“Development of Decision Support Tools on Sustainable Land Management (SLM) as a Key to address Abiotic Stresses in Areas Vulnerable to Climate Change”
(PhilCAT-SLM)

COMPILATION OF SLM PRACTICES IN THE PHILIPPINES

Engr. Samuel M. Contreras
Project Leader
Project Objectives

General Objective:
To develop sustainable land management (SLM) decision support tools for combating land degradation, and the effects of climate change.
Project Components

1. Awareness raising, education, and training particularly on WOCAT tools and methodologies

2. Documentation of SLM and climate change adaptation best practices and success stories using WOCAT methodology and tools;

3. Development of on-line database on SLM knowledge management;

4. Development and publication of compendium of best practices on sustainable land management (SLM)

5. Multi-media Documentation of SLM

6. Project Management and Monitoring
The WOCAT Process and Tools

The WOCAT process and tools

Field level

Experience

Contributors and users

Implementation

Users at the planning level

Questionnaires

Technology

Approach

Map

Database

Management, retrieval and analysis tools

Outputs

Reports/Books

Maps

CD-ROM

WWW

"Development of Decision Support Tools on Sustainable Land Management (SLM) as a Key to address Abiotic Stresses in Areas Vulnerable to Climate Change"
Technology Functions within the landscape
(34 SLM Technologies and 9 Approaches)

1. Soil Fertility Management
2. Water Management
3. Runoff Management and Erosion Control (Structural measures)
4. Runoff Management and Erosion Control (Vegetative measures)
5. Enrichment Planting and Protection of Vegetative Cover
6. Fire and Wind Breaks
7. Biological Pest Control
SLM PRACTICES IN THE PHL

Project Web site

www.bswm.da.gov.ph/phlicat-slm

G. Schwilch

About the Project.

Despite continuous efforts to spread SLM practices, adoption is still alarmingly low. Successful adoption of SLM depends on a combination of factors and it is a challenge to find best SLM practices for diverse local conditions. It is, therefore, essential to provide decision support tools for local land-users, specialists, planners, and decision-makers and invest in knowledge management and decision support mechanisms by following sound procedures and tapping existing knowledge (WOCAT 2011).

SLM technologies and approaches remain scattered and in different formats. There are knowledge gaps specifically in terms of the area covered, impacts and economics of SLM and therefore these knowledge are not used to make decisions. Hence, there is a need to document this wealth of knowledge on SLM, put them into a database, and process them into knowledge products that can be used as decision support tools.

Objectives

The general objective is to develop sustainable land management (SLM) decision support tools for combating land degradation, and the effects of climate change.

Specific Objectives:
1. Document available SLM and climate change adaptation best practices and success stories, both indigenous and science-based knowledge, from different parts of the country;
2. Increase capacity and awareness of local partners on SLM and adaptation strategies in areas vulnerable to the effects of climate change;
3. Develop SLM knowledge management and decision support tools using WOCAT methodology;
4. Strengthen the PHILCAT in its advocacy and activities related to SLM; and
5. Communicate and disseminate results to land users, SWC advocates and specialists, and policy and decision makers to facilitate broader adoption.

Project Outputs

The project will deliver the following outputs with respect to each specific objective:

Objective 1: To document available SLM and climate change adaptation best practices and success stories

Output 1. Guidelines and protocols to select SLM best practices completed

Output 2. SLM best practices identified and selected from the 5 strategic ecosystems through the conduct of seminar-workshop in the identified SLM centers.

Output 3. SLM best practices are documented using WOCAT questionnaires on technology and approaches, and mapped/tagged.

Objective 2: To increase capacity and awareness of local partners on SLM and climate change adaptation strategies.

Output 4. Trained project staff and local partners on the application of WOCAT tools and methodologies.

Output 5. Well informed local partners regarding SLM as climate change adaptation options.

Objective 3: To develop SLM knowledge management and decision support tools using WOCAT methodology.

Output 6. Documented SLM best practices are entered in the WOCAT database.

Output 7. Summarized report of SLM best practices generated from the WOCAT database.

Objective 4: To strengthen the PHILCAT in its advocacy and activities related to SLM.

