Global Change and Terrestrial Ecosystems

Report No. 6

GCTE Focus 3 Erosion Network:

Model, Experimental and Monitoring Metadata

GCTE: A Core Project of the International Geosphere-Biospere Programme (IGBP)

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Prepared and published by the GCTE Focus 3 Office

Wallingford, UK, 1997

Contents

Global Change and Terrestrial Ecosystems .... **vi**

The GCTE Erosion Network .... **vii**

SECTION I Model Metadata **1**

ACRU - Agrohydrological Modelling System **1**

APEX - Water and Wind Erosion **7**

AUSGUL - Water Erosion **13**

CSEP - Water Erosion **18**

EPIC - Water and Wind Erosion **22**

EUROSEM - Water Erosion **29**

LISEM - Water Erosion **33**

MEDALUS - Water Erosion **38**

MEDRUSH - Water Erosion **44**

NORGUL - Water and Thermoerosion **49**

WEPP - Water and Wind Erosion **53**

SECTION II Experimental Metadata **59**

Soil Detachment, St Anne, Martinique **51**

Splash and Run-off, Roujon, Heuralt, France **53**

Run-off and Sediment Load, Sudanese Zone, North Cameroon **56**

Rill and Interrill Water Erosion in Relation to Land Use, Murcia, Spain **59**

Field Scale Sediment Budget, Leuven, Belgium **63**

Soil Aggregation, Benidorm, Spain; Catchment Studies, Luxembourg **67**

Soil Surface Dynamics in Relation to Land Use, Attica, Greece **69**

Soil Surface Dynamics Under Simulated Rainfall, Normandy, France **71**

Mult- scale, Multi-process, Kwazulu - Natal, South Africa 75

Tillage Erosion, Masvingo and Harare, Zimbabwe 79

Rainfall Simulations and Soil Surface Degradation, Arizona and New Mexico, USA 82

Gully Erosion, Leuven, Belgium and Almeria, Spain 87

Run-off and Soil Loss Experiment, Seven South East Asian Sites 91

Soil Resistance Dynamics Under Simulated Rainfall, Tuscany, Italy 93

Rill Erosion, Alberta, Canada 96

Storm Run-off, Los Alomos, New Mexico, USA 99

SECTION III Monitoring Metadata 101

Fortuna Basin, Se Spain, 1988 -, Torriorthent and Xerorthent, Water Erosion 97

South Downs, UK, 1982-91, Rendzina, Arable/Grazing, Water Erosion 103

Orcia River Valley, Italy, 1990-94, "Bad-Lands" Erosion Features, Water Erosion 106

South Limburg, The Netherlands, 1988-93, Loess, Arable/Grazing, Water Erosion 109

Various Sites in England and Wales, UK, 1982-87, Arable Landscape, Various Soils, Water Erosion 112

Kaluga Region, Russia, 1982-95, Dernovo-Podzol Soils, Arable/Grazing, Water Erosion 116

Central Belgium, 1981-85, Silty Loamy Soils, Arable, Water Erosion 119

Western Lithuania, 1982-2000, Soddy-Podzolic, Arable, Water Erosion 122

Western Lithuania, 1994-2007, Loamy, Sandy, and Clay Soils, Water Erosion 125

Attica Greece, 1991-95, Xerochrepts, Water Erosion 128

Mgeri Basin, South Africa, 1990-, Sub-Tropical Savanna, Pine Plantations, Sugar Cane and Farm Land, Water Erosion 130

Fort Reno, Oklahoma, 1977-94, Formerly Native Grassland, Sub-Humid, Water Erosion 134

Leuven, Central Belgium, 1982-94, Loess/Loam Belt, Intensively Cropped, Water Erosion 136

Harpenden, Herts, UK, 1988-, Loamy Sand, Arable, Water Erosion 139

Leuven, Central Belgium, 1989-94, Loess/Loam Belt, Intensively Cropped, Water Erosion 141

Xingguo County, Jiangxi Province, Red and Purple Soil, Barren Land, Water Erosion 144

SECTION IV Annexes .... **I**

Annex I GCTE Erosion Network: Formal Membership, 1997 .... **I**

Annex II The GCTE Erosion Network: A Contribution to GCTE Core Research .... **IV**

Annex III Applying to Join the GCTE Erosion Network .... **VI**

Annex IV GCTE Data and Model Sharing Policy .... **VII**

Annex V GCTE Report Series .... **VIII**

GLOBAL CHANGE AND TERRESTRIAL ECOSYSTEMS

A Core Project of the International Geosphere-Biosphere Programme

Global Change and Terrestrial Ecosystems (GCTE) is one of the eight Core Projects of the International Geosphere-Biosphere Programme (IGBP). GCTE's has twin objectives:

> To predict the effects of changes in climate, atmospheric composition and land-use on terrestrial ecosystems, including (a) agriculture, forestry and soils, and (b) ecological complexity.
>
> To determine how these effects can lead to feedback to the physical climate systems.

To address these objectives, GCTE is structured as four major themes or *Foci*; the work plan for each is published in the GCTE Operational Plan (IGBP Report No. 21, Stockholm, 1992), copies of which are available from the GCTE Core Project or Focus 3 Offices (see below). GCTE Focus 3 is devoted to the study of global change impact on agriculture, managed forests and soils, while Foci 1, 2 and 4 deal with ecosystem physiology, change in ecosystem structure, and global change and ecological complexity, respectively.

GCTE Focus 3: Global Change Impact on Agriculture, Forestry and Soils

GCTE Focus 3 is devoted to studying how global change will effect managed ecosystems, and in particular the effects on yield. The Focus, led by Prof. Peter Gregory, comprises five interrelated subject areas, or *Activities*, dealing with (i) major monocrops, pastures and rangelands, (ii) managed forests (iii) multi-species agroecosystems; and the cross-cutting issues of (iv) pests, diseases and weeds, and (v) soils. Each Activity encompasses several *Tasks*, designed to achieve the Focus' objectives; a full description of the Activities and Tasks is given in the Operational Plan.

Copies of the GCTE Operational Plan, and further details about GCTE in general, may be obtained from:

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For further details about GCTE Focus 3, please contact:

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The GCTE Erosion Network

GCTE's operational definition of "global change" encompasses far more than just changes in climate and atmospheric composition. It also includes change in land use, as driven by demographic, economic, technological, and social pressures. Over the next few decades this human dimension of global change will have the most profound influence on the fate of terrestrial ecosystems; one aspect intimately associated with this change in land use (but also linked to the other changes discussed above) is soil erosion and it poses a major threat for sustainable land management.

Soil erosion is a very widespread phenomenon, and is usually irreversible. Once the nutrient-rich surface soil has been lost, the ability to sustain plant growth is severely reduced, and increased runoff from the more impermeable subsoils results in reduced plant-available water. Furthermore, erosion brings various associated "off-site" problems, including reduced water quality from increased sediment loads and poorer air quality due to dust.

