Practical guide for Land Degradation Monitoring

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Somalia Water and Land Information Management

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Introduction

This practical guide for land degradation monitoring will provide tools that can be used to facilitate a simple and systematic approach to monitoring long-term changes in soil and rangeland conditions and will be the working document for future monitoring programmes. The simple monitoring methods presented in this guide will be used to periodically generate quantitative information from different representative sites of degraded land, land under degradation or sensitive degraded land within the country. The monitoring approach will enable information to be shared among all stakeholders involved in land resource management and will help national decision-makers and the donor communities to make sound land resource management decisions.

The aim of monitoring of land degradation is to identify regions of the country which are experiencing changing trends of land degradation so that they can be targeted for detailed analysis and subsequent appropriate control measures.

SWALIM phase IV has set out to establish a land degradation monitoring systems for Somalia, with focus on the three regions, Puntland, Somaliland and South Central Somalia. Beauty

What is monitoring?

Monitoring is the repeated observation of a system in order to detect signs of change. Monitoring can be used to quantify change, identify the causes of change and determine acceptable levels of change. Monitoring allows us to understand what kind of human induced factors affect the mangrove, whether people are benefiting from the current levels of management and how they perceive the ecosystem in question. Ecological monitoring allows us to form a picture of how the ecosystem is doing.

In order to carry out monitoring, we first need to establish a baseline (the situation, or point in time, from which we are measuring change.

Why do we monitor land degradation?

Land degradation is the major root cause of the declining agricultural and rangeland productivity in Somalia and if not controlled will lead to deterioration of food security in the country. Although information details on the extent of the land degradation in Somalia remains incomplete, it was reported by SWALIM in 2009 that 22% of the country is strongly degraded and 31% is moderately degraded and the rest is lightly or none affected. This issue is very important for Somalia in light to the increasing affected land space, vulnerability of the effects of natural and man-made hazards and heavy dependence of the population livelihood on the natural resources.

Who will monitor land degradation?

The land degradation monitoring exercise will be conducted jointly by teams of Somali professionals from the line ministries of Somaliland and Puntland and South Central Somalia (if it will be feasible) and SWALIM liaison office with the support of the SWALIM Nairobi office. The data collecting teams from the line ministries shall be professionals with basic knowledge in ecology, soil science, environment or related fields (preferably a diploma, Bsc. or Msc. degree).

The types of land degradation to monitor

The kind of land degradation to monitor include areas in Somalia where SWALIM has identified and mapped in the past as given in the reports (L-10 and L-14). The prevalent land degradation types are loss of topsoil by water and wind erosion, soil compaction and crusting (Physical degradation), reduction of vegetation cover (Biological degradation), aridification, decline of soil fertility in agricultural potential areas and salinization (Chemical degradation) and decline of palatable plant species and increase of invasive exotic plant species.

Where to monitor?

Monitoring sites are located in different parts of the country where the original land has decreased in value and productivity due to results of different types of degradation. The degradation monitoring in the field should target degraded land, land under degradation or sensitive degraded land (or hot spots) of selected areas. SWALIM has mapped and listed the geographic coordinates of 159 sampling sites within the selected representative areas (see report N^0 L-14, L-18 and L-19).