Output 8. PHILCAT institutional members’ active participation and contribution in the project implementation and WOCAT activities.
Compilation of SLM Best Practices

Philippine SLM Case Studies......
ADVANTAGES
The technology was made only with indigenous material such as rocks from the area.

DISADVANTAGES
Less durability of the technology because the rocks piled were easily dislodged. This could be improved by cementing the gaps between rocks to further enhance resiliency of the rockwall.

MAINTENANCE OF THE ROCKWALL
Maintenance is done thrice a year by repiling of dislodged rocks.

ACCEPTANCE/ADOPTION
There is a moderate trends towards spontaneous adoption of the technology. Even without LGU assistance, the technology will continue since most of the land-users in the area were trained and taught on how to construct rockwall with the use
WHAT IS Rockwall Terracing?

Rockwall terracing technology is widely practiced by farmers in hilly area of Barangay Nasunggan, La Libertad, Negros Oriental. Rockwall terraces are built to reduce soil erosion and provide ease in land preparation through the removal of naturally present rocks in the cultivated area. It also contributes to the partial arrangement and diversification of land use.

HOW TO ESTABLISH ROCKWALL TERRACING?

- Rocks or stones that were taken from the area are piled along the contour lines with the width of 1.10 m and a height of 1.50 m.
- 360 person days are needed to construct a 50-meter rockwall which costs 800 USD.
- Maintenance of the structure is done by piling dislodged stones three times a year.
- The terrace bed were cultivated and planted with corn, watermelon and vegetables. In some areas, livestock like cattle and native pigs were also raised.

BENEFICIAL EFFECTS

Production and socio-economic benefits
- Increased crop yield
- Reduced expenses on agricultural inputs
- Increased farm income
- Diversification of income sources
- Increased production area
- Increased product diversification

Socio-cultural benefits
- Strengthened community institution
- Strengthened national institution
- Improved conservation and erosion knowledge
- Improved food security and self-sufficiency
- Improved cultural opportunities
- Improved situation of disadvantaged groups

IMPLEMENTATION ACTIVITIES, INPUTS AND COSTS

<table>
<thead>
<tr>
<th>Establishment activities</th>
<th>Establishment inputs and costs per unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inputs</td>
</tr>
<tr>
<td></td>
<td>Labour</td>
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<td></td>
<td>Equipmen</td>
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<tr>
<td></td>
<td>TOTAL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance/repair activities</th>
<th>Maintenance/repair inputs and costs per unit/year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inputs</td>
</tr>
<tr>
<td></td>
<td>Labour</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
</tr>
</tbody>
</table>

OTHER FUNCTIONS

Main technical functions
- control of dispersed runoff: retain / trap
- control of concentrated runoff: retain / trap

Secondary technical functions
- control of raindrop splash
- reduction of slope angle

INFLUENCE OF NATURAL AND HUMAN FACTORS

Natural Environment

<table>
<thead>
<tr>
<th>Average annual rainfall (mm)</th>
<th>Altitude (m a.s.l.)</th>
<th>Landform</th>
<th>Slope (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 5000</td>
<td>&gt; 4000</td>
<td>Mountains</td>
<td>steep</td>
</tr>
<tr>
<td>3000-5000</td>
<td>2000-3000</td>
<td>Mountain tops</td>
<td>steep</td>
</tr>
<tr>
<td>2000-2500</td>
<td>1000-2000</td>
<td>Hills</td>
<td>steep</td>
</tr>
<tr>
<td>1000-1500</td>
<td>&lt; 1000</td>
<td>Valleys</td>
<td>steep</td>
</tr>
</tbody>
</table>

Soil depth (cm)

| Soil depth | Soil texture: medium/fertile | Soil structure: medium (1.5%)
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20</td>
<td>Medium</td>
</tr>
<tr>
<td>20-50</td>
<td>Medium</td>
</tr>
<tr>
<td>50-100</td>
<td>Medium</td>
</tr>
<tr>
<td>&gt;100</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Soil water storage capacity: medium

Water quality: good drinking water

Drought intensity: low

Tolerance of climatic extremes: temperature increase, seasonal rainfall increase, seasonal rainfall decrease sensitive to climatic extremes: heavy rainfall events: Intensive and amount

