RESTORATION OF EQUATORIAL RAINFOREST SLOPES OF MABONJI IN THE MEME DIVISION SW REGION OF CAMEROON.

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INTRODUCTION

The research area is located within the equatorial rainforest slopes of Mabonji in Meme division of the South west province of Cameroon between latitude 4º3'N and longitude 9º3'W. The area is highly undulated with fast growing population who practice different land use systems on unplanned land space.

INTRODUCTION CON'D

- Method is Interactive Participation (IP) working with local people and associations in the community using practical and semi structured interviews to gather information on the histories, functioning, community governance, farming systems, inventory of natural resources, problems and difficulties faced, and planning of activities and work plans at meetings, and workshops.

INTRODUCTION CON'D

- Three pilot sites for trial farms were selected with adoption of Sustainable Agrotropic-rainforestry approach for cultivation, seed nurseries established, and alternative livelihood activities implemented including Snail, Pig and Non timber forest product farming. A water catchment was demarcated, protected and developed for community use and contributions and supply of working materials, farm plots and services to the process.

INTRODUCTION CON'D

- Data collected on the trial farms and analyzed show positive results. Abandoned hill slopes, hill forest ecosystems, biodiversity, and farming system are restored and conserved and improved with increased crop yield and production.
- Frequently occurring erosions and other problems have ceased with increased land fertility.

INTRODUCTION CON'D

- Many are busy acquiring land on hill slopes and carrying out the adopted farming system, something that was never done before.
- Other benefits such as (Bush allowance) i.e. those NTFPs that are integrated in to the farming system are harvested during off seasons to sustain the farmer.

INTRODUCTION CON'D

- It is expected that this process will empower village people, build their capacities and skills, improve knowledge on natural resource governance and enhance community participation for common development.

FINDINGS

- Area is hilly with steep slopes, deep valleys, and cluster of hills.
- Slopes have equitable distribution of humus.
- Litter production can be derived through agro forestry system from leaves, barks, branches, trunks to improve on the soil fertility and roots of plants will provide support on the slopes preventing erosion thereby conserving the soil and biodiversity.

FINDINGS CON'D

- Microclimate is changed; with lose of important biodiversity and ecological habitats.
- Sol fertility decreases along the slop to the top influencing crop yield and crop type at each gradient on the slope.
- High concentration of farms on lower part of slopes and greater tendency of clearing/slash and burn at upper part of the slopes rendering uphill prone to erosions /infertility, landslide and abandonment.

FINDINGS CON'D

- Natural occurrence and grouping of plants and particular crops occur on the slope e.g., coffee, rubber, banana, plantain, NTFP's, secondary/tertiary forest plants on middle slope while most species of raffia palms/hydrophytes are on lowest gradient. NB; Insert picture of oil palms and coffee.
- Distinct stratification of vegetation with grasses/shrubs at top of slope down to big trees at bottom.

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PROBLEMS

- Degraded hills and hill slopes.
- Insufficient and inaccessible farmlands.
- Inappropriate and rudimentary farming methods.
- Food insufficiency, water, poverty and growing populations
- Lack of community participation and community forests.
- Land tenure and community/village land conflicts.
- Lack of knowledge, education and training.
- Loss of biodiversity, ecological habitats and hill rainforest

PROBLEMS CON'D

- Fall in cultural values and touristic potentials, encroachment and invasion of forest reserves by local population for arable land and for Non Timber forest Products.
- Poor and fragile soils with poor water retention capacity.
- Lack of understanding of the forestry and environment laws.
- Depletion of natural resources because of commercial timber exploitation in the area since 1960.
- Change of landscape, vegetation and climate.

OBJECTIVES AND HYPOTHESIS

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OBJECTIVES AND HYPOTHESIS CON'D

- Facilitate Participatory governance of natural resources for community interest/equitable benefit sharing and alternative income generating activities.
- Improve and maintain inaccessible forest land thereby curbing encroachment into forest reserves.
- Ensure sustainability of natural resources of forestry, wildlife, fisheries and prevent climatic changes.

PROPOSED SOLUTIONS

- Establishment of restoration and management design technologies.
- Adoption and implementation of Agrotropic-rainforestry approach.
- Sensitization of local populations and adoption of participatory natural resource management.
- Improve seed production techniques and cropping systems.

HOW FINDINGS WOULD BE USED

Adopted as a tool for participatory natural resources management

and governance.

