WB 4 - MONITORING AND IMPLEMENTATION

WP 4.1 -Design of an integrated implementation plan for the hotspot areas

Guidelines for the design of the Site Implementation Plan for monitoring of conservation technologies and approaches

The Site Implementation Plan (WP 4.1)

In WB4 the SWC measures selected by he stakeholders in WB3 are implemented and monitored. This implementation is on a field/plot level, i.e. the scale on which the stakeholders normally operate. This can be a farmers field, an area selected for grazing, even a small catchment depending on the desertification process. The setup of WB4 is a comparative study between locations that have SWC measures implemented and locations that don't. Additional monitoring on different scales is of course possible and encouraged, but the *minimum* that has to be done is described in his document.

Overall aim of WB4

To test the effectiveness and potential of the conservation and mitigation technologies and approaches against:

- the effects on the environment and mitigation of desertification processes, such as decrease of erosion, restoration of plant cover, increase of soil moisture, decrease of salinisation etc.
- the effect on the socio-economic situation of the stakeholders that implement the SWC measures, who will expect that their 'livelihood' will be improved (such as higher yield, more income security, survival of cattle etc).

Objectives

1. To streamline the activities on all sites and facilitate the comparison of results across the sites a **Site Implementation Plan** has to be made (WP 4.1).
2. Implementation of the SWC measures and installing of equipment and monitoring strategies (WP 4.2)
3. The term 'potential' of SWC measures means that an analysis has to be done to asses the effectiveness outside the immediate timeframe of the monitoring. This means a form of analysis and modelling of the desertification process to enable predictions and analysis of "what-if" scenarios. For this *additional variables* may have to be measured (WP 4.3) to be able to run the models that are needed for the analysis.
4. Improvement of indicators (WP 4.4). The trials may offer a possibility to test which indicators proposed in WB2 are sensitive enough to register the effect of the SWC measures and are able to monitor quickly the intended improvements. The results of the trials may be used to propose change in the indicator system. This analysis is also done in WB2, but not on the detailed scale and 3 year monitoring of WB4.
5. The results of WB4 are used in the regional modelling by PESERA and have to be translated to HIS requirements in WB6. More details about this will be forthcoming.
6. **Feedback to stakeholders**: this is not actually in the DOW but is of course very important and will be done near the end of WB4. Probably a third stakeholder meeting has to be organized to show the results. A protocol for this will be created a.s.a.p.

Implementation strategy

Since most sites are covering a large area and complex in terms of topographic relief, land use and soils, it will not be possible to monitor all combinations of Soil and Water Conservation measures, land use types and environmental setting. WB4 in DESIRE is based on a strategy of comparison between plots/fields where several SWCs are implemented and adjacent plots/fields where they are not. The advantage of this approach is that it is close to the experience of the stakeholders and direct feedback is possible, the disadvantage is that extrapolation from a few plots to the whole study site is "challenging" (read: scientifically very difficult if not impossible). Since there are already several analyses of the entire study site in WB1, WB2 and WB5, we will have to link the results with these activities.

The following points have to be taken into account:

1. *At least two SWC measures* should be selected and compared to a non-SWC field. In spite of the second stakeholder workshop, some measures preferred by the stakeholders may still not be feasible for implementation in the DESIRE context. For instance DESIRE cannot provide the means to implement heavy structural and technical changes, such a construction of certain type of terraces, or some technologies will unlikely show any effect within the time span of DESIRE, like tree plantations. It is therefore wise to always add a technology that is field based and the stakeholder can implement him/herself. These are generally the agronomical or vegetative technologies in WOCAT.
2. Additionally older research locations can be used where SWC measures have been used for a longer period to get insight into the long term effects of these measures, as well as untreated sites to get insight into the long term trends in desertification processes. The analysis of these locations can be part of WP 4.5 (deliverables 4.2.2).
3. *Select locations* for the implementation and monitoring of the preferred SWC measures. The exact selection is left to the site coordination team who know the area best. It is based on a combination of representativeness and willingness of the stakeholders to help in the next 3 years.
4. A *Site Implementation Plan* (SIP) is constructed by the site coordination team according to the outline below. A draft plan must be ready for the plenary meeting in November 2008 in Turkey, so that all sites see all plans and they can be discussed and improved, bottlenecks overcome etc. The team of ITC can give guidance where necessary so please contact me if needed.
5. *Equipment* needed to do the monitoring in *accordance with the SIP* must be bought before the end of 2008.
6. *Stakeholder involvement*. It is very important that he stakeholders continue to be involved so as not to loose the goodwill created in WB3. There are several ways: they can document exactly when and how they are active on the monitoring locations. They can help monitor the crop/vegetation quantity an quality. They can be included in the monitoring degradation processes using local indicators. They should be asked to help in evaluating he results after each growing season. A method and questionnaire for this will be provided by the WB coordinators.

