A global initiative to combat desertification

July 2010

A publication from the DESIRE project - funded by the European Union's 6th Framework Program 'Global Change and Ecosystems'

Info-brief 4

Progress with monitoring the field experiments

All the chosen strategies are being implemented and monitored

At all the DESIRE study sites scientists have consulted with local stakeholders to choose and implement strategies to mitigate land degradation and desertification.

Standard questionnaires from WOCAT (World Overview of Conservation Approaches and Technologies) were used to evaluate, share and document the strategies. Then some were selected for further investigation using the WOCAT decision support tool. This "learning for sustainability" process helps to ensure that the measures selected will be successful. Successful strategies will have to satisfy evaluation criteria of ecological sustainability set by scientists, such as significantly decreased rates of soil erosion, but also be attractive and cost-effective for long term land use.

Scientists and stakeholders are currently busy monitoring the effects of the chosen strategies. In all study sites there are interesting stories emerging, and in the following pages some preliminary results are described.

Each page is from a DESIRE study site partner:

University of Aveiro, Portugal (Mação site); Democritus University of Thrace, Greece (Nestos river basin); University of Botswana (Boteti site); L'Institut de recherche pour le développement (IRD), France (Cointzio site, Mexico); Instituto de Investigaciones Agropecurarias (INIA), Chile (Secano interior)

Edited by Nichola Geeson, July 2010

For more information and contact details see:

• The DESIRE Harmonised Information System: www.desire-his.eu and DESIRE website: www.desire-project.eu

The DESIRE project (2007-2011) is funded by the European Commission, VI Framework Program, 'Global Change and Ecosystems' and brings together the expertise of 26 international research institutes and non-governmental organisations (NGOs). This project is implemented by ALTERRA - research institute for the green living environment in the Netherlands.

Contact DESIRE coordinator: Coen.Ritsema@wur.nl
Contact DESIRE Communications: ngproject3@googlemail.com

SIXTH FRAMEWORK PROGRAMME

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ALTERRA WAGENINGEN UR

MAÇÃO, PORTUGAL – reducing the burned area

University of Aveiro

CESAM Centre for Environmental and Marine Studies

Installation of the meteorological station

Overview of the meteorological station in the watchtower

Flume in the Caratão catchment

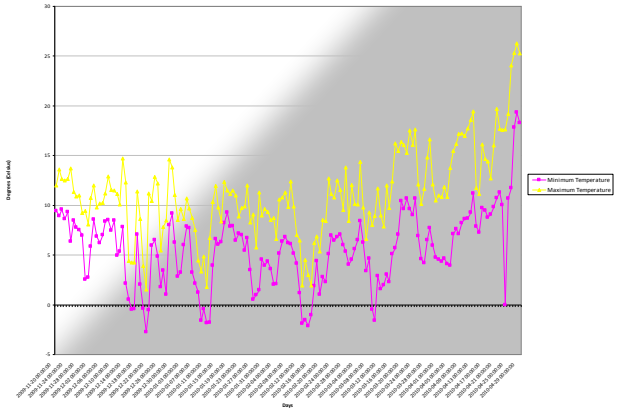
In this area drought has been compounded by catastrophic fires, resulting in soil loss and land degradation. Preventive forestry techniques are being implemented, (e.g. the Primary Strip Network System), and monitored.

In July 2009 the flume in the Caratão catchment was improved and reinforced, to enable better monitoring when rain falls and flow occurs.

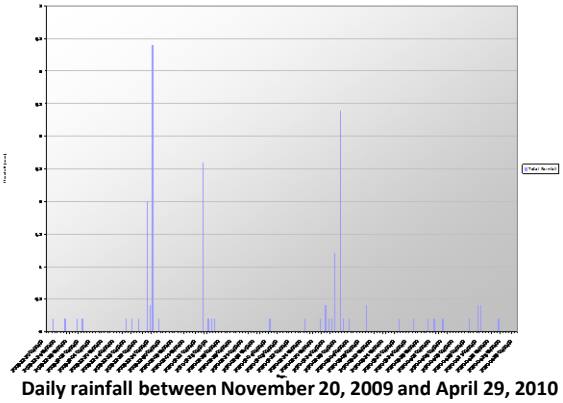
Installation of the meteorological station in the Serra dos Bandos, November 2009

The UAvr team has hired two technicians to install the meteorological station on top of the watch tower, in the Serra dos Bandos, which is located about 5 km from the Caratão catchment.