- Establish a wide scale sustainable restoration design land use

Planning for degraded hill slopes and for land in the area and beyond.

HOW FINDINGS WOULD BE USED CON'D

- Improve seed and agricultural production techniques and cropping systems.
- Solution to land tenure problems through recovery of abandoned

  sites to arable sufficient more productive land area for quick, cheap

  and sustainable means of income for household/ community development

METHODOLOGY

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- Solution to land tenure problems through recovery of abandoned sites to arable sufficient more productive land area for quick, cheap and sustainable means of income for household/ community development

METHODOLOGY CON'D

- Establishment of three trial farms of 500m2, plot I on uncleared slope, plot II on cleared slope & plot III on a degraded slope were cultivated/cropped, to compare yield and determine acceptable method.
- Establish crop/tree nurseries of cash crops, NTFP's, fast growing timber species, plant in March, monitor and collect data yearly for five years.

AGROTROPIC-RAINFORESTRY

- “Agrotropic-rainforestry” or “natural mosaic cropping” is defined as integral cultivation, or cultivation of a multitude of crops and plants in an existing rainforest, using traditional, indigenous farming methods.
- In this approach, management for enrichment planting improves conditions for new and existing plants, following a natural growth pattern and sequence.

AGROTROPIC-RAINFORESTRY CON'D

- Where there is no existing forest, all the crops, trees and forest plants are generally grown side by side.
- In the agrotropic-rainforestry approach, mimicking the natural forests structure, a mosaic design is used with an irregular planting system, i.e. intercropping different species in the same environment, depending on their ecological requirements, topography and soils.

CHOOSING THE SITE

- Preferable site chosen is depleted, degraded and abandoned hill slopes due to lack of arable land, growing populations, drying water sources etc for reasons of restoration.
- No areas are excluded except already in use for other activities.
- A participatory approach/working together as a team is used in instructing the farmers by empowering, enabling them proactive and to understand that the restored area and farms shall be eventually owned by the group where all will benefit.

CHOOSING THE SITE CON'D

- There is no national/regional legislation that determines the choosing of the site except for the Forestry law of Cameroon of no: 94 of 20th January 1994 and the environment law no: 96/12 of 6th August 1996 regulating environmental management in Cameroon.
- Restoration of equatorial rainforest slopes of Mabonji in the Meme division of the Sw region Cameroon

PREPARING THE SOIL

- Physical observations of the soil have showed that it is loose, with very poor water holding capacity, and prone to element leaching. This soil is not productive without fertilizers (Nkwi 2003). During the slightest rainfall the soil becomes very sticky and muddy. The stickiness indicates that the soil contains some clay, as well as laterite and large rocks. This physical observation ties with scientific findings on soils from a study on watersheds in the rainforest of Southwest Cameroon (Robain et al. 1992).

PREPARING THE SOIL CON'D

- € Their study revealed that soils in general and especially top soils in this area are fragile and are easily degraded.
- Litter production from trees is very high, with leaves, bark and branch litter rendering the soil very fertile. Thus, selective felling by girdling is done to allow as above. It is crosscut, allowed for three months to completely decompose. Then manual tilling of soil using hoes ready for planting.
- However, conventional farming causes serious erosion problems and soil nutrient

GENETIC MATERIAL AND PLANT SELECTION

- To test the suitability of the agrotropic-rainforestry approach, three trial farm plots were established on different terrains, all measuring 500 m2 and with three replicates each. Plot I was on an uncleared slope, plot II on a cleared slope and plot III on a degraded slope. These plots were cultivated to compare yields and decide on a suitable restoration method.
- This was followed by the establishment of tree nurseries for production of planting material by rooted system for seeds of fast-growing timber species, including cash

GENETIC MATERIAL AND PLANT SELECTION CON'D

- Timber species included *Cedrela odorata*, iron wood (*Lophira alata*), camwood (*Pterocarpus soyauxii*), bete (*Mansonia altissima*), frake (*Terminalia superba*) and iroko (*Milicia excelsa*).
- The root system and the suitability of the plant for a certain part of the slope are important considerations for choice of plants for slope restoration. Cocoa, kolanut, bitter cola, oil palm, plums, pears, bananas, plantains mango, and coco yams were planted on the middle slope alongside already existing timber and non-timber