7. *An analysis method* has to be considered already at this stage, because auxiliary data may be needed to analyze the data, for instance with a runoff or water balance model, in which case for instance soil physical parameters are needed.
8. Everyone must monitor the *rainfall and evaporation* close to he SWC locations, so that the climatic boundary conditions of the system are known. This must be done with a time resolution necessary for a proper analysis. For instance rainfall and evaporation measurements for soil moisture or plant growth and quality may need a daily timestep, while rainfall measurements for runoff and erosion may need a 5 minute timestep (depending on the analysis method or model). Note that we can only monitor 3 years at most and these years may show considerable climate variation. Thus a SWC measure may not seem to have the intended effect and a good analysis of the *drivers* is needed.

Layout Site Implementation Plan (SIP, part of deliverable 4.1.1)

The next pages show SIP for a non-existing site, text in blue is example text, adapt it according to your specific situation. *The information requested should be specific for the monitoring fields/plots*, not the entire study site in general, as this was already collected for WB1. The SIP has a number of categories:

A) General: Location of the monitoring plots
B) Summary: Brief summary of the problems at this particular location and the SWC chosen, summary from WB3
C) Location description: soil type, relief, climate and photo's of the plot/field area
D) Stakeholder info: name, level of technology applied on this location
E) Land use: crop, rotation, grazing practice etc.
F) Conservation measures and experimental setup: short description of SWC measures, experimental setup, plot layout, situation map
G) Monitoring activities:
   1) One time measurements
   2) Repeated visual monitoring supported by digital photography
   3) Repeated measurements
   4) Stakeholder activities
   5) Yield assessment:

   Adapt these activities according to your own situation if needed
H) Timetable of activities
I) Analysis strategy

Immediate activities

1. **Select monitoring sites**
2. **Make SIP - Site Implementation Plan**
3. **Send the draft SIP to me before 10 Nov 2008. Phone me in case of questions: 0031 53 4874412, or email me: jetten@itc.nl**
4. **Make a short Powerpoint presentation of your SIP to show in the November plenary meeting in Turkey. We have one WB4 day to discuss the plans.**
5. **Buy equipment necessary before the end of 2008**

Site Implementation Plan

A

Site Information

Site: name Nr site number

Site Coordinator - Partner: partner name and number

Joining Partners:

B

Summary

(Brief summary of the problems at this particular location and the SWC chosen, summary from WB3)

The location comprises 2 agricultural fields under Wheat production. The fields are located on a moderately steep slope on shallow soils and prone to rill erosion. Gullies are present in the vicinity. SWCs tested include contour ploughing, the application of mulch, application of both and creation of an upstream small dam for water supply, decreasing erosion and improving soil moisture availability. The control field has no mulch and normal ploughing direction. Monitoring for rill activity, soil moisture and soil structure, and crop yield and health parameters. A flume downstream measures runoff and sediment loads. Meteo variables measured at 12 km distance.

C

Location description

Coordinates: UTM coordinates

Situation: 2 adjacent fields of 2 ha each, one is the control field without improvements, one is divided in 3 zones: the left with mulch the right with contour ploughing and the middle overlapping zone with both measures.