It has long been known that both water and wind erosion are commonly accelerated by degrading vegetation cover, presently the main manifestation of global change; given a relatively stable set of conditions many successful strategies have been developed for combating erosion. Global change will, however, bring added problems, as it encompasses more than just change in land-use; change in atmospheric composition and, more particularly, change in climate will further stress many systems. The severity, frequency and extent of erosion will certainly be altered by changes in rainfall amount and intensity, and by changes in wind. Global change will thus amplify many current problems, but as certain soil thresholds are exceeded, potentially new and different problems could arise. It will therefore be crucial to understand the potential impacts of global change on soils to allow the predictive capability necessary to improve their management in the future to be developed. The "GCTE Soil Erosion Network" (one of the key components of the soils research agenda of the Global Change and Terrestrial Ecosystems Core Project of the International Geosphere-Biosphere Programme), is dedicated to this goal.

One of the unique features of GCTE is that it has set an internationally agreed research agenda (the GCTE Operational Plan, see above) to investigate the interactive effects of changes in the global change drivers. To achieve its aims, this research will require collaboration between research teams, between nations and between disciplines. The GCTE Soil Erosion Network is designed to provide the international coordination and linkages necessary to achieve the Network's objectives.

Network Objectives

To design and undertake experimental and monitoring programmes to provide a predictive understanding of the impacts of changes in climate and land-use on soil erosion.

To refine and adapt current erosion models for use in global change studies from plot to regional scales.

Network Research Themes

The GCTE Soil Erosion Network is being developed around three closely interrelated themes:

(i) Erosion monitoring

Since erosion processes commonly only start beyond a certain threshold set of conditions, emphasis will be put on the determination of such thresholds, on reversibility of processes, and on soil resilience. Infrequent climatic events, such as heavy storms, typhoons, etc. can trigger severe erosion, that would be unpredictable from short-term records. Long-term erosion monitoring is therefore essential to observe possible transient and non-equilibrium responses to climatic and land use changes. For inclusion in the Network monitoring studies must

(ii) Experimentation

Despite the numerous current and past soil erosion experiments, many uncertainties about the mechanisms involved remain. Furthermore, as many experiments are very site-specific, extrapolation of results is difficult. These uncertainties must be resolved by detailed experimentation to gain the understanding required to allow models to be developed that are both highly sensitive to global change and sufficiently flexible to be relevant under the largest range of conditions.

Past experiments have often been at the "run-off" plot scale, using land cover and tillage as experimental variables. These variables are of course key determinants of erosion rate, and the Network will build on the valuable base-line data and understanding gained from such experiments. However, GCTE is interested in the interaction of global change driving forces. The Network will therefore also examine the impact of changed variance and mean for key climate parameters and the effects of elevated CO_2, via their direct and indirect impact on aggregation and aggregate stability.

(iii) Modelling

Erosion processes are both varied and complex, and several modelling approaches have been developed for a range of temporal and spatial scales, for erosion by both water and by wind. These, and other, approaches need to be systematically validated across environmental space to determine which are most robust for global change studies. The broad range of data covering the space-time domain flowing from the many monitoring and experimental programmes worldwide will be used to calibrate, initialize and validate soil erosion simulation models; this will be one of the primary objectives of the network.

(These three aspects of the Network are discussed in detail in a series of papers related to the GCTE Soil Erosion Network published in a special issue of the *Journal of Soil and Water Conservation,* **51**, 1996.)

Details about how to join the GCTE Erosion Network are given in Annex III.

Purpose and Structure of this Report

The Report lists the metadata (descriptions) of those projects that are formally accepted in the GCTE Soil Erosion Network at the time of printing (further studies are very much welcomed - see Annex III). Its aim is to promote collaboration by publicising and detailing work suitable for global change studies; it allows researchers to identify suitable work for bi- and multi-lateral collaborative studies.

The Report is structured in four sections: Models; Experiments; Monitoring Studies; and Annexes. Models appear in alphabetical order according to model name, and experiments and monitoring studies according to contact name.

For further details about the GCTE Erosion Network, please contact:

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SECTION I

Model Metadata

1. Model identification

1.1	Model name	ACRU Agrohydrological Modelling System
1.2	Most recent version	ACRU 3.0
1.3	Date of release	February 1995.

2. Water erosion

3. Contact person

3.1	Name	Simon A Lorentz
3.2	Address	Dept Agricultural Engineering, University of Natal, Box X01, Scottsville, South Africa
3.3	Tel	+27 331 2605701
3.4	Fax	+27 331 2605818
3.5	Email	lorentz@aqua.ccwr.ac.za

4. Model Author(s) Professor Roland Schulze, Hydrology
Dr Simon Lorentz (*et al*) Sediment Yield.

5. Model components

5.1	Water erosion:	Modified universal soil loss equation with RUSLE parameters. K factor moisture content dependant. GIS based evaluation of parameters.
5.2	Wind erosion:	None
5.3	Hydrology:	Daily soil water budget. SCS with updated soil water redistribution.
5.4	Site/topography:	Latitude and longitude. Slope
5.5	Plant growth:	Maize model.
5.6	Management:	Simulates surface roughness.
5.7	Soil:	Mode 1 ® A and B horizon Mode 2 ® 20 user defined layers.
5.8	Chemistry:	P and E-Coli considered.
5.9	Weather:	Daily weather data.

6. Model characteristics

6.1	Spatial	
6.1.1	Class of area:	Catchment: Mode 1. Point or Field: Mode 2
6.1.2	Flow routing system:	Muskingum routing between sub-catchments.
6.1.3	Minimum area:	Point.
6.1.4	Maximum area:	Not advised for > 50 km^2.
6.2.	Temporal	-
6.2.1	Timestep:	Mode 1: Daily. Mode 2: Break point or 1 minute.
6.2.2	Single or multiple event?	Multiple.
6.2.3	Maximum simulation duration:	
		System limitation is 150 years (daily).