GENETIC MATERIAL AND PLANT SELECTION CON'D

- Planting was done at the beginning of the rainy season in March, followed by yearly monitoring and evaluation, for a period of five years. All activities and methods relevant to the process were conceived by the entire working group, and any doubts were openly and thoroughly addressed.
- The project was established in an area including the trial plots mentioned above, the catchment and other participant farmlands making an estimated surface area of about 4,000 hectares. In addition, other farmers joined the project

PLANTING

- At the top of the slopes, grasses, shrubs, oil palm, mango, paw paw, maize and coffee did well, therefore this portion was enhanced by planting oil palm and coffee as well as fast-growing timber species such as *Cedrela*, iron wood and frake.
- These enrichment plantings were done in areas where the light availability was increased by treatments to the existing vegetation, i.e. on pegged ringed open spaces.

PLANTING CON'D

- In areas where there was dense growth of grasses and shrubs, brushing was done to open up space for planting, and only the area where the hole was dug was ringed.
- Digging the holes for all planting and cropping activities on the slope consisted of a procedure that involves first identifying points for planting, pegging, and creating terraces on the upper part of the slope,
- then using the soil removed from the upper part to build up the lower part, after which the hole is prepared for planting.

PLANTING CON'D

- To keep the young planted seedling upright and intact, sticks, branches, palm fronds and tree trunks are tied together in a bundle and placed at the base of the hole, close to the plant.
- The bundle is held together and supported by stakes, and protects the plants from erosion, runoff and nutrient leaching.
- This bundle helps form a biomass chain and network across the entire slope. The bundle also serves as check dam, preventing siltation at the foot of the slope.
- **Selective felling and girdling of**

PLANTING CON'D

- Elimination of unwanted trees is needed to open space for the desired trees and crops, and it can be done either by selective felling or girdling according to the specific situation encountered in the field.
- Selective felling of unwanted trees creates gaps, allowing sun rays to reach the crops.
- Some of the cut logs and branches are laid perpendicular to the slope along the entire length of the slope.

PLANTING CON'D

- The trees felled are allowed to decompose for 3 months before enrichment planting is done.
- The second and most effective way to remove trees is by girdling at a height of 1.5 m, to enable defoliation and subsequent litter decomposition to take place.

PLANTING CON'D

- The organic material provides nutrients to the crops. This litter also acts as mulch to improve the soil structure, retaining moisture on the slope, and enabling a soil microenvironment with healthy microbial and macrofauna populations.
- The mulch also prevents erosion, especially sheet erosion, and prevents landslides. It also provides a medium for germination of young seeds.

PLANTING CON'D

- Girdling is preferred to felling because the stump and roots can remain viable and re-sprout.
- The roots of the girdled tree still anchor the soil for some time, and some of the excess water percolated into the soil will be absorbed, thus reducing danger of land slides.
- In contrast, when trees are felled, the roots die off much faster, facilitating runoff and erosion.

PLANTING CON'D

- The roots of the girdled stumps, together with those of remaining trees, shrubs, grasses, and food crops form an underground network, anchoring and reinforcing the soil, thereby keeping the slope intact.
- This network also prevents surface water saturation by absrobing excess water.

PLANTING CON'D

- Plant production is low when the crops are still young, but as they mature in a favorable environment with constant nutrient input to the soil from leaves and branches, yields increase.
- Also observed is an apparent healthy interaction among different tree and crop species.
- Alternative livelihood activities incorporated in agrotropic-rainforestry are important, ensuring the system is readily accepted in the community because of immediate benefits to compensate for time and other

CULTIVATION AND MAINTENANCE

- Agro tropic rain forestry on slope follows natural vegetation distribution and habitat occurrence enhanced with oil palms, coffee, fast growing timber species of cedrela, iron wood, and frake.
- Planting is done on pegged ringed sunk holes on open spaces while thick bushes were brushed cleared.
- Identify hole points for planting on slope following a unique procedure, peg, dig and scoop soil on the upper end in a terracing manner, and mount soil on the lower end.

CULTIVATION AND MAINTENANCE CON'D

- Plant seedling and keep in position and intact using pieces of sticks, cut branches, palm fronds, leaves, and trunks packed together in a bundle at the lower base of the hole close to the plant.
- Hold bundle together with pinned pegs prepared from sticks to secure the plants from erosion, runoffs and carrying away of food material and soil nutrients. NB; Place picture of mosaic Agro tropic rain forestry, see text.
- Bundle of woody material serves as check dams against siltation at the foot of the

Mosaic slope agrotropicrainforestry system. See check dam and different crops and cropping system on slope in PLOTI.