Physiographic setting of the plots (slope, landscape etc): the fields are located on a convex-straight slope with a sharp edge to the valley floor. The slope is at the edge of a plateau, slope is up to 20%. The field spans the entire slope, no fields are upstream (see photo 1)

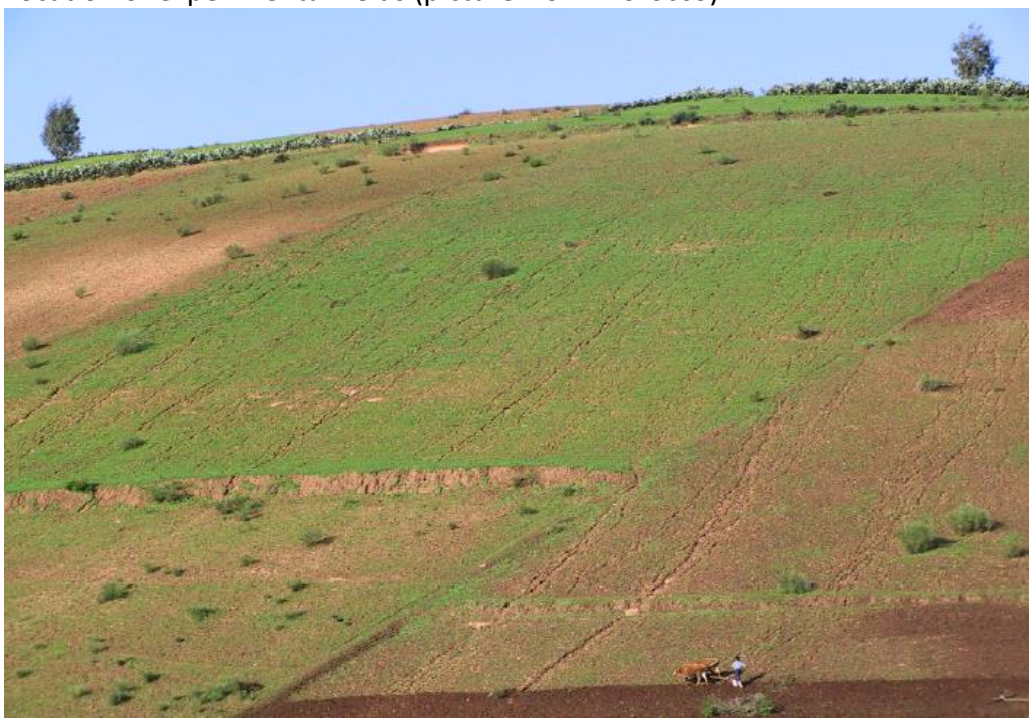
Soil information (type, texture, depth, fertility indication, mapunit): stony shallow soils (<50 cm), sandy loams with a loamy Bt horizon surfacing along the slope, fertility is low. The soil is prone to light crusting under heavy rainfall. There is no groundwater present.

Geological information (formation, lithology, mapunit): Pliocene and Miocene marls

Annual rainfall and seasonality information: 400-550 mm rainfall annually, single rainy season from October to March. Evaporation up to 1300 mm annually. Below 500 mm rainfall the risk of crop failure is high.

(provide one or more photos)

Location of experimental fields (picture from Morocco)