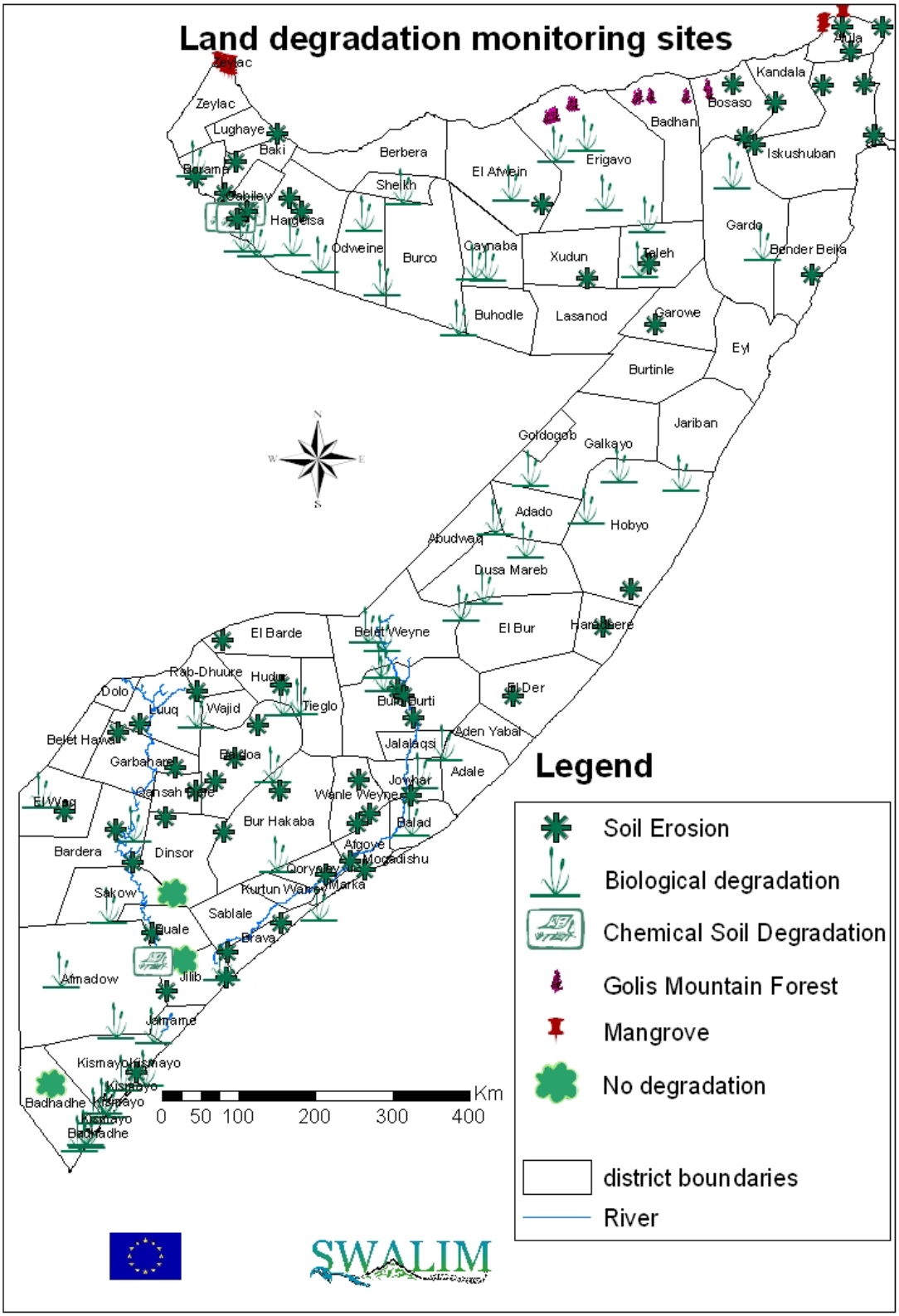

Figure 1: The land degradation sites in Somalia

Periodicity of monitoring in the sites

This guide proposes an initial annual monitoring in the sites for the first three years.

Data collection shall be done after the rainy seasons (April to May in Gu season and Oct to Nov in Deyr season) and should be repeated the same periods every year. This time of year is appropriate for identifying and observing signs of plant degradation and soil erosion. Data collection shall proceed even if the rains fail. However, the semi-structured questionnaire will be repeated every 5 years.

Field monitoring planning

The field monitoring plan entails collecting land degradation data in the same way in the future, using the same methods at the same sites and the same time of year. The land degradation field monitoring must be planned carefully and the monitoring activity must be in line with the set objectives stated in the SWALIM report L-14. The monitoring sites must be accessible given the roads and the vehicle that shall be used.