7 Model's representation of processes

7.1	Water erosion processes	
7.1.1	Interrill:	Lumped with rill using. RUSLE
7.1.2	Rill:	Lumped
7.1.3	Gully:	Not modelled separately. Subject of current study
7.1.4	Streambank:	-
7.1.5	Deposition:	Only in terms of RUSLE LS factor.
7.2	Wind erosion processes:	-
7.2.1	Creep/surface roll:	None
7.2.2	Saltation:	-
7.2.3	Suspension:	-
7.3	Hydrological processes:	-

7.3.1	Evaporation/transpiration:	Selection of: Expert system. A - pan, Penman, Margreaves, Limacre, Blaney-Criddle,Thoruthwaite.
7.3.2	Runoff:	Mode 1. Daily water budget. SCS with updated soil water content and redistribution. Mode 2. Excess from Green - Ampt.
7.3.3	Infiltration:	Mode 1. Difference between effective rain and runoff. Unsaturated redistribution. Mode 2. Green - Ampt and Richards equ. redistribution.
7.3.4	Subsurface flow:	Mode 1. Cascading layers with user define response parameters. Mode 2. Richards equ with constant head boundary.
7.3.5	Return flow:	Mode 1. User defined response rate.
7.4	Plant processes:	
7.4.1	Light interception and photosynthesis:	Through crop coefficient. Leaf area index and degree day.
7.4.2	Dry matter and residue:	Specified in RUSLE C factor.
7.4.3	Root growth:	Specified in RUSLE C factor. Growth in irrigation routine.
7.4.4	Pests:	None
7.4.5	CO_2 sensitivity:	Through sensitivity of transpiration suppression. Select C3 or C4 plant.
7.5	Soil:	Mode 1. A and B horizon + baseflow response - cascading layers. Mode 2. 20 layers retention + hydraulic characteristics green - ampt and Richards equ.
7.5.1	Crust development:	Mode 2: Exponential equ.
7.5.2	Aggregate properties:	Used in specification option for defining hydraulic properties. Used in specifying RUSLE K factor in

sediment yield.

7.6	Chemistry:	
7.6.1	Nutrients:	In irrigation option. Nitrate and phosphorus in water quality option.
7.6.2	Carbon:	None
7.6.3	Pesticides:	None
7.6.4	Other contaminants:	Phosphorus and e-coli.
7.7	Weather:	On-line real time mode is planned.

8. Input Data (* = Mandatory)

8.1 Weather: Daily precipitation*, Max*, Min* temperature, Relative humidity, wind speed, a pan data, radiation.

8.2 Soil: Physical characteristics* of each layer - Texture, porosity, WP, FC - or soil form and series* mandatory or A-B horizon response, B-T horizon response - HC for each layer. Surface K* factor for sediment yield.

8.3 Hydrology: Coefficient of baseflow response*. Coefficient of quickflow response*. Impervious area*. Coefficient of initial abstraction*. Critical depth of soil from which stormflow takes place*

8.4 Plant cover: Crop coefficient* - Leaf area index*. C factor for sediment yield. Interception loss* - Fraction of root in topsoil*, effective root depth* orcrop/type vegetation.

8.5 Soil surface cover: Depth of A & B horizons. Cracking soil (clay content class).

8.6 Management: P factor for sediment yield. Mode 2: Soil roughness.

8.7 Topography/site characteristics: Time of concentration (*for sediment yield). Slope (for peak flow). Hydraulic length - altitude, lat, long catchment area*

8.8 Micro-topography: Mode 2: Soil roughness - decrease of roughness with rainfall after tillage.

9. Output data:

Daily, monthly or annual values of any variable calculated in the program. Specified in output option program. Typically: rainfall, effective rain, evap (pot & actual) soil water content, quickflow, total runoff, peakflow, sediment yield.

10 **Programming Language:** PC : Fortran or Unix : Fortran 77

11 **Computer requirement:**

PC : 560KB RAM 20 mb disk space. Storage of output (daily) 98kb per subcatchment (all variables) per year. 16kb/sc/ (10 variables per year. Unix enquire CCWR.

12 Documentation

12.1 Scientific documentation:

Hydrology and Agrohydrology.: A text to Accompany the ACRU 3.00 Agrohydrological Modelling System. Schulze, R. 1995. WRC report II.

12.2 User's guide:

ACRU - Agrohydrological Modelling System. User Manual v3.00. Smithers, J. and Schulze, R. 1995. Water Research Commission (WRC) Report II 70/95, Pretoria, South Africa.

12.3 Technical documentation: None.

13 Availability

On request. Charge for.

14 Other relevant information

Future planning. GIS-model direct link. Real time modelling. Enhancement of soil water & sediment yield processes.

1 Model identification

1.1	Model name	APEX - Water and Wind Erosion
1.2	Most recent version	APEX 4220
1.3	Date of release	August 1994

2 Water erosion and **Wind Erosion**

3 Contact person

3.1	Name	J R Williams
3.2	Address	USDA-ARS, 808 E Blackland Road, Temple, TX 76503
3.3	Tel	+1 817 770 6508
3.4	Fax	+1 817 770 6561
3.5	Email	

4 Model Author(s) J Williams, J Arnold, J Kiniry, K Potter, K King

5 Model components

5.1	Water erosion:	USLE/MUSLE (several variations)
5.2	Wind erosion:	Modified Manhattan KS model (Bagnold energy component)
5.3	Hydrology:	Runoff- modified SCS CN; Peak rate-modified rational or SCS TR-55; ET: 4 options options, Penman, Penman-Montieth, Hargreaves, Priestly-Taylor
5.4	Site/topography:	Whole Farm/small watershed/landscape; watershed may be subdivided
5.5	Plant growth:	General crop growth model simulates about 30 crops
5.6	Management:	Irrigation, fertilizer, liming, furrow diking, crop rotation. Variety of tillage operations
5.7	Soil:	Up to 30 soil layers. Core data: Bulk density, field capacity, wilting point, organic C_o texture

5.8	Chemistry:	N and P cycling; pesticide fate; water quality
5.9	Weather:	Precipitation, temperature (max, min) solar radiation, relative humidity, wind (speed & direction). Input or generated

6 Model characteristics

6.1	Spatial	
6.1.1	Class of area:	Whole farm, small watershed, landscape
6.1.2	Flow routing system:	Streamline - natural subareas
6.1.3	Minimum area:	1 ha
6.1.4	Maximum area:	100 km^2
6.2.	Temporal	
6.2.1	Timestep:	1 day
6.2.2	Single or multiple event?	Continuous
6.2.3	Maximum simulation duration:	1000 years

7 Model's representation of processes

7.1	Water erosion processes	
7.1.1	Interrill:	Combined
7.1.2	Rill:	Combined
7.1.3	Gully:	None now - development is high priority
7.1.4	Streambank:	Yes - sediment routing degrades channel as a function of flow velocity
7.1.5	Deposition:	Yes - governed by flow velocity and particle size
7.2	Wind erosion processes:	
7.2.1	Creep/surface roll:	Yes - Bagnolds eg
7.2.2	Saltation:	Yes - Bagnolds eg

7.2.3	Suspension;	Yes - Bagnolds eg
7.3	Hydrological processes:	
7.3.1	Evaporation/transpiration	Penman, Penman - Montieth, Hargreaves, Priestly-Taylor
7.3.2	Runoff:	SCS CN modified for volume; modified rational of SCS TR55 for peak rate
7.3.3	Infiltration:	SCS CN modified