Human Environment

<table>
<thead>
<tr>
<th>Mixed per household (ha)</th>
<th>Land user: Individual/household: Small scale</th>
<th>Population density: 10-30 people/pct.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Individual/household: Small scale land users, subsistence farmers, men and women</td>
<td></td>
</tr>
</tbody>
</table>

Importance of off-farm incomes: less than 5% of total income

Food, clothing, education, employment opportunities, markets, roads and transport, financial services, medical care, high technical assistance, livestock and other livestock, government intervention, subsistence and commercial
IEC Materials Production

ADVANTAGES

• Availability of labor
  - Job generation
• Strengthened community participation

DISADVANTAGES

• Poor Road Network (farm-to-market road)
• Lack of irrigation system in the cropping area
• Insufficient hedgerow crops

ACCEPTANCE/ADOPTION

There is a strong trend towards spontaneous adoption of the technology. Additional Barangays will be adopting the technology.

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CONTOUR FARMING USING HEDGEROWS

Contour farming is a technology practiced in sloping areas in which hedgerows are established along the contour while crop production is carried out in between the hedges.
What is Contour Farming Using Hedgerows?

Contour farming is being practiced by the farmers in sloppy areas to prevent or control surface run-off, soil erosion, and to conserve natural soil fertility. Hedgerows are established along contour lines which are planted with napier grass and permanent crops like banana and coconut. Napier grass are planted purposely as feeds for livestock. In between contour lines, corn is planted inter-crop with peanut.

Start Contour Farming Using Hedgerows?

1. Contour lines (0.5 m) are measured with the aid of an A-frame.
2. Napier grass are planted along the contour at 8x8m and 4x4m distance.
3. Grafted cacao trees are also inserted in-between banana at 4x4m distance.
4. Corn and peanut are planted in 4-meter wide and 30-meter long production areas located between contours.

Other Functions

Primary functions:
- Control of rainfall splash
- Control of dispersed runoff: retain / trap

Secondary functions:
- Reduction of slope angle
- Reduction of slope length

Technical Drawing: Patricio A. Yambot

Beneficial Effects

Production and socio-economic benefits
- Increased crop yield
- Increased fodder production
- Improved fodder quality
- Increased farm income
- Diversification of income sources
- Increased product diversification

Production and socio-economic benefits
- Strengthened community institution
- Strengthened national institution
- Improved situation of disadvantaged groups
- Increased recreational opportunities
- Improved conservation knowledge
- Improved soil moisture
- Improved excess water drainage
- Improved soil cover
- Increased biomass above ground Carbon
- Increased nutrient cycling recharge
- Increased soil organic matter / below ground Carbon
- Reduced emission of carbon and greenhouse gases
- Reduced soil loss
- Increased plant diversity
- Increased water quality
- Reduced wind velocity
- Increased / maintained habitat diversity

Implementation Activities, Input and Costs

<table>
<thead>
<tr>
<th>Establishment activities</th>
<th>Establishment inputs and costs per unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>Costs (US$) % met by land user</td>
</tr>
<tr>
<td>Construction material</td>
<td></td>
</tr>
<tr>
<td>Bamboo stakes</td>
<td>0.56</td>
</tr>
<tr>
<td>- Bamboo stakes</td>
<td></td>
</tr>
<tr>
<td>Agricultural</td>
<td></td>
</tr>
<tr>
<td>- seeds</td>
<td>75.11</td>
</tr>
<tr>
<td>- fertiliser</td>
<td>17.78</td>
</tr>
<tr>
<td>TOTAL</td>
<td>122.78</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance/recurrent activities</th>
<th>Maintenance/recurrent inputs and costs per unit per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour</td>
<td>Costs (US$) % met by land user</td>
</tr>
<tr>
<td>Equipment</td>
<td>Animal traction</td>
</tr>
<tr>
<td>Agricultural</td>
<td></td>
</tr>
<tr>
<td>- seeds</td>
<td>4.44</td>
</tr>
<tr>
<td>- fertiliser</td>
<td>40.36</td>
</tr>
<tr>
<td>TOTAL</td>
<td>44.80</td>
</tr>
</tbody>
</table>