This station will continuously monitor the following parameters: temperature, rainfall, relative humidity and radiation. A sensor for wind speed will be installed later.



Minimum and maximum temperatures between November 20, 2009 and April 29, 2010



Daily rainfall between November 20, 2009 and April 29, 2010

Rainfall simulations in the Primary Strip Network System for Fuel Management, June and July 2010

The UAvr team is carrying out rainfall simulation experiments to measure the runoff (infiltration capacity and soil moisture), sediment loss and nutrient loss in the Primary Strip Network System for Fuel Management. This System helps to limit the availability of fuel, so that fires can be contained.

The rainfall simulations will be conducted for different land uses (shrubland and forest: eucalyptus and *Pinus pinaster*) and with different slope angles.

Rainfall simulation event (land use: shrubland)

Rainfall simulation plot (land use: *Pinus pinaster* forest)

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THE NESTOS RIVER DELTA, GREECE
– addressing soil salinization

Democritus
University of
Thrace, Greece

At this study site, in the eastern part of Nestos River delta, using saline groundwater for irrigation purposes has resulted in significant damage to soil properties, and loss of crop production. Aiming to combat desertification and increase crop production, the effects of using surface freshwater instead of saline groundwater for irrigation purposes are being quantified and compared.

Two fields with the same crop and the same soil properties, cultivated by the same farmer, are being studied in detail. This study analyses the chemistry of soil samples and soil water, and the surface water and groundwater used for irrigation. It is evident that the chemistry of the groundwater has become unacceptable for irrigation. Furthermore, the data show that the aquifer from which the groundwater has been drawn for many years is undergoing active seawater intrusion, increasing its salinity.

Soil sampling was performed four times during the past year. During each sampling campaign, a total number of nine samples were obtained from six soil layers. After a standard pre-treatment, soil moisture content and dry bulk density were calculated. From the derived data, it is evident that the soil irrigated with freshwater had low concentrations of soluble salts during the whole cultivation period. On the other hand, irrigation with groundwater results in salt accumulation up to a depth of 70cm, especially during the second half of the production season.

It is clear that only irrigation with non-saline surface water will allow continued sustainable agricultural production, but this depends on a viable and economical source of freshwater, that is currently imported by canal.

Testing soil samples in the laboratory

BOTETI, BOTSWANA – biogas production form cattle dung helps to avoid degradation

UNIVERSITY OF BOTSWANA

The demand and availability of brushwood has become a problem. This adds to land degradation as pastoral farmers also overstock their rangelands. Therefore scientists and stakeholders decided to see if production of biogas from cattle dung would be a sustainable and economical alternative. First results suggest that this idea will work well.

Mopane (*Colophospermum mopane)* woodland: DESIRE scientist taking biomass measurements, July 2009

Where the loss of vegetation cover leaves the dry soil uncovered, whirl-winds (**1**) and dust storms (**2)** will become more common and severe, and Boteti will become more degraded and inhospitable for the population (July 2009).

In preparation for the construction of a pilot biogas plant in Boteti, DESIRE scientists have collected baseline data on household energy consumption, woody biomass measurements, and cattle dung estimates (to establish the adequacy of feedstock for sustainable biogas production), and also studied the available literature. This new information highlights the current situation of the decreasing stock of dead tree biomass for firewood within collection zones. The land users have chosen biogas production as an alternative energy source, before the live trees, (which are now more accessible through increasing use of motor vehicles), are also cut for firewood. This choice will therefore answer a basic human welfare need, while also conserving an important carbon sink, and an anti-wind erosion and anti-aerosol pollution resource.