Check dam: bundle of biomass packed together and

CULTIVATION AND MAINTENANCE CON'D

- Create light spaces for sun rays to penetrate on the crops by thinning through selective felling at foot level.
- Cross cut felled material and laid perpendicularly some cut logs and branches in a coaxial manner along entire length of the slope.
- Girdle big trees at height of 1.5 m from bottom to allow for defoliation enabling leaves/branches to gradually drop and trunk to die off and decompose over time providing perennial fertility of the soil.

CULTIVATION AND MAINTENANCE CON'D

- Mulch prevents sheet erosion, runoffs, slides, harvest rolling down slope, and medium for germination of seeds.
- The roots of the stumps together with those of trees, shrubs, grasses, food crops etc forms a webbed network playing vital roles in anchoring, reinforcing the soil keeping the slope intact. It supports and prevents surface saturation liberating excess water leaving just the required quantities for uptake by plants.

CULTIVATION AND MAINTENANCE CON'D

- The felled material is allowed for a period of three months to decompose ready for cultivation and planting.

- The timber and other fast-growing species serve as wind breaks during heavy storms and provide shade conducive for the development of sensitive crops such as cocoa.
- The slope is constantly monitored for water gullies. Immediate remedy to stop the water flow in gullies is provided by split plantain and banana stems or small logs and

WATER MANAGEMENT

- At the foot of the slope, there is a brook with a stream that serves as a source of potable water. Water here is used for irrigation, other farm and community activities, and drinking. On the banks close to the slope there is a natural forest with a variety of aquatic hydrophytic and non-aquatic species.
- This area has been enhanced with oil palms, raffia palms, njabe (the oil is used in cooking and for medicinal purposes), and was protected from human intervention, including farming, logging

WATER MANAGEMENT CON'D

- On one side, a dense forest was allowed to act as a natural boundary to all human activities. Fast-growing *Cedrela odorata* were planted for delimitation.
- The water source was protected from contamination by mounting rocks into a dam collecting the water into a pipe that facilitates easy fetching by the community. This dam improves water quality for human consumption.

WATER MANAGEMENT CON'D

- Previously, the water source was exposed, lying in a stagnant pool, and was scooped from the ground with dishes. This left the water dirty and turbid, and caused scarcity especially during the dry season, as well as disease.
- The dam has greatly improved the situation. It was also explained to the local community that the catchment will dry up if the area is cleared for farming. The community committed to properly managing the upper slopes of the hill to prevent erosion and siltation.

Raffia palms at the foot of the slope, tapped for palm wine, art and craft for designing and many other uses.

Level of vegetation cover demarcated around the water shed.

Established system on plot I after restoration. See different crops and vegetation layers involved

Successfully established cocoa farm on the middle of the slope of plot I.

BENEFITS

Mr. Nkangu Johnson with “Bush Allowance”. Key technician for nursery activities and grafting to the project, farmer and representative to the community

PROTECTED WATER SOURCE

- Mabonji water source: Catchment protected and preserved for community use .
- Scarcity of water has raised consciousness amongst community people to conserve their water source.

SNAILS FARMING PROJECT

Nursery side

After restoration

Maize farm after restoration

Overview of slopes after restoration

CONCLUSION

- An ideal farming system, Agrotropic-rainforestry was discovered.
- Team work, empowerment of locals and working participatorily was useful.
- Abandoned hill slopes have been transformed to economically, biologically, ecologically useful and crop yield/productivity has increased.
- Community water/fish pond projects are realized

CONCLUSION CON'D

- Alternative livelihood/ income activities are discovered in the system through Bush Allowance activities.
- Hill forest, ecosystems and biodiversity is conserved.
- Landslides, Erosions and infertility have been improved.
- A sustainable management method to natural resources and farming method has been adopted for the area.
- Indigenous knowledge on farming and community development has improved.

FURTHER WORK

- Organize workshops, seminars and attend congresses/conferences to disseminate results, share experiences, and promote implementation in the area and beyond.
- Train community people, and further knowledge and capacity in areas where gaps exist, on engineering and hydrologic properties of the soils of the area.

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