Influence of Human and Natural Factors

- Natural Environment
- Landform
- Slope (%)
ADVANTAGES
• Seed Production of Forage Legumes can control soil erosion and it also increase the soil fertility
• It can also serve as wind breakers

DISADVANTAGES
• Low seed production during long dry season or drought
• Provision of irrigation system is needed in order to continue the seed production during dry months

Contribution to the Livelihood
Seed produced from forage legumes serves as extra income from land-users which they were used for the education of their children

ACCEPTANCE/ADOPTION
There is a moderate trend towards spontaneous adoption of the technology. Most of the farmers were assisted by the local government officials on the production of seeds and the sales of the produce.
What is Seed Production of Forage Legumes?

Forage Legumes such as Flemengia macrophylla and Indigofera tinctoria locally known as Malabalatong and Indigo plant, respectively, are used primarily for seed production. This process is introduced through Conservation Farming Village (CFV) project in Barangay Elecia, La Libertad, Negros Oriental.

The plants are drilled along contour lines and the seeds of these plants are maintained until mature enough for harvest. Fodder and other dry matter parts of the plants are used as feeds for livestock while hard portions such as branches are used as firewood.

Seed production of forage legumes is practiced by farmers in the Barangay to conserve soils as well as to supplement the seed requirement of expansion area of the CFV project in the municipality.

How to Establish Seed Production of Forage Legumes?

1. Contour lines are established in sloppy areas using an A-frame.
2. A hectare lay-outing requires 8 person days while land preparation (i.e. plowing and furrowing) requires at least 30 person animal day per hectare.
3. Flemengia and Indigofera seeds are drilled along contour lines at rate of 24kg/ha and 8kg/ha, respectively.
4. Weeding and hilling-up are done 30 person animal day. Harvesting of pods starts a year during the months of February, May and October.
5. Indigofera produces seeds three months after flowering which starts a year from planting.
6. Matured pods are harvested twice a year by hand-picking then sun-dried for at least two days.
7. Manual threshing is done to remove seeds from the pods.

Beneficial Effects

Production and socio-economic benefits
- Increased crop yield
- Increased farm income
- Diversification of income sources
- Increased product diversification

Socio-cultural benefits
- Strengthening community institution

Ecological benefits
- Improved soil cover
- Increased nutrient cycling recharge
- Reduced soil loss
- Improved harvesting / collection of water

Implementation activities, inputs and costs

Establishment activities
- Land Preparation, Planting, Harvesting and Furrowing
- Establishment of contour lines laying out

Establishment inputs and costs per unit

<table>
<thead>
<tr>
<th>input</th>
<th>Cost (US$)</th>
<th>% met by land user</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeds</td>
<td>44.44</td>
<td>100%</td>
</tr>
<tr>
<td>Technology/paper</td>
<td>2.22</td>
<td>100%</td>
</tr>
</tbody>
</table>

Maintenance/recurring activities
- Weeding / Hilling-up
- Harvesting
- Manual Threshing
- Harvesting of Flemengia and Indigofera

Maintenance/recurring inputs and costs per unit per year

<table>
<thead>
<tr>
<th>input</th>
<th>Cost (US$)</th>
<th>% met by land user</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seeds</td>
<td>4.15</td>
<td>100%</td>
</tr>
</tbody>
</table>

Technical Functions of the Technology

Main technical functions:
- Control of dispersed runoff: retain / trap
- Control of concentrated runoff: retain / trap
- Improvement of ground cover
- Promotion of vegetation species and varieties (quality, eg palatable fodder)

Secondary technical functions:
- Reduction of slope length
- Increase of surface roughness
- Increase in organic matter
- Reduction in wind speed

Influence of Natural and Human Factors

Natural Environment
- Average annual rainfall (mm)
- Landform

Human Environment
- Cropland per household (ha)
- Land use:
  - Individual / household: Small scale,ammen, anaheng and water, men and women
  - Land ownership: individual, titled
  - Land use rights: individual

Importance of off-farm income:
- Access to services and infrastructure (education, employment opportunities, market, roads & transport, financial services)
- Reducing poverty
- Reducing vulnerability to climate change

Mechanization:
- Manual labour
- Livestock grazing as crop

Technical Drawing: Patricio A. Yambot
### Decision Support to Select Appropriate Sustainable Land Management (SLM) Practices Within the Landscape

**Engr. Samuel M. Contreras**  
Division Head, Soil Conservation and Management Bureau of Soils and Water Management

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This workbook consists of four main worksheets, namely: 1) Techno-Ecosystem, 2) Techno-Measures, 3) Techno-Function by Ecosystem, and 4) Financial Analysis.