7.3.4	Subsurface flow:	Yes - lateral and vertical computed simultaneously when field capacity is exceeded. Vertical governed by saturated conductivity; lateral by land slope
7.3.5	Return flow:	Yes - function of lateral flow and subsurface travel time from watershed centroid to outlet
7.4	Plant processes:	
7.4.1	Light interception and photosynthesis:	Yes - Beer's law; potential daily biomass growth limited by minimum stress factor - water, nutrients, temperature, aeration
7.4.2	Dry matter and residue:	Yes - at harvest yield is removed (harvest index). Standing dead residue falls to the soil surface at a rate driven by accumulated rainfall, and surface & subsurface residue is decayed as a function of soil moisture and temperature.
7.4.3	Root growth:	Depth driven by heat units; limited to max for crop or soil depth. Root mass a function of water use. Limited by bulk density, alumini saturation, or temperature
7.4.4	Pests:	Insects, weeds, diseases. Generic model driven by moisture, temperature & biomass
7.4.5	CO_2 sensitivity:	Through canopy resistance in Penman-Montieth eqn and crop coefficient converting energy to biomass
7.5	Soil:	Up to 30 layers permitted with variable thickness. Erosion removes soil from profile; layer 2 becomes thinner until it approaches O, then removed from system. Properties change with erosion, tillage mixing, mineralization of organic matter
7.5.1	Crust development:	-
7.5.2	Aggregate properties:	Large and small aggregates estimated from texture - and used in sediment routing
7.6	Chemistry:	
7.6.1	Nutrients:	N and P cycles: mineral, organic (NO_3, NH_3, active & stable organic N; labile P, active and stable mineral and organic P. Water and sediment transport, crop uptake, mineralization-immobilization nitrification, denitrification, N fixation, volatilization

7.6.2 Carbon: Tracks organic N

7.6.3 Pesticides: GLEAMS pesticide component. Wash off of plants, decay in soil & on foliage, leaching runoff and sediment transport

7.6.4 Other contaminants: None

7.7 Weather: Precipitation, temperature (max & min), solar radiation, wind speed, relative humidity. Input or generated

8 Input Data (* = Mandatory)

8.1 Weather: Precipitation*, temperature* (monthly means), solar radiation, wind speed, relative humidity

8.2 Soil: Bulk density*, texture*, Organic C*, field capacity, wilting point, saturated conductivity, % rock, pH, sum of bases, CEC, A_l saturation, C_aCO_3, labile P, mineral P active & stable, NO_3, Organic N active & stable.

8.3 Hydrology: SCS CN_2, watershed area, channel length & steepness, Mannings N. Optional: channel depth

8.4 Plant cover: Crop parameter table; planting and harvest dates

8.5 Soil surface cover: Initial standing and flat residue

8.6 Management: Tillage table; operation schedule (complete crop rotation by dates)

8.7 Topography/site characteristics: Land slope & steepness, Mannings N

8.8 Micro-topography: Random roughness and ridge interval and height created by each tillage operation

9 Output data

Weather, hydrology, erosion, nutrients, pesticides, crop production, soil properties. By sub-area, routing reach and total watershed. Option S: daily, monthly, annual; user selects outputs

10 Programming language Fortran

11 Computer requirements IBM PC compatible with at least 640K

12 Documentation

12.1 Scientific documentation:

Sharpley & Williams, 1990. EPIC-Erosion/Productivity Impact Calculator: 1. Model Documentation, USDA Tech Bull # 1768.

12.2 User's guide:

EPIC User's Guide; USDA ARS SCS, and TAES; Vanicek and Daneshil Editors.

12.3 Technical documentation:

Sharpley & Williams, 1990. EPIC-Erosion/Productivity Impact Calculator: 2. User Manual.

13 Availability Upon request from developer

1	**Model identification**	
1.1	Model name	AUSGUL - Water Erosion
1.2	Most recent version	3.1
1.3	Date of release	March 1992
2	**Water erosion**	
3	**Contact person**	
3.1	Name	Prof.A.Sidorchuk
3.2	Address	Lab of Soil Erosion and Fluvial Processes, Geographical Faculty, Moscow State University, 119899 Moscow, Russia
3.3	Tel	+7 095 9395697
3.4	Fax	+7 095 9328836
3.5	Email	sidor@yas.geogr.msu.su
4	**Model Author(s)**	Prof.A.Sidorchuk
5	**Model components**	
5.1	Water erosion:	Based on sediment budget equation
5.2	Wind erosion:	No
5.3	Hydrology:	Simulated or observed hydrograph
5.4	Site/topography:	Initial slope longitudinal profile
5.5	Plant growth:	No
5.6	Management:	No
5.7	Soil:	Multiple layers
5.8	Chemistry:	No
5.9	Weather:	For used hydrological model

6 Model characteristics

6.1 Spatial

6.1.1	Class of area:	Catchment
6.1.2	Flow routing system:	Streamline
6.1.3	Minimum area:	Point
6.1.4	Maximum area:	No limit, in practice about 10-50 sq.km

6.2. Temporal

6.2.1	Timestep:	Daily and less
6.2.2	Single or multiple event?	Multiple
6.2.3	Maximum simulation duration:	Until stable gully profile development

7 Model's representation of processes

7.1 Water erosion processes

7.1.1	Interrill:	No
7.1.2	Rill:	Modelled at the upper part of catchment
7.1.3	Gully:	The main model
7.1.4	Streambank:	In form of mass movement on the gully sides
7.1.5	Deposition:	Modelled with low accuracy, better to exclude
7.2	Wind erosion processes:	no
7.3	Hydrological processes:	Simulated separately
7.4	Plant processes:	no
7.5	Soil:	Multiple layer system; properties changes when layer eroded away
7.6	Chemistry:	No
7.7	Weather:	No
7.8	Other:	

1.Stable gully cross-section profile is modelled after each hydrological event

2.The critical velocity of erosion initiation is calculated, mainly for the upper soil layer with vegetation cover and residue

8 Input Data (* = Mandatory)

8.1 Weather: For used hydrological model

8.2	Soil:	Erosivity coefficient (not from USLE) for each soil layer: water resistant soil aggregates diameter mean soil particles diameter cohesion angle of internal friction density porosity elevations of top surface of soil layer (longitudinal profile) roughness coefficient (after Manning)
8.3	Hydrology:	Row of specific discharge values for the catchment
8.4	Plant cover:	No
8.5	Soil surface cover:	Density of the grass roots in the upper soil layer
8.6	Management:	No
8.7	Topography/site characteristics:	Longitudinal profile in elevations along initial streamline; -catchment area change along this line
8.8	Micro-topography:	No
8.9	Other:	1. Empirical relation between flow width and discharge 2. Empirical relation between stable gully bottom width and discharge

9 Output data

Gully longitudinal profile evolution during the simulation period in hydrological event resolution listing of:

- elevations of bottom surface along the gully
- gully depth along the gully
- gully bottom and top width along the gully
- gully volume along the gully

10 Programming language

FORTRAN-90

11 Computer requirements

Any with FORTRAN translator

12 Documentation

12.1 Scientific documentation:

A.Sidorchuk (1994) Static and Dynamic Models for Estimation of the Dimensions of Gullies in: G.Larionov and M.Nearing ed. Proc.of Int. Workshop on Soil Erosion. Purdue University, pp.136-156.

