地

- 半天 天/林地森林 伐

Tree types (常): Cedrus species, Anadenanthera peregrina, Ficus spp.,
产品和服务: 林 害shade协

供水

- [ ] 养
- [x] 合
- [ ] 充分

土地退化相关的目的

- [ ] 止土地 化
- [x] 减少土地 化
- [ ] 修复/恢复严 化 土地
- [ ] 应土地 化
- [ ] 不

解决的退化问题

生物性退化 - Bh 栖息地丧失Bq 数/ 减少

SLM组

- 农业林学
- 减少基于 态 害

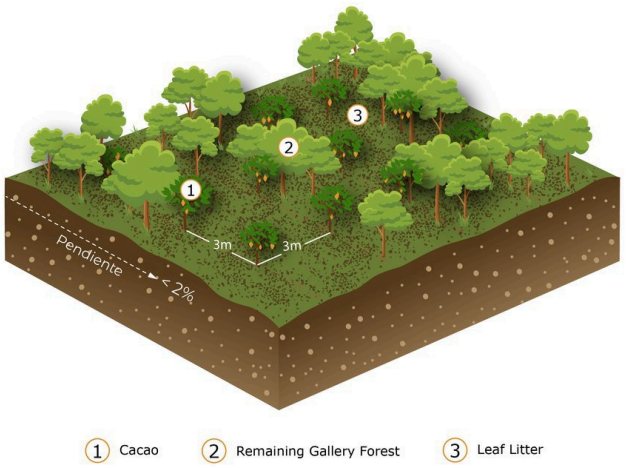
SLM措施

管理措施 - M1 改变土地使 M5型 /变化 控制

技术图

技术规范

In the agroforestry system of cacao and gallery forest, the cacao trees are planted, having 3 m distance between them. The native forest occupies 30% approximately, of the system and provides shadow to the cacao trees. Shadow is important for the good development of cacao, especially in early stages. Additionally, the forest increases system complexity, diversity and balance, enhancing crop pollination and health and mitigating climate change impacts, such as high temperature and storms. The leaf litter from the cacao and the forest are also an important source of organic matter for soil enrichment.



Author: Diego Orduz and Luisa F. Vega

技术建□ 与□ 护□ □ 动、投入和□ □

投入和成本的计算

- □ □ □ 成本为□ 每个技术区域和□ □ 单位为 **hectares**□
- 成本□ □ 使□ □ 为 **Colombian Pesos**
- □ □ □ 换□ 为1 □ 元兑 3750.0 Colombian Pesos
- □ □ 劳工□ 每日平均工□ 45000□

影响成本的最重要因素

The plant material from seeds to seedlings are the highest cost for the technology establishment. Then, the fertilization is an important maintenance cost.

技术建立活动

1. Seed germination (时□ /□ □ Enero)
2. Plant nursery establishment (时□ /□ □ Febrero)
3. Clear felling of 70% of native forest in the area (时□ /□ □ Febrero)
4. Sow hole digging (时□ /□ □ April-May (beginning of rainy season))
5. Addition of lime and rice husk to the sow hole (时□ /□ □ April-May (beginning of rainy season))
6. Cacao seedling planting in field (时□ /□ □ April-May (beginning of rainy season))

技术建立的投入和成本 (per 4 hectares)

对投入进行具体说明	单位	数量	单位成本 (Colombian Pesos)	每项投入的总成本 (Colombian Pesos)	土地使用者承担的成本%
劳动力					
Forest thinning to open cropland	ha	4.0	150000.0	600000.0	100.0
Sow hole preparation and seedling planting	ha	4.0	575000.0	2300000.0	100.0
植物材料					
Cacao seeds	seed	5400.0	25.0	135000.0	100.0
cacao seedlings	seedling	5000.0	500.0	2500000.0	100.0
肥料和杀菌剂					
Lime sack	50 kg	10.0	12000.0	120000.0	100.0
Rice husk	container	1.0	400000.0	400000.0	100.0
技术建立所需总成本				**6'055'000.0**	
技术建□ 总成本□ □ 元				*1'614.67*	

技术维护活动

1. Cutting of weeds, specially around each cacao tree (时□ /□ □ Every 2 months)
2. Cacao tree trimming (时□ /□ □ Every 2 months)
3. Fertilization (时□ /□ □ Every 2-3 months)
4. Harvesting (时□ /□ □ Every 2 weeks)

技术维护的投入和成本 (per 4 hectares)