Methods for land degradation monitoring

SWALIM has put together methods for monitoring land degradation in Somaliland at both national and local level (Report N^0 L-10, L-14, L-18 and L-19). These methods can easily be repeated periodically to provide opportunity for monitoring land degradation. These methods include the following:

1. Land degradation assessment by LADA-WOCAT method which involved the initial development of a land use systems (LUS) map. The LUS map provided the reference units for assessment. The subsequent steps involved validation of the map, expert assessment of land degradation using questionnaires, and the final development of a land degradation map from the expert assessment
2. Land degradation assessment using remote sensing: this method involved remote sensing image (mainly Normalized Difference Vegetation Index, NDVI) analysis.
3. Field measurements of land degradation specifically soil erosion by measuring loss of topsoil, soil sampling for chemical analysis, measuring gully and rill severity and recording loss of vegetation.
4. Field measurements on vegetation density and frequency of occurrence

The field measurements will focus on selected indicators of land degradation. These indicators fall under different types of land degradation and include the following:

1. **Soil erosion :** focus will be on the two types of soil erosion, erosion by water and wind with the indicators to measure including a) increase in gully and rill size (width, length, depth)

2. b) increase of bank erosion (width), c) nutrient deficient and salt affected soils (such as N,P,K, texture, compaction, crusting, pH and EC etc.), d) signs of bare ground (total area)
3. **vegetation loss:** The important indicators for measuring vegetation loss are amount of bare ground , plant (herbaceous and woody) cover, tree/shrub density, plant height; cover and density of invasive species

Appendix 1 shows the list of the selected monitoring sites, the names of their respective regions, districts, the types of land degradation to monitor in those sites and their coordinates.

Time required for field monitoring

The time required for a field monitoring survey activity will depend on the following:

- The amount of the monitoring sites to visit
- The distance between the different monitoring sites
- The accessibility of the roads in each region and their networks
- When the field monitoring sites are close to one another, the time required to travel from one place to another will be short. It is therefore important to that the selection of the sites to monitor should be carefully done to avoid wate of time.

Finding the monitoring sites in the field:

The GPS shall be used to find the monitoring sites. The GPS will be very useful in navigation to the point. A printout of the map with the monitoring sites will also be used to aid in the field survey planning. The map will also have settlement points and their names to assist in easy access of the monitoring sites.

Monitoring site data collection

Once you reach the monitoring site you will conduct the following activities:

1) Use the GPS to obtain the x and y coordinates of the monitoring site. Record in the data sheet the x and y coordinates.
2) Find the right position to have a clear overview of the area. This will help in facilitating clear description of the area.
3) Fill in the land cover data form to obtain a description of the area being monitored
4) Take four pictures as indicated in the land cover description data form

Monitoring methods for soil erosion

The field surveys will comprise of a rapid rural appraisal and field measurements in the monitoring sites that have been selected and provided in figure 1and appendix 1.

The primary indicator for assessing impacts on soil erosion is topsoil loss. In severe cases of soil erosion, you can see in the field roots of trees and shrubs exposure above the ground, tree mounds, amour layer, soil pedestals, build up of soil against field barriers (e.g. walls, plants); soil surface hardness as compaction and crusting formation. This is a visible evidence that the topsoil layer was affected to a certain extent or disappeared due to soil erosion. In other cases you can see rills or sheet erosion.

The details for measuring the soil loss and soil chemical and physical properties are given in the SWALIM Field Survey Manual Report N^{O} L-01 (pg 62-86)]. However, in case of soil chemical properties the soil samples will be taken to the laboratory for analysis.

Vegetation Monitoring

The vegetation parameters to be measured shall include those that are highlighted in SWALIM reports L-01, L-03, L-11, L-15, L-18 and L-19. Data collection shall be done after the rainy seasons (April to May in Gu season and Oct to Nov in Deyr season) and should be repeated the same periods every year.