12.2	User's guide:	In FORTRAN listing comments
12.3	Technical documentation:	Reports in Russian
13	**Availability**	On request from author
14	**Other relevant information**	No

1 Model identification

1.1	Model name	CSEP - Water Erosion
1.2	Most recently realised version	1.0
1.3	Date of release	Latest version, January 1995

2 Water erosion

3 Contact person

3.1	Name	Mike Kirkby
3.2	Address	School of Geography, University of Leeds, Leeds LS2 9JT, UK
3.3	Tel	+44 113 233 3310
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3.5	Email	mike@geog.leeds.ac.uk

1.

4 Model Author(s)

Mike Kirkby, N J Cox

5 Model components

5.1	Water erosion:	Based on climate data only at present
5.2	Wind erosion:	-
5.3	Hydrology:	Point hydrological model, based on modified TOPMODEL inter alia
5.4	Site/topography:	Regional scale DEM if available, but other scales may also be used
5.5	Plant growth:	Model for generic living and soil biomass
5.6	Management:	-
5.7	Soil:	Local parameters for erodibility if available, with computed organic component
5.8	Chemistry:	Organic soil component using C budget
5.9	Weather:	Monthly data and distributions

6 Model characteristics

6.1	Spatial	
6.1.1	Class of area:	Regional to Global
6.1.2	Flow routing system	none at present
6.1.3	Minimum area:	Hillslope
6.1.4	Maximum area:	Global
6.2.	Temporal	
6.2.1	Timestep:	Monthly, integrating over distributions
6.2.2	Single or multiple event?	Integrated over distribution
6.2.3	Maximum simulation duration:	Probably 108 years

7 Model's representation of processes

7.1	Water erosion processes	
7.1.1	Interrill:	Lumped
7.1.2	Rill:	Ditto
7.1.3	Gully:	Ditto
7.1.4	Streambank:	-
7.1.5	Deposition:	Not modelled at present: may be included when combined with DEM
7.2	Wind erosion processes:	-
7.2.1	Creep/surface roll:	
7.2.2	Saltation:	
7.2.3	Suspension:	
7.3	Hydrological processes:	
7.3.1	Evaporation/transpiration:	Priestley-Taylor (based on radiation) and soil moisture
7.3.2	Runoff:	Single store model

7.3.3	Infiltration:	Not explicitly modelled
7.3.4	Subsurface flow:	Implicit TOPMODEL
7.3.5	Return flow:	Ditto
7.4	Plant processes:	
7.4.1	Light interception and photosynthesis:	Beer's law
7.4.2	Dry matter and residue:	Based on transpiration; respiration; leaf fall etc.
7.4.3	Root growth:	Not modelled separately from above
7.4.4	Pests:	-
7.4.5	CO_2 sensitivity:	Not modelled at present
7.5	Soil:	
7.5.1	Crust development:	-
7.5.2	Aggregate properties:	-
7.6	Chemistry:	Only for carbon
7.6.1	Nutrients:	
7.6.2	Carbon:	Used in logging organic soil accumulation and decomposition
7.6.3	Pesticides:	
7.6.4	Other contaminants:	
7.7	Weather:	Distribution function (Gamma or 2 exponentials) for integrated total effect

8 Input Data (* = Mandatory)

8.1	Weather:	Monthly values, with distribution data as available. Precipitation*, potential evapotranspiration of temperature*, cloudiness or sunshine hours*
8.2	Soil:	Erodibility
8.3	Hydrology:	Soil storage capacity (before runoff)*

8.4	Plant cover:	Uncultivated or crop type*
8.5	Soil surface cover:	Only if imposed
8.6	Management:	For crops*
8.7	Topography/site characteristics:	DEM if available
8.8	Micro-topography:	-

9 **Output data** Runoff, sediment yield, vegetation and organic soil biomass by month

10 **Programming language** Quick-BASIC

11 **Computer requirements** IBM compatible PC

12 **Documentation**

12.1 Scientific documentation:

Kirkby, M.J. and Cox, N.J. (in press, 1995). A climatic index for soil erosion potential (CSEP) including seasonal and vegetation factors. Catena Supplement.

12.2	User's guide:	Not available
12.3	Technical documentation:	Not available

13 **Availability** On request from author (Kirkby)

14 **Other relevant information** Undergoing further development

1 Model identification

1.1	Model name	EPIC - Water and Wind Erosion
1.2	Most recent version	APEX 4220
1.3	Date of release	August 1994

2 **Water erosion** and **Wind Erosion**

3 Contact person

3.1	Name	J R Williams
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3.4	Fax	+1 817 770 6561
3.5 `	Email	williams@brcsun0.tamu.edu

4 Model Author(s)

J Williams, J Arnold, J Kiniry, K Potter, K King

5 Model components

5.1	Water erosion:	USLE/MUSLE (several variations)
5.2	Wind erosion:	Modified Manhattan KS model (Bagnold energy component)
5.3	Hydrology:	Runoff- modified SCS CN; Peak rate-modified rational or SCS TR-55; ET= 4 options, Penman, Penman-Montieth, Hargreaves, Priestly-Taylor
5.4	Site/topography:	Whole Farm/small watershed/landscape; watershed may be subdivided
5.5	Plant growth:	General crop growth model simulates about 30 crops
5.6	Management:	Irrigation, fertilizer, liming, furrow diking, crop rotation. Variety of tillage operations
5.7	Soil:	Up to 30 soil layers. Core data - Bulk density, field capacity, wilting point, organic CO texture
5.8	Chemistry:	N and P cycling; pesticide fate; water quality

5.9	Weather:	Precipitation, temperature (max, min) solar radiation, relative humidity, wind (speed & direction). Input or generated

6 Model characteristics

6.1	Spatial	
6.1.1	Class of area:	Whole farm, small watershed, landscape
6.1.2	Flow routing system:	Streamline - natural subareas
6.1.3	Minimum area:	1 ha
6.1.4	Maximum area:	100 km^2
6.2.	Temporal	
6.2.1	Timestep:	1 day
6.2.2	Single or multiple event?	Continuous
6.2.3	Maximum simulation duration:	1000 years