#### What are the basic inputs?
1. Initial assessment/Identification - Are we looking for an Approach or a Technology?
2. Location or Area of interest - Coastal, Lowland, Upland to hillyland, or Highland
3. Bio-physical characteristics of the area of interest, i.e. land use, soils, slope, rainfall and nature of land degradation to be addressed.

#### How to use the Spreadsheet?
1. Proceed to worksheet Techno-ecosystem, Techno-Measures, or Techno-Function by ecosystem (i.e. depending on the menu preference) for the selection of an appropriate SLM technology, or to Approach worksheet for the selection of a possible approach (Project/program).
2. Within each worksheet, refer to the landscape diagram as initial basis in the selection of potential SLM technologies and approaches.
3. Based on the initial assessment, fill in the cell in yellow with the required letter (capitalized), number, or combination of number and small letter as indicated in the worksheet.
4. Assess and analyze the list of potential SLM technologies and approaches with respect to the bio-physical characteristics of the area of interest and nature of land degradation that will be addressed, as basis in making decision.
5. After the initial selection (using capital letter or number as required), refer to the standardized report of the selected technology/approach for more details (i.e. What & how? Where it is appropriate (natural and human environment), cost and benefits and impacts). Also, refer to the Assessment of the Technology in making decision. The complete details of the selected technology can be accessed by clicking the opposite cell with two selections: 1) with no available internet or 2) with available internet.
6. Subject the selected SLM Technology(ies) to Financial/Economic Analysis to determine its profitability if applied to specific farm sites.

**Note:**

SLM Approach defines the ways and means used to implement one or several SLM Technology(ies), including material and technical support, involvement and roles of different stakeholders, etc. An approach can refer to a project/program or to activities initiated by the landusers themselves.

SLM Technology is a physical practice on the land that controls land degradation, enhances productivity, and/or other
Decision support to select SLM options by Ecosystem

Sustainable Land Management (SLM) Land use Planning Decision Support Tool

Lowland (<100 masl)
- Level to nearly level (0-3%) - Very good land, can be safely cultivated and requires simple yet good agricultural practices. Either rainfed or irrigated and suitable for field crops production.
- Nearly level to gently sloping (3-6%) - Cropland, good land for cultivation, expansion for rice production. Can be utilized for upland crop cultivation, including high value crops, with simple soil conservation and management practices (e.g., contour strip cropping).

Upland - Hillyland (100-500 masl)
- Gently sloping to rolling (8-18%) (Upland) - Modified cropland. Soil conservation measures: alley cropping with vegetative (grass or legumes) barriers; alley cropping or hedge row intercropping system.
- Rolling to moderately steep (18-30%) (Hillyland) - Diversified cropland, suitable for pasture or forest. This can be developed for agriculture by adopting farm-based agroforestry system. Can be utilized for cultivation with careful management and complex soil conservation practices (e.g., hedgerow intercropping, multi-storey cropping system).

Highland (>500 masl)
- Moderately steep to steep (30-50%) to Very steep (>50%) and Plateau - Suitable for forest and wildlife as protected areas. For rehabilitation through enrichment planting, replanting of damaged areas, and/or saturation planting with indigenous species. Planting of shade tolerant species. Those areas being cultivated for agriculture (e.g., Cordillera) including plateaus should consider appropriate soil and water conservation measures (e.g., terracing, contour farming, residue management).
### Decision support to select SLM options by Ecosystem