Heavy rill activity

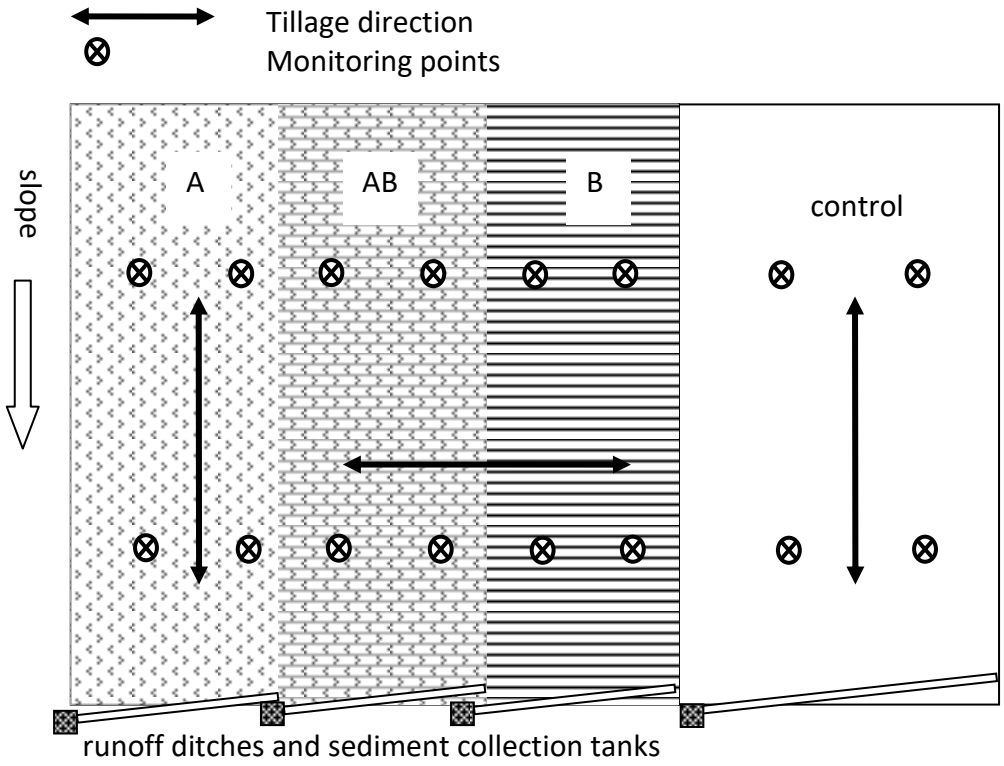
D

Stakeholder information

Landowner name: Mr/Mrs XXX

Level of input (e.g. mechanization): Low level of mechanization. Farmer has other activities, field is not his main source of income.

	Main activity on this location: arable farming Other stakeholders (if active at this location): none
E	**Land use** Crops (and rotation): single Barley or Wheat crop, fallow remaining part of the year. If insufficient rainfall for a harvest, crop is used s fodder/grazing. Crop calendar & tillage practices: tillage with animal traction in March, sowing after first rain. Weeding by hand. No pesticide application, Harvest manually normally beginning of July. Chemicals (fertilizer, pesticides) applied: once NPK after first rainfall, manure after harvest or when cattle grazes on failed crop Irrigation: none Natural vegetation, main types and species composition: n.a. Stocking density of animals: if stubble grazing: farmer owns 5-10 cattle
F	**Conservation measures and experimental setup** Experimental setup: 1 fields is split in three zones (see map). The left 1/3 is mulch only (A), middle 1/3 is mulch and contour ploughing (AB), the right 1/3 is contour ploughing only (B) The treatment applies mulch once after sowing, type of mulch is straw with a density of X kg/m^2. 2nd field is reference field. At the bottom of each treatment a small ditch is dug that leads to a sediment trap, consisting of a dug-out storage tank lined with metal plates. WOCAT reference conservation measure (Qt reference): WOCAT reference implementation approach (Qa reference): Expected effects: mulch will reduce evaporation and conserve soil moisture. I will also provide resistance to runoff and protection against splash erosion. When incorporated in the soil it will improve soil structure. Runoff will be interrupted by contour ploughing.



G

Monitoring activities

0) Meteorology

Meteo measurements by a rainfall station at X km. Rainfall intensity is recorded by a tipping bucket, hourly meteo-variables for Penman Evapotranspiration (wind radiation, pressure, rel. humidity and temperature).