7 Model's representation of processes

7.1	Water erosion processes	
7.1.1	Interrill:	Combined
7.1.2	Rill:	Combined
7.1.3	Gully:	None now - development is high priority
7.1.4	Streambank:	Yes - sediment routing degrades channel as a function of flow velocity
7.1.5	Deposition:	Yes - governed by flow velocity and particle size
7.2	Wind erosion processes:	
7.2.1	Creep/surface roll:	Yes - Bagnolds eg
7.2.2	Saltation:	Yes - Bagnolds eg

7.2.3	Suspension	Yes - Bagnolds eg

7.3 Hydrological processes:

7.3.1	Evaporation/transpiration	Penman, Penman - Montieth, Hargreaves, Priestly-Taylor
7.3.2	Runoff:	SCS CN modified for volume; modified rational of SCS TR55 for peak rate
7.3.3	Infiltration:	SCS CN modified

7.3.4	Subsurface flow:	Yes - lateral and vertical computed simultaneously when field capacity is exceeded. Vertical governed by saturated conductivity; lateral by land slope
7.3.5	Return flow:	Yes - function of lateral flow and subsurface travel time from watershed centroid to outlet
7.4	Plant processes:	
7.4.1	Light interception and photosynthesis:	Yes - Beer's law; potential daily biomass growth limited by minimum stress factor - water, nutrients, temperature, aeration
7.4.2	Dry matter and residue:	Yes - at harvest yield is removed (harvest index). Standing dead residue falls to the soil surface at a rate driven by accumulated rainfall, and surface & subsurface residue is decayed as a function of soil moisture and temperature
7.4.3	Root growth:	Depth driven by heat units ; limited to max for crop or soil depth. Root mass a function of water use. Limited by bulk density, aluminium saturation, or temperature
7.4.4	Pests:	Insects, weeds, diseases. Generic model driven by moisture, temperature & biomass
7.4.5	CO_2 sensitivity:	Through canopy resistance in Penman-Montieth equation and crop coefficient converting energy to biomass
7.5	Soil:	Up to 30 layers permitted with variable thickness. Erosion removes soil from profile; layer 2 becomes thinner until it approaches O, then removed from system. Properties change with erosion, tillage mixing, mineralization of organic matter
7.5.1	Crust development:	Not modelled
7.5.2	Aggregate properties:	-
7.6	Chemistry:	
7.6.1	Nutrients:	N & P cycles - mineral, organic (NO_3, NH_3, active & stable organic N; labile P, active and stable mineral and organic P. Water and sediment transport, crop uptake, mineralization-immobilization nitrification, denitrification, N fixation, volatilization

7.6.2 Carbon: Tracks organic N

7.6.3 Pesticides: GLEAMS pesticide component. Wash off of plants, decay in soil & on foliage, leaching, runoff and sediment transport

7.6.4 Other contaminants: None

7.7 Weather: Precipitation, temperature (max & min), solar radiation, wind speed, relative humidity. Input or generated

8 Input Data (* = Mandatory)

8.1 Weather:

Required: Precipitation, temperature (monthly means) optional; solar radiation, wind speed, relative humidity

8.2 Soil:

Required: Bulk density, texture, Organic C, optional field capacity, wilting point, saturated conductivity, % rock, pH, sum of bases, CEG, AL saturation, $CACO_3$, labile P, mineral P active & stable, NO_3, Organic N active & stable

8.3 Hydrology: SCS CN_a, watershed area, channel length & steepness, Mannings N, Optional: channel depth

8.4 Plant cover: Crop parameter table; planting and harvest dates

8.5 Soil surface cover: Initial standing & flat residue

8.6 Management: Tillage table; operation schedule (complete crop rotation by dates)

8.7 Topography/site characteristics: Land slope & steepness, Mannings N

8.8 Micro-topography: Random roughness and ridge interval & height created by each tillage operation

9 **Output data:**

Weather, hydrology, erosion, nutrients, pesticides, crop production, soil properties. By sub-area, routing reach, and total watershed. Option S-daily, monthly, annual; user selects outputs

10 Programming language Fortran

11 Computer requirements IBM PC compatible with at least 640K

12 Documentation

12.1 Scientific documentation:

Sharpley & Williams, 1990. EPIC-Erosion/Productivity Impact Calculator: 1. Model Documentation, USDA Tech Bull # 1768.

12.2 User's guide:

EPIC User's Guide; USDA ARS SCS, and TAES; Vanicek & Dameshil Editors.

12.3 Technical documentation:

Sharpley & Williams, 1990. EPIC-Erosion/Productivity Impact Calculator: 2. User Manual.

13 Availability Upon request from developer

14 Other relevant information -

1 Model identification

1.1	Model name	EUROSEM - Water erosion
1.2	Most recently realeased version	3.3
1.3	Date of release	January 1995

2 Water erosion

3 Contact person

3.1	Name	R.P.C. Morgan
3.2	Address	Silsoe College, Cranfield University, Silsoe, Bedford MK45 4DT, UK
3.3	Tel	+44 (0)1525 863059
3.4	Fax	+44 (0)1525 863099

4 Model Author(s)

R.P.C. Morgan, J.N. Quinton, R.E. Smith, J.W. A. Poesen, G.Govers, D. Tozzi, G. Chisci, M.E. Styczen

5 Model components

5.1	Water erosion:	Dynamic physically-based simulation
5.2	Wind erosion:	-
5.3	Hydrology:	Modified Kineros
5.4	Site/topography:	Uniform hillslope planes arranged as cascading sequence
5.5	Plant growth:	Physical description of plants as data input
5.6	Management:	Physical description of surface roughness as data input
5.7	Soil:	1 soil layer described by physical and mechanical properties
5.8	Chemistry:	-
5.9	Weather:	Breakpoint rainfall data

6 Model characteristics

6.1 Spatial

6.1.1	Class of area:	Field/small catchment
6.1.2	Flow routing system:	Cascading planes
6.1.3	Minimum area:	1 m^2
6.1.4	Maximum area:	1 km^2

6.2. Temporal

6.2.1	Timestep:	1 minute
6.2.2	Single or multiple event?	Single
6.2.3	Maximum simulation duration:	1,000 minutes

7 Model's representation of processes

7.1 Water erosion processes

7.1.1	Interrill:	Explicit simulation
7.1.2	Rill:	Explicit simulation
7.1.3	Gully:	-
7.1.4	Streambank:	-
7.1.5	Deposition:	Explicit simulation