The indicators under vegetation monitoring shall include:

1. Tree density
2. Species frequency
3. Tree height
4. Tree canopy cover
5. Herbaceous biomass

Questionnaires, to be repeated every 5 years, shall also be administered to give an indication on use and management of the vegetation. The questionnaires to use for these indicators are given in SWALIM reports L-18 and L-19.

Equipment/materials needed:

1. GPS ; 2. Slope meter (clinometer); 3. Campus; 4. Digital camera; 5. Soil augur; 6. Geological hammer; 8. Soil knife; 9. Munsell color chart; 10. Shovel; 11. Meter stick; 12. Soil test kit (for soil pH, EC, phosphorus, potassium and nitrogen); 13. Field forms; 14. Field bags; 15. Plastic folders; 16. Pens; 17. Pencils; 18. Erasers; 19. area map; 20 sleeping bags; 21. 50m string (10mx10m

quadrat); 22) Measuring tape (30-50m length); 23) Calculator (optional); 24) Field record book; 25) area map; 26) vehicle ; mangrove boots

Other essential items for the field work

You should make sure to have a good topographic map showing all the existing settlements and road networks, appropriate communication instruments (Satellite phone, VHF radio, and/or cell phone), water and food availability, first aid kit, try to know in advance where is the closest lodging sites for every day, sleeping stuff during the fieldwork activities.

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Appendices

Appendix 1: Land degradation monitoring sites in Somalia

S No.	X	Y	LD Type
1	323830	1258546	Mangrove
2	332178	1262882	Mangrove
3	314149	1267318	Mangrove
4	322855	1264855	Mangrove
5	318864	1264046	Mangrove
6	332560	1255260	Mangrove
7	330172	1256723	Mangrove
8	328705	1257364	Mangrove
9	1128747	1329923	Mangrove
10	1129300	1330161	Mangrove
11	1129399	1330561	Mangrove
12	1129671	1330943	Mangrove
13	1130637	1331492	Mangrove
14	1131110	1331050	Mangrove
15	1131426	1331369	Mangrove
16	1132082	1331318	Mangrove
17	1103511	1311288	Mangrove
18	1104331	1315141	Mangrove
19	1104639	1316530	Mangrove
20	1105071	1317442	Mangrove
21	1106105	1319212	Mangrove
22	747854	1192356	Golis Mountain Forest
23	749085	1190394	Golis Mountain Forest
24	750980	1193999	Golis Mountain Forest
25	785223	1216173	Golis Mountain Forest
26	781876	1215850	Golis Mountain Forest
27	789054	1215398	Golis Mountain Forest
28	755292	1195185	Golis Mountain Forest
29	754059	1193223	Golis Mountain Forest
30	933476	1221432	Golis Mountain Forest
31	930185	1220384	Golis Mountain Forest
32	926282	1219202	Golis Mountain Forest
33	924105	1217318	Golis Mountain Forest
34	880723	1217581	Golis Mountain Forest
35	878687	1219641	Golis Mountain Forest
36	875009	1221264	Golis Mountain Forest

37	876529	1218097	Golis Mountain Forest
38	1128840	1311890	Soil Erosion
39	1139355	1280904	Soil Erosion
40	1180941	1312279	Soil Erosion
41	1103096	1236177	Soil Erosion
42	1157795	1237125	Soil Erosion
43	1041361	1214222	Soil Erosion
44	391423	1172149	Soil Erosion
45	337698	1136883	Soil Erosion
46	985610	1237236	Soil Erosion
47	1002458	1167725	Soil Erosion
48	1169957	1171261	Soil Erosion
49	796582	1174694	Biological degradation
50	986210	1125500	Biological degradation
51	1026381	1031940	Biological degradation
52	737628	1080186	Soil Erosion
53	285753	1115340	Soil Erosion
54	556848	1104745	Biological degradation
55	697202	1109159	Biological degradation
56	407824	1088884	Soil Erosion
57	505801	1069597	Biological degradation
58	423283	1071995	Soil Erosion
59	323366	1094442	Soil Erosion
60	330457	1082553	Soil Erosion
61	347973	1064668	Soil Erosion
62	528959	986289	Biological degradation
63	796423	983685	Soil Erosion
64	365218	1035716	Biological degradation
65	412736	1038748	Biological degradation
66	877256	1002655	Soil Erosion
67	649664	1006733	Biological degradation
68	885473	924634	Soil Erosion
69	920356	730946	Biological degradation
70	815856	528337	Soil Erosion
71	838508	740828	Biological degradation
72	796093	687452	Biological degradation
73	723544	736962	Biological degradation
74	716526	642594	Biological degradation
75	676970	673107	Biological degradation
76	632944	561182	Biological degradation
77	662671	583341	Biological degradation