1) One time measurements:

a. Soil parameters at measurement points: texture and stoniness , organic matter, saturated hydraulic conductivity, porosity, depth. Ksat, porosity and bulk density are measured with 100CC sample rings

2) Repeated visual monitoring supported by digital photography (2 weekly):

b. Regular soil surface assessment (crusting/surface structure, roughness, see monitoring manual chapter 6)
c. Crop characteristics: height (m), cover fraction
d. mulch cover fraction, digital analysis using 1m^2 frames at sample locations
e. Erosion features (rill density and dimensions)
f. STAKEHOLDER local indicators observations (see example questionnaire)

3) Repeated measurements (2 weekly/ monthly):

g. Soil moisture with portable TDR probe (0-10 cm depth), 10-12h morning, average of 5 measurements per sample location. Frequency weekly (if possible more frequently) and after rainfall
h. Soil organic matter (in laboratory by ignition loss)
i. Soil strength of moist soil (shear vane, in kPa)

	j. Surface roughness (max difference microrelief in cm) k. Steady state infiltration rate, using double ring infiltrometer (mm/h) l. Empty sediment tanks and estimate volume at regular intervals, if possible after each rainfall. Checked every week for activity. Volume is estimated and 5 samples of 100CC are taken for dry weight analysis, each time the sediment tank is emptied 4) Agronomical activities by stakeholder: m. Dates and type of tillage: ploughing, sowing, weeding, harvest n. Application of chemicals/fertilizer etc o. Animal practices (stocking density) p. Other input (fuel, labour, time) 5) Yield assessment: q. Total yield in kg/ha r. General yield quality or herd/grazing quality assessment s. General impression by stakeholder (advantages/disadvantages) t. Comparative assessment with regular practice
H	**Timetable** See next page
I	**Analysis** <u>Bio physical</u> ▪ Results comprise soil moisture series upslope and downslope, and between the 3 treatments and he reference field (2x4 series). Repetitions are averaged. ▪ Hydrus 1D or other 1D water balance software will be calibrated and used to predict other situations. ▪ Sediment storage is compared. LISEM is used to simulate soil erosion and calibrated on sediment totals in storage tanks. <u>Socio-economical</u> ▪ Cost-benefit analysis (see chapter 3 of monitoring manual) ▪ inventorize need for subsidies or external funds to continue practice ▪ inventorize need for other forms of assistance to continue practice ▪ Inventorize direct and indirect benefits ▪ Overall quality assessment of stakeholder

G) Local indicator questionnaire

These criteria are taken from the list of local indictors in WB3. They are very qualitative but are factors that the stakeholders observe. We should use these to complement our observations and measurements. Note however that the classes 'none', 'moderate' and strong' have to be supported by photographs and a short description so that at least some reference is available.

	none moderate strong	remarks
Degradation		
Loss of soil colour, white spots		
Soil crusting and compaction		
Loss in crop quality		
Drought stress in soils and crops		
Poor vegetation cover		
Slow growth of plants		
Early withering of plants		
Poor seed germination		
Frequent dust in the air		
Improvement		
Easiness of soil ploughing		
rapid crop emergence		
rapid growth		
Good quality		
moist soils		

H) Time table of activities

Use the growing season or wet season applicable to your site. Ere the period October to April is shown, but it may be different according to your local climate. This table indicates in which weeks a specific measurement or monitoring activity takes place.

		Oct				Nov				Dec				Jan				Feb				Mar				Apr			
	Activity	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 one time	a	x																											
2 visual monitoring	b	x		x		x		x		x		x		x		x		x				x				x			
	c	x		x		x	x	x	x	x	x	x	x	x		x		x		x		x		x		x			
	d	x		x		x		x		x		x		x		x		x		x		x		x		x			
	e	x		x		x		x		x				x				x				x				x			
	f	x		x		x		x		x				x				x				x				x			
3 measurements	g	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
	h	x				x				x				x				x				x				x			
	i	x				x				x				x				x				x				x			
	j	x				x				x				x				x				x				x			
	k	x				x				x				x				x				x				x			
	l	x		x		x		x		x		x		x		x		x		x		x		x		x			
4 agronomical activities	m n o p q	Depends on agricultural activities and management																											
5 yield assessment	r																									x			
	s																									x			
	t																									x			
	u																									x			