7.2 Wind erosion processes:

7.2.1	Creep/surface roll:	-
7.2.2	Saltation:	-
7.2.3	Suspension:	-

7.3 Hydrological processes:

7.3.1	Evaporation/transpiration:	-
7.3.2	Runoff:	Infiltration-excess (Hortonian) Manning's N used

for flow velocities

7.3.3	Infiltration:	Smith and Parlange
7.3.4	Subsurface:	-
7.3.5	Return flow:	-
7.4	Plant processes:	
7.4.1	Light interception and photosynthesis:	-
7.4.2	Dry matter and residue:	-
7.4.3	Root growth:	-
7.4.4	Pests:	-
7.4.5	CO_2 sensitivity:	-
7.5	Soil:	Not explicitly modelled
7.5.1	Crust development:	Not explicitly modelled
7.5.2	Aggregate properties:	-
7.6	Chemistry:	
7.6.1	Nutrients:	-
7.6.2	Carbon:	-
7.6.3	Pesticides:	-
7.6.4	Other contaminants:	-
7.7	Weather:	Semi-stochastic rainfall generation model

8 Input Data (* = Mandatory)

8.1	Weather:	List of mandatory items
8.2	Soil:	Attached -
8.3	Hydrology:	- guide values from tables
8.4	Plant cover:	May be used as inputs if measured values not

		available

9 **Output data**

Storm runoff total, storm soil loss total. Hydrograph. Sedigraph. Location of sediment sources and sinks

10	**Programming language**	FORTRAN (Microsoft 5.1)
11	**Computer requirements**	IBM PC compatibles under DOS 3.3; 640KRAM. Also runs on work stations as FORTRAN 77
12	**Documentation**	
12.1	Scientific documentation:	In preparation
12.2	User's guide:	In preparation
12.3	Technical documentation:	In preparation
13	**Availability**	On request from R P C Morgan or J N Quinton (Silsoe College)
14	**Other relevant information**	Planned to extend model to cover ephemeral gullies. Planned to make model particle-size selective

1 Model identification

1.1	Model name	LISEM - Water erosion
1.2	Most recent version	3.0
1.3	Date of release	October 1995.

2 Water erosion

3 Contact person

3.1	Name	Dr Ad P.J. De Roo.
3.2	Address	Department of Physical Geography, Utrecht University, P.O. Box 80115, 3508 TC Utrecht, The Netherlands.
3.3	Tel	+31 30 253 5773
3.4	Fax	+31 30 254 0604
3.5	Email	a.deroo@frw.ruu.nl

4 Model Author(s)

Dr. Ad P.J. De Roo, Mr. C.G. Wesseling, Dr. V.G. Jetten (INRA, Laon, F). Mr. C.J. Ritsema (Staring Centre, Wageningen).

5 Model components

5.1	Water erosion:	Splash detachment: using Aggregate Stability (new). Flow detachment: using soil cohesion (EUROSEM). Transport capacity: using D50 (Govers; EUROSEM).
5.2	Wind erosion:	-
5.3	Hydrology:	Seven options: (1) no infiltration (2) Richards equation (3) Richards plus wheeltracks (4) Richards plus crust plus wheeltracks (5) Holtan (6) Green/Ampt (7) two layer Green/Ampt; using Manning equation catchment.
5.4	Site/topography:	-
5.5	Plant growth:	-
5.6	Management/tillage:	Simulates roughness, wheeltracks, paved roads, effects of field strips and grassed waterways.

5.7	Soil:	For Richards: unlimited amount of layers.
5.8	Chemistry:	-
5.9	Weather:	Breakpoint rainfall data, multiple rain gauges.

6 Model characteristics

6.1 Spatial

6.1.1	Class of area:	Catchment
6.1.2	Flow routing system:	Kinematic wave on rasters; separate for overland flow and channel network.
6.1.3	Minimum area:	0.5 ha.
6.1.4	Maximum area:	Roughly estimated at 200 km^2: not suitable for catchments containing large rivers (larger than pixel).

6.2. Temporal

6.2.1	Timestep:	User defined, from 1 second up to several minutes.
6.2.2	Single or multiple event?	Single event.
6.2.3	Maximum simulation duration:	A few days.

7 Model's representation of processes

7.1 Water erosion processes

7.1.1	Interrill:	Lumped with rill erosion; however, within the pixel flow can be concentrated; using EUROSEM equation.
7.1.2	Rill:	When critical shear velocity for rill initiation is exceeded (Rauws & Govers).
7.1.3	Gully:	In preparation.
7.1.4	Streambank:	When there is transport capacity left over and the channel bed cohesion is sufficiently small.
7.1.5	Deposition:	When transport capacity is exceeded (EUROSEM) equation).

7.2	Wind erosion processes:	
7.2.1	Creep/surface roll:	-
7.2.2	Saltation:	-
7.2.3	Suspension:	-
7.3	Hydrological processes:	
7.3.1	Evaporation/transpiration	:
7.3.2	Runoff:	Kinematic wave and Manning equation.
7.3.3	Infiltration:	Richards, Holtan or one or two layer Green/Ampt.
7.3.4	Subsurface flow:	In preparation.
7.3.5	Return flow:	-
7.4	Plant processes:	
7.4.1	Light interception and Photosynthesis:	-
7.4.2	Dry matter and residue:	-
7.4.3	Root growth:	-
7.4.4	Pests:	-
7.4.5	CO_2 sensitivity:	-
7.5	Soil:	Unlimited number of layers (Richards).
7.5.1	Crust development:	Crust development in preparation, a partly crusted surface can be simulated with Richards.
7.5.2	Aggregate properties:	Aggregate stability.
7.6	Chemistry:	
7.6.1	Nutrients:	-
7.6.2	Carbon:	-
7.6.3	Pesticides:	-
7.6.4	Other contaminants:	-
7.7	Weather:	Breakpoint rainfall from multiple rain gauges.

7.8	Other:	LISEM simulates the effects of wheeltracks, roads, field strips, grassed waterways, all smaller than the pixel size. Also the effects of stones and crusts are simulated.

8 Input Data (* = Mandatory).

8.1 Weather:

(All spatial inputs are in a PC-based raster Geographical information) breakpoint rainfall data (time, intensity).

8.2 Soil:

Aggregate stability, soil cohesion, D50, random roughness, fraction with stones, fraction with crusts, initial moisture content or pressure head, infiltration characteristics depending on infiltration method (saturated hydraulic conductivity and other Richards/Green-Ampt or Holtan parameters).

8.3	Hydrology:	Manning's n for overland flow and channels, channel dimensions.
8.4	Plant cover:	Leaf area index, fraction of soil cover, crop height.
8.5	Soil surface cover:	Percentage cover by vegetation, cover by stones, cover by crusts, cover by roads, cover by wheeltracks.
8.6	Management:	Location and width of field strips and waterways.
8.7	Topography/site characteristics:	Slope gradient, aspect (local drain direction).
8.8	Micro-topography:	Random roughness.