**General Description:** Highland

<table>
<thead>
<tr>
<th>Count No.</th>
<th>SLM No. and Name of the Technology</th>
<th>Location</th>
<th>Land Use</th>
<th>Land Degradation</th>
<th>Conservation Measures &amp; Stages of Intervention</th>
<th>Technical Function</th>
<th>Altitude, meters above sea level</th>
<th>Annual Rainfall, mm</th>
<th>Landform</th>
<th>Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7. Littaku growing for forest enhancement</td>
<td>Upland to hillyland and Highland</td>
<td>Natural; Other: Grazing land, forest</td>
<td>Biological degradation; reduction of vegetation cover; loss of habitat</td>
<td>Vegetative Measures; Rehabilitation</td>
<td>Promotion of vegetation species and varieties; conservation of trees that serve as hosts; increase organic matter; increase biomass</td>
<td>100-500</td>
<td>2000-3000</td>
<td>hillslopes</td>
<td>hilly to steep</td>
</tr>
<tr>
<td>2</td>
<td>11. Natural Vegetative Strips (NVS)</td>
<td>highland</td>
<td>Annual cropping, trees and shrubs: rainfall</td>
<td>Soil erosion by water; loss of top soil; surface erosion; gully erosion; chemical soil deterioration; fertility decline and reduced organic matter</td>
<td>Agronomic and Vegetative Measures; Prevention and Mitigation</td>
<td>Reduction of slope angle; reduction of slope length; control of dispersed runoff; increase infiltration and decrease soil fertility</td>
<td>500-1500</td>
<td>1500-3000</td>
<td>footslopes</td>
<td>rolling-hilly</td>
</tr>
<tr>
<td>3</td>
<td>12. Rainfed paddy rice terraces</td>
<td>highland</td>
<td>Annual cropping, rainfall</td>
<td>Soil erosion by water; loss of top soil; surface erosion; chemical soil deterioration; fertility decline and reduced</td>
<td>Structural Measures (Bench Terraces); Prevention and Mitigation</td>
<td>Control of dispersed runoff; retain trap; increase/maintain water stored in the soil; reduction of slope angle; reduction of slope length</td>
<td>1500-2500</td>
<td>1500-3000</td>
<td>mountain slopes</td>
<td>hilly to steep</td>
</tr>
</tbody>
</table>
Decision support to select SLM options by Ecosystem

SELECTED SLM OPTIONS: 29
Compact farming for vegetables production

SPECIFIC FEATURES:

Landusers are organized into a group or association to undertake jointly activities in the farm which include operation, input procurement, and marketing of produced crops.

In Compact farming, farmers cultivate vegetable on a contract growing scheme. Some of the farm practices consist of growing vegetables and fruits using indigenous organic materials as soil conditioner and livestock raising. Vegetables and fruits are cultivated in divided parts but in the same area. Compact farming was organized to enhance group interactions and leadership among members of the association. The aim of the landusers in growing organic vegetables is to revive and sustain soil fertility and maximize waste management practice. Marigold was also planted in between plots within the farm to prevent and control insect and pest manifestation. Landusers in the barangay were empowered through farming and conservation of the forest area. Through this technology, marketability and available markets for the produced commodities were increased. The association received numerous award in the regional and province because of their demonstration of a productive and profitable farming system in the upland area. Basic among members of the association. Most of the farmers cultivated one parcel with size ranging from 1000-2000 square meters. Ownership and land use right is communal. The farm production is managed by the cooperative composed of small scale land users. Members of the association are engaged in off-farm activities such as hunting and hired labor for additional income.

Decision support to select SLM options by Type of Measures

**Sustainable Land Management (SLM) Land use Planning Decision Support Tool**

**PARTICULAR:**

**SLM PRACTICES (Approach OR Technology):** Technology

**CONSERVATION MEASURE CATEGORIES:**


**General Description:** Structural Measures

<table>
<thead>
<tr>
<th>Count No.</th>
<th>SLM No and Name of the Technology</th>
<th>Location</th>
<th>Land Use</th>
<th>Land Degradation</th>
<th>Conservation Measures &amp; Stages of Intervention</th>
<th>Technical Function</th>
<th>Altitude, meters, above sea level</th>
<th>Annual Rainfall, mm</th>
<th>Landform</th>
<th>Slope</th>
<th>Soil Deep Fertility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5. Small farm reservoirs</td>
<td>lowland; upland</td>
<td>Annual cropping</td>
<td>soil erosion and excessive runoff; limited water supply</td>
<td>Structural Measures: Prevention and rehabilitation</td>
<td>Water harvesting/ increase water supply; Control dispersed runoff, retain/trapped; control concentrated runoff: retain/trap.</td>
<td>&lt; 100; 100-500</td>
<td>1500-2000</td>
<td>plains/nilslopes</td>
<td>rolling</td>
<td>20-50; low mater class</td>
</tr>
</tbody>
</table>
Decision support to select SLM options by Functions within specific ecosystem