DESIRE scientists have established there is enough cattle dung for biogas production in Boteti

COINTZIO WATERSHED, MEXICO – combating soil erosion

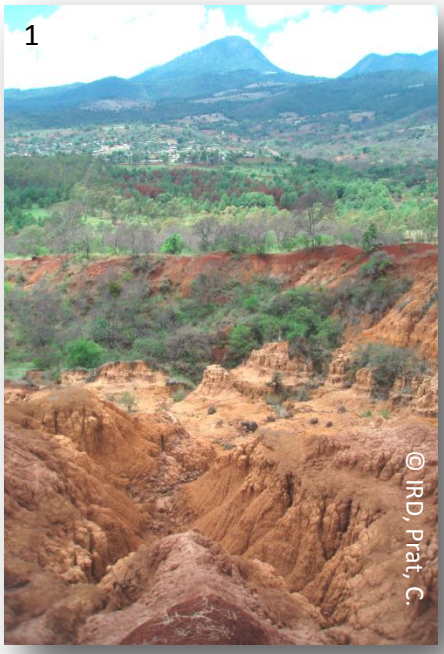
L'Institut de recherche pour le développement (IRD), France

The Cointzio watershed in Michoacán state, Mexico, has a temperate semi-humid climate with a 6 month rainy season. The landscape can be divided into three parts: a plain with irrigated highly mechanized agriculture; red iron-rich clay soils and fragile loamy soils with low mechanisation and subsistence farming on the hills; and forest at altitudes above ±2300 m. The usual system on the plain is for corn production one year, followed by fallow the next year, although it is possible to grow crops every year. Cattle are kept on the fallow and also on the common land.

DESIRE experiments involving stakeholders show that from 130 rain events in a year only 6 to 12 events resulted in soil erosion. On the most fragile soils barley production as fodder is better than corn, and the traditional association of corn/beans/zucchini is the best protection system.

Soil erosion measured on plots varied between 1 to 5 t ha^{-1} y^{-1} which is quite low. However, runoff can be extremely high during fallow seasons (over 80%) and may result in severe gully erosion on slopes. To reduce soil erosion and runoff, it is necessary to have crop residues covering at least 30% of the surface to reduce the runoff to < 10% of the rainfall amount.

The other main cause of land degradation is soil compaction, due to both soil properties and the weight of the cattle. It is therefore essential to limit the numbers of grazing animals and control the feeding areas. All these actions address the sustainability goals of the DESIRE Project.



1.Potrerillos , showing soil and gully erosion, 2008
2. Tensiometers measured soil water at different depths, just before harvest, La Cortina, December 2009
3. Field plots, Huertitas, 2007
4. Ploughing with horses, La Cortina, 2007

SECANO INTERIOR, CHILE - reducing erosion by water

Instituto de Investigaciones Agropecurarias (INIA), Chile

Cauquenes : infiltration trenches, January 2008

Cauquenes : banks with subsoiling, January 2008

Infiltration trenches, June 2008

The experimental sites are located in the Mediterranean zone of central Chile, a dryland area characterized by highly degraded soils, which require the use of conservation tillage systems to mitigate water erosion, as well as to improve infiltration and water storage. The first experiments were implemented in 2007, studying the mitigation of water erosion with an oat-wheat rotation (15% slopes) under different conservation systems: NO TILLAGE (NT), NT+subsoiling, NT+barrier hedges, NT+contour ploughing and conventional tillage. The second experiment was established in an agroforestry system (slopes <30%) and the conservation techniques are: banks with subsoiling, infiltration trenches and a control treatment without conservation structure.

This region has an average annual precipitation of 695 mm, concentrated in the midwinter months (80%) with five months of drought. During the study period the precipitation was very variable in distribution and intensity (372, 768, and 536 mm for 2007, 2008 and 2009, respectively). The preliminary results showed that in the first experiment, the intensity of precipitation during 2008 before sowing produced high runoff, especially under conventional tillage (70%) compared to NT systems (20-30%). In these compacted soils, NT+subsoiling increased the yield especially in the first year, but after three years, it lost the effect. However, it helped water to accumulate to greater depth in the soil profile. NT+subsoiling showed lower water content than conventional tillage, NT+contour ploughing, NT+barrier hedges and NT, at between 10 to 50 cm depth, but higher water content than the conventional tillage for 70 to 110 cm. However, in a wet year (2008) at the end of the growing season, soil moisture (at a depth of 10-110 cm) was reduced by 44% to 51% in conservation systems while in the conventional system the reduction was 60%.

Cauquenes sediment tanks, August 2007

Cauquenes : contour ploughing, October 2007