对投入进行具体说明	单位	数量	单位成本 (Colombian Pesos)	每项投入的总成本 (Colombian Pesos)	土地使用者承担的成本%
劳动力					
Cutting of weeds, specially around each cacao tree	day	18.0	45000.0	810000.0	100.0
Cacao tree trimming	day	12.0	45000.0	540000.0	100.0
Fertilization and soil amendment with lime	day	13.0	45000.0	585000.0	100.0
Harvesting	day	24.0	45000.0	1080000.0	100.0
设备					

Manual tools (e.g. machete, trimmer, shovel)	kit	1.0	150.0	150.0	100.0
肥料和杀菌剂					
Lime sack	50 Kg	10.0	12000.0	120000.0	100.0
Fertilizer sack	50 Kg	40.0	96000.0	3840000.0	100.0
技术维护所需总成本				**6'975'150.0**	
技术 护总成本 元				*1'860.04*	

境

年平均降雨量

- [ ] < 250
- [ ] 251-500
- [ ] 501-750
- [ ] 751-1,000
- [ ] 1,001-1,500
- [ ] 1,501-2,000
- [x] 2,001-3,000
- [ ] 3,001-4,000
- [ ] > 4,000

农业气候带

- [x]
- [ ] 半
- [ ] 半干旱
- [ ] 干旱

关于气候的规范

The technology is located between 2000-2200 mm isohyets. The rain season occurs from April to November and dry season from December to March.

precipitation map of the Municipality of Tauramena (2015)

斜坡

- [x] 平0-2%
- [ ] 3-5%
- [ ] 6-10%
- [ ] 11-15%
- [ ] 16-30%
- [ ] 31-60%
- [ ] 60%

地形

- [x] 平原
- [ ] 山
- [ ] 山坡
- [ ] 山地斜坡
- [ ] 坡
- [ ] 底

海拔

- [ ] 0-100 m a.s.l.
- [x] 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 情况
- [x] 不 关

土壤深度

- [ ] 常 0-20厘
- [ ] 21-50厘
- [ ] 中 50-80厘
- [ ] 81-120厘
- [x] 常 > 120厘

土壤质地（表土）

- [ ]
- [ ] 中 壤土、 土
- [ ]

土壤质地（地表以下>20厘米）

- [ ]
- [ ] 中 壤土、 土
- [ ]

表土有机质含量

- [x] > 3%
- [ ] 中 1-3%
- [ ] 低 <1%

地下水位

- [ ] 上
- [x] < 5
- [ ] 5-50
- [ ] > 50

地表水的可用性

- [x]
- [ ] 好
- [ ] 中
- [ ] 匮乏/ 有

水质（未处理）

- [ ] 好
- [x] 不 处
- [ ] 仅供农业使
- [ ] 不可

盐度是个问题吗？

- [ ] 是
- [x] 否

洪水发生

- [x] 是
- [ ] 否

物种多样性

- [x]
- [ ] 中
- [ ] 低

栖息地多样性

- [x]
- [ ] 中
- [ ] 低

应 技术 土地使 征

市场定位

- [ ]
- [x] 合 商业
- [ ] 商业/市场

非农收入

- [ ] 低于全 收入10%
- [x] 收入 10-50%
- [ ] > 收入 50%

相对财富水平

- [ ] 常
- [ ]
- [x] 平均 平
- [ ] 丰富
- [ ] 常丰富

机械化水平

- [ ] 手工作业
- [ ] 力 引
- [x] 机械化/ 动

定栖或游牧

- [x] 定栖
- [ ] 半
- [ ]

个人或集体

- [x] 个人/家庭
- [ ] 团体/ 区
- [ ] 合作
- [ ] 员工 公司、政府

性别

- [x] 女人
- [x] 人

年龄

- [ ] 儿
- [ ] 年人
- [ ] 中年人
- [x] 年人

每户使用面积

- [ ] < 0.5 公
- [ ] 0.5-1 公
- [ ] 1-2 公
- [ ] 2-5公
- [ ] 5-15公
- [ ] 15-50公
- [x] 50-100公
- [ ] 100-500公
- [ ] 500-1,000公

规模

- [ ] 小 模
- [x] 中 模
- [ ] 大 模

土地所有权

- [ ] 州
- [ ] 公司
- [ ] 村庄
- [ ] 团体
- [ ] 个人 未命名
- [x] 个人 有命名

土地使用权

- [ ] 入 无
- [ ] 区 有
- [ ]
- [x] 个人

用水权

- [ ] 入 无
- [ ] 区 有
- [x]

1,000-10,000公
> 10,000公

个人

进入服务和基础设施的通道

健康 好
教 好
技术援助 好
就业 例如 农 好
市场 好
好
和交 好
和卫 施 好
服务 好

影响

社会经济影响

作 产

增加

There was not crop production before the SLM

产区域 使 中 新土地

增加

SLM之前 数 0 ha
SLM之后 数 4 ha
There was not a production area before SLM

农业投入

增加 低

Once the cacao agroforestry system was implemented, expenses on agricultural inputs came with it.