Sustainable Land Management (SLM) Approaches and Technologies Search Tool

PARTICULAR:

SLM PRACTICES (Approach OR Technology):

- Soil Fertility Mgmt (1a-lowland, 1b-upland to hillyland, 1c-highland)
- Water Mgmt (2a-lowland, 2b-upland to hillyland, 2c-highland)
- Runoff Mgmt & Erosion Control (Structural) (3a-lowland, 3b-upland to hillyland, 3c-highland)
- Runoff Mgmt & Erosion Control (Vegetative) (4a-lowland, 4b-upland to hillyland, 4c-highland)
- Enrichment & Protection of Vegetative Cover (5a-coastal/lowland, 5b-upland to hillyland, 5c-highland)
- Fire and Wind Breaks (6a-lowland, 6b-upland to hillyland, 6c-highland)
- Biological Pest Control (7a-lowland, 7b-upland to hillyland, 7c-highland)
- Others (8a-lowland, 8b-upland to hillyland, 8c-highland)

MAIN FUNCTION:

- 1. Soil Fertility Mgmt
- 2. Water Mgmt
- 3. Runoff Mgmt & Erosion Control (Structural)
- 4. Runoff Mgmt & Erosion Control (Vegetative)
- 5. Enrichment & Protection of Vegetative Cover
- 6. Fire and Wind Breaks
- 7. Biological Pest Control
- 8. Others

Objective:

Enrichment and/or Protection of Vegetative cover to address vegetation degradation in the coastal/lowland area

<table>
<thead>
<tr>
<th>Count No.</th>
<th>SLM No. and Name of the Technology</th>
<th>Location</th>
<th>Land Use</th>
<th>Land Degradation</th>
<th>Conservation Measures &amp; Stages of Intervention</th>
<th>Technical Function</th>
<th>Altitude, meters above sea level</th>
<th>Annual Rainfall, mm</th>
<th>Landform</th>
<th>Slope</th>
<th>Soil Depth, cm &amp; Fertility Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32. Mangrove as buffer against natural hazard</td>
<td>Coastal area</td>
<td>Forest/woodlands; crustaceans breeding ground</td>
<td>Reduction of vegetation cover, loss of habitats</td>
<td>Vegetative measures; prevent land degradation</td>
<td>Conserve ecosystem; preserve biodiversity; reduce disaster; adapt to CC; mitigate</td>
<td>0.00 - 100</td>
<td>1,500 - 2,000</td>
<td>Coast</td>
<td>0-2</td>
<td>Low</td>
</tr>
</tbody>
</table>
Decision support to select SLM options by Functions within specific ecosystem