78	698643	438482	Soil Erosion
79	853533	578210	Soil Erosion
80	529849	521185	Biological degradation
81	549111	448578	Soil Erosion
82	319674	510895	Soil Erosion
83	510524	532579	Biological degradation
84	421768	439052	Biological degradation
85	528381	486670	Biological degradation
86	286845	420701	Biological degradation
87	287476	444518	Soil Erosion
88	395725	453415	Soil Erosion
89	531280	468278	Biological degradation
90	212770	402158	Soil Erosion
91	184027	390608	Soil Erosion
92	399355	436541	Biological degradation
93	258818	344616	Soil Erosion
94	610008	377478	Biological degradation
95	393430	232163	Biological degradation
96	366393	399783	Soil Erosion
97	311040	326793	Soil Erosion
98	114334	287958	Soil Erosion
99	579147	341565	Biological degradation
100	386004	350070	Biological degradation
101	454197	205481	Soil Erosion
102	83993	316163	Biological degradation
103	180902	263715	Soil Erosion
104	394684	315314	Soil Erosion
105	321734	260803	Soil Erosion
106	496593	271252	Soil Erosion
107	567824	280633	Biological degradation
108	203930	272223	Biological degradation
109	254742	181950	None
110	172256	165129	Biological degradation
111	325103	70008	Soil Erosion
112	505921	212021	Soil Erosion
113	446426	168816	Biological degradation
114	96642	-67382	None
115	319677	90468	Biological degradation
116	110264	81378	Biological degradation
117	231738	9215	Biological degradation
118	192159	-52561	Biological degradation

119	207303	-52853	Soil Erosion
120	220197	-46771	Biological degradation
121	165773	-83857	Biological degradation
122	172683	-88204	Biological degradation
123	155582	-96138	Biological degradation
124	141707	-124849	Biological degradation
125	143911	-128124	Biological degradation
126	136005	-133915	Biological degradation
127	182489	15024	Biological degradation
128	1089093	989024	Soil Erosion
129	496962	329170	Soil Erosion
130	267217	93801	None
131	231922	91716	Chemical Soil Degradation
132	351395	1071434	Chemical Soil Degradation
133	325150	1063468	Chemical Soil Degradation
134	339593	1061630	Chemical Soil Degradation
135	351395	1071434	Soil Erosion
136	339593	1061630	Soil Erosion
137	347513	1042092	Biological degradation
138	448129	1015134	Biological degradation
139	285724	1141500	Biological degradation
140	629583	932729	Biological degradation
141	865182	1009821	Biological degradation
142	668009	1004363	Biological degradation
143	875558	1067621	Biological degradation
144	820071	1097303	Biological degradation
145	756020	1160601	Biological degradation
146	1015400	1158300	Soil Erosion
147	568569	409530	Soil Erosion
148	556673	438526	Soil Erosion
149	336659	358153	Soil Erosion
150	245864	280252	Soil Erosion
151	285083	315173	Soil Erosion
152	566338	308788	Soil Erosion
153	512064	284252	Soil Erosion
154	396079	142246	Soil Erosion
155	486785	223286	Soil Erosion
156	326935	104328	Soil Erosion
157	202772	221428	Soil Erosion
158	247010	52655	Soil Erosion
159	228794	129235	Soil Erosion