农业收入

增加

The cacao production and its processing has increased the farm income.

收入来 多样性

增加

Before the SLM, the income was only from extensive livestock, after SLM, the gallery forest is used to cultivate cacao and produce 100% cacao bars for drinking chocolate.

工作

增加 低

The cacao agroforestry system demands more work than before when the land use was exclusive gallery forest with none crop in it.

社会文化影响

品安全

减少 改

The cacao production is commercial oriented, however it is also consumed by the land users.

SLM/土地 化

减少 改

The land users recognize the cacao agroforestry system as a more sustainable technology in comparison to the neighbored land uses, such as extensive rice or oil palm tree plantations.

生态影响

养分循 /

增加

It has not been quantified, however it is assumed nutrient recharge as the land users use fertilizer several times per year.

土壤有机 /地下C

增加

It has not been quantified, however it is assumed a soil organic matter increase due to the leaf litter inputs added by the cacao trees.

度

增加 减少

It has not been quantified, however it is assumed soil acidity reduction due to use of amendments.

植 层

增加

The cacao agroforestry system has less vegetation cover than the original gallery forest.

/地上C

增加

It has not been quantified, however it is assumed the cacao agroforestry system has less above ground biomass than the original gallery forest.

植 多样性

增加

It has not been quantified, however it is expected the cacao

agroforestry system has less plant diversity than the original gallery forest.

栖息地多样性

增加

It is apparently the same before and after SLM as the cacao agroforestry system has the same forest strata than the original gallery forest.

场外影响

力 按土壤、植 、 地划分

减少 改

The different strata of the agroforestry system and the cacao tree density might increase water retention and infiltration. It contributes to reduce down stream flooding during rainy season.

成本效 分析

与技术建立成本相比的效益

期回报 常 常 极

期回报 常 常 极

与技术维护成本相比的效益

期回报 常 常 极

期回报 常 常 极

候变化

渐变气候

季 性 增加

常不好 常好 季旱季

和 应

采用该技术的地区内土地使用者的百分比

- [x] 单例/实
- [ ] 1-10%
- [ ] 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？

- [ ] 候变化 候
- [ ] 不断变化 市场
- [ ] 劳动力可 性 例如 于

和吸取 教

长处: 土地使用者的观点

- The technology generates Income along the year and keep us busy.
- It is a way of having a crop and the gallery forest together.

长处: 编制者或其他关键资源人员的观点

- The more complex and diverse production system might favored pollination and crop health.
- The technology compared with other land uses around it such as oil palm tree and rice is more sustainable.

弱点/缺点/风险: 土地使用者的观点如何克服

- It takes 6 years to begin to produce, but during the first years it is still requirement all maintenance activities Planting cacao varieties, which produce fruits in less than 6 years.
- There is little support for small farmers an entrepreneur initiatives, from public and private institutions, when then do not belong to any project. By planning the potential occurrence of technologies/ initiatives,FF that is worth to give support, especially from public institutions and plan some resources for it.

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

- Gallery forest thinning to open cropland is about 70%, which is a high portion of forest. The more gallery forest is protected, the better buffering for extreme climatic events Using cacao tree varieties with more shadow tolerance, which let leave more forest percent in the agroforestry system

参 文

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WOCAT数据库中的完整描述
https://qcat.wocat.net/zh/wocat/technologies/view/technologies_5763/

链接的SLM数据
不

文件编制者

机构
- Cesos - Centro de Estudios para la Sostenibilidad - Fundación Wajari (Wajari) - 哥伦比亚

- Onsite and Offsite Benefits of SLM

主要参考文献

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- Video: Land Use Change Impacts in the Cusiana Watershed of the River Basin, Orinoco River Basin, Colombia. Author: Liniger HP, Vega LF, Ramírez BH, Eichenberger J, Year: 2020: https://vimeo.com/429999595