The Highly Diversified Cropping in Live Trelils System is a traditional or local farmers’ initiative technology widely practiced in Brgy. Bukal, Nagcarlan, Laguna situated in the area of Mt. Banahaw. The area with rolling to hilly terrain is receiving an annual rainfall of 1000-2000 mm. Each of the farmers who practiced the technology has 0.5 to 1.0 ha production area. Moreover, the community is accessible to infrastructures such as schools and markets. Soils in the area is relatively good for agriculture cultivation. Kakawate, a small to medium-sized, thorny tree which usually attains a height of 10-12 m is being used as live trellis or ‘baling’ to various annual crops such as tomato, cucumber, chayote, beans, and ampalaya in the community. The cropping system is highly diversified since crop rotation is being practiced throughout the year. Aside from being an anchorage for annual crops, kakawate also stabilizes sloping lands and reduces soil erosion due to its strong roots which can grow 3-5 meters laterally, thereby holding the soil firmly. They are planted in a row of approximately 2-3 meters making it more effective in preventing soil erosion. Furthermore, kakawate is being trimmed and maintained every 3-6 months or as needs arise to a height of 3 m as live trellis, the trimmed leaves are very rich in nitrogen and will eventually serve as compost or crop cover. These will help in improving soil quality and moisture in the soil. In addition, kakawate has multiple uses and benefits; they can serve as hardwood or firewood when matured, as materials in making furniture and anchorage for flowering plants like orchids. In establishing the live trellis system, kakawate trunk or cuttings “quick sticks” with at least 2-meter height are planted in a row. An estimate of 0.5 to 1 meter planting distance within a row and also between rows is used. When the kakawate trunks are already set up and planted, they are interconnected using a metallic wires. Along these wires, plastic straws are tied in a vertical position whereby the crop can utilize these straws for creeping/climbing. Finally, the desired crop will be planted according to their cropping pattern. Maintenance of the technology includes: weeding and trimming. During infestation, application of pesticide is done but in minimal. The technology requires manual work resulting to elimination of machines that contributes to soil compaction. The technology has been a practice in the community for a long time, and land users continue to adopt the technology because of its easefulness and inexpensiveness to establish, and low cost in terms of maintenance activity. Adding up to this is the variety of plants to be grown, making their market more profitable. Climacia normally grows in tropical countries like the Philippines and is being utilized as hedgerows for erosion control measures. Over the years, its effectiveness as erosion control is known, and an increasingly used forage crop in cut-and-carry systems.

Establishment activities: Manual labor for weeding, planting, fertilizer application, harvesting and hauling - P3,600/ha, Planting materials - P2,550/ha, Fertilizers and biocides - P10,030/ha, Construction materials - P3,880; Total cost - P20,060. Maintenance activities: Labor for weeding, trimming of kakawate, application of fertilizers, spraying - P4,500/ha

<table>
<thead>
<tr>
<th>ASSESSMENT OF THE TECHNOLOGY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.20</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>

Specific and Total Benefits are assessed as high, medium, little or negligible.
Financial and Economic Analysis as basis in making decision

C. Project Profitability Indicators

<table>
<thead>
<tr>
<th>Financial Analysis</th>
<th>Sensitivity Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+20% in Cost</td>
</tr>
<tr>
<td>1. Net Present Value (NPV)*:</td>
<td>1,947,931.36 P</td>
</tr>
<tr>
<td>2. Benefit - Cost Ratio (BCR)*:</td>
<td>2.05</td>
</tr>
<tr>
<td>3. Internal Rate of Return (IRR):</td>
<td>60.671 %</td>
</tr>
</tbody>
</table>

3.1 Trial Method for IRR Calculation

<table>
<thead>
<tr>
<th>Assumed Discount Rate:</th>
<th>Total Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Rate: 60%</td>
<td>5,998.11 (Positive NPV)</td>
</tr>
<tr>
<td>Upper Rate: 64%</td>
<td>(29,766.08) (Negative NPV)</td>
</tr>
</tbody>
</table>

3.2 Sensitivity Analysis:

<table>
<thead>
<tr>
<th>Assumed Discount Rate (%)</th>
<th>Total Present Value</th>
<th>Assumed Rate</th>
<th>Total Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
<td>2,204.66</td>
<td>29</td>
<td>16,596.12 (Positive NPV)</td>
</tr>
<tr>
<td>46</td>
<td>(12,927.09)</td>
<td>30</td>
<td>(6,765.09) (Negative NPV)</td>
</tr>
</tbody>
</table>

Note: IRR is a discount rate that makes the NPV of all cash flows equal to zero.

Decision points >>> NPV > 0    BCR ≥ 1    IRR > relevant discount rate
Conclusion

- Soil and water conservation should be examined in the general framework of sustainable development goal that addresses
  - environmental challenges (e.g. climate change, land degradation, bio-diversity loss),
  - attainment of economic targets, and
  - provision of social needs;
Conclusion

WHAT WE NEED:

- Effective knowledge management and decision support tools to contribute in up-scaling, replicating and mainstreaming SLM practices into Local Government Development Plan;

- Enabling environment in terms of a unified soil/water-related policies, institutional arrangements, financing and marketing support, and incentive mechanisms to broaden the implementation of sustainable land management, specifically soil and water conservation.
Thank You and Good Day!