9 Output data

Total rainfall, total discharge, peak discharge, time of peak discharge, runoff percentage of rainfall, total soil loss, average soil loss, total infiltration, total splash detachment, total flow detachment, total deposition; ASCII files to construct storm hydrograph and sediment concentration graph; Maps of erosion and deposition. Maps over overland flow at a number of predefined times during the event.

10 Programming language C + +, Utrecht modelling language (Dynamite).

11 Computer requirements — Minimum 386+math coprocessor + 4Mb ROM. For larger catchments a Pentium is recommended.

12 Documentation

12.1 Scientific documentation:

De Roo, A.P.J., Wesseling, C.G., Cremers, N.H.D.T., Offermans, R.J.E., Ritsema, C.J. and van Oostindie, K. (1994) LISEM: a new physically-based hydrological and soil erosion model in a GIS-environment: Theory and implementation. IAHS Publication No. 224 (Proceedings of the Canberra Conference), 439-448.

De Roo, A.P.J. and Offermans, R.J.E. (1995). LISEM: A Physically-based hydrologic and soil erosion model for basin scale water and sediment management: sensitivity analysis, calibration and validation. IAHS Publication No. 231 (Proceedings of a Boulder symposium), 399-407.

De Roo, A.P.J., Wesseling, C.G. and Ritsema, C.J. (1995). LISEM: a single event physically-based hydrologic and soil erosion model for drainage basins. I: Theory, input and output. Hydrological Processes (in press).

De Roo, A.P.J., Offermans, R.J.E. and Cremers, N.H.D.T. (1995). LISEM: a single event physically-based hydrologic and soil erosion model for drainage basins. II: Sensitivity analysis, validation and application. Hydrological Processes (in press).

12.2 User's guide: — User manual (Dutch and English version).

12.3 Technical documentation: — User manual (Dutch and English version).

13 Availability — On request from author. Both LISEM and the PC-based GIS are distributed.

14 Other relevant information — There are plans to include nutrient transport, subsurface flow, gully erosion and evapotranspiration to make a continuous model version. Also the dynamics of soil roughness and crusts are studied.

1 Model identification

1.1	Model name	MEDALUS - Water erosion
1.2	Most recently realised version	1.0
1.3	Date of release	December 1994

2 Water erosion

3 Contact person

3.1	Name	Mike Kirkby
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4 Model Author(s)

M D McMahon, M J Kirkby, J B Thornes, F I Woodward

5 Model components

5.1	Water erosion:	Water and sediment routed over rough surface
5.2	Wind erosion:	-
5.3	Hydrology:	Richards equation for soil: Infiltration into rough, vegetated surface
5.4	Site/topography:	Hillslope catena from field data
5.5	Plant growth:	Models for uncultivated annuals, grass and shrubs
5.6	Management:	-
5.7	Soil:	Dynamic change with erosion in armour and composition
5.8	Chemistry:	Organic soil component using C budget
5.9	Weather:	Automatic Weather station data (5-15 minute)

6 Model characteristics

6.1	Spatial	
6.1.1	Class of area:	Slope catena/small catchment
6.1.2	Flow routing system:	Grid
6.1.3	Minimum area:	Erosion plot
6.1.4	Maximum area:	10 Ha
6.2.	Temporal	
6.2.1	Timestep:	5-15 minute
6.2.2	Single or multiple event?	Multiple
6.2.3	Maximum simulation duration:	100 years

7 Model's representation of processes

7.1	Water erosion processes	
7.1.1	Interrill:	Included in spectrum of surface roughness
7.1.2	Rill:	Included in spectrum of surface roughness
7.1.3	Gully:	Included in spectrum of surface roughness
7.1.4	Streambank:	-
7.1.5	Deposition:	Included in integrated sediment routing
7.2	Wind erosion processes:	-
7.2.1	Creep/surface roll:	-
7.2.2	Saltation:	-
7.2.3	Suspension:	-
7.3	Hydrological processes:	
7.3.1	Evaporation/transpiration:	Modified Penman, allowing for soil layers, plant stress, etc.
7.3.2	Runoff:	Overland flow routing over rough micro-topography

7.3.3	Infiltration:	Spatially variable using Richards equation for ponded and non-ponded areas
7.3.4	Subsurface flow:	Lateral component of Richards equation
7.3.5	Return flow:	Arises from solution of equations in principle
7.4	Plant processes:	
7.4.1	Light interception and photosynthesis:	Beer's Law
7.4.2	Dry matter and residue:	Based on photosynthesis and transpiration; respiration; leaf fall, etc.

7.4.3	Root growth:	Functional-group based partition of net growth with stems
7.4.4	Pests:	-
7.4.5	CO_2 sensitivity:	Implicit in water stress photosynthesis calculations
7.5	Soil:	
7.5.1	Crust development:	Not modelled for stony soils
7.5.2	Aggregate properties:	-
7.6	Chemistry:	Only for carbon
7.6.1	Nutrients:	-
7.6.2	Carbon:	Used in logging organic soil accumulation, mixing and decomposition
7.6.3	Pesticides:	-
7.6.4	Other contaminants:	-
7.7	Weather:	Stochastic generator used for future scenarios

8 Input Data (* = Mandatory)

8.1 Weather:

5-15 minute interval (or stochastic generator) for precipitation*, temperature*, net radiation*, humidity*, wind speed* (AWS data). Grain sizes with depth*, including stoniness

8.2	Soil:	-
8.3	Hydrology:	Moisture retention curve*(s)
8.4	Plant cover:	% shrub*, grass*, annuals* and bare*, with detail as available
8.5	Soil surface cover:	Surface stoniness*, vegetation crown cover by functional; type*
8.6	Management:	-
8.7	Topography/site characteristics:	Slope profile

8.8 Micro-topography: RMS roughness* at several* points down slope profile

8.9 Other: Physiological characteristics of dominant plants in each functional group

9 Output data:

Runoff, soil moisture profiles, sediment transport and net erosion/deposition down length of slope, integrated over selected time intervals. Vegetation and organic soil biomass, surface roughness and armour characteristics over time

10 Programming language Turbo Pascal (V6.0)

11 Computer requirements IBM PC compatibles, preferably a fast 486/586 and minimally a 386DX

12 Documentation

12.1 Scientific documentation:

Kirkby, M.J., Baird, A.J., Lockwood, J.G., McMahon, M.D., Mitchell, P.J., Shao, J., Sheehy, J.E., Thornes J.B. and Woodward, F.I. 1993. MEDALUS Project A1: Physically based process models: Final report (part of MEDALUS I final report, edited J B Thornes).

12.2 User's guide: Not yet available

12.3 Technical documentation: Available on request from author (McMahon)

13 Availability Available on request from authors

14 Other relevant information Currently still undergoing testing, but available in trial form for experimental use.

1	**Model identification**	
1.1	Model name	MEDRUSH - Water erosion
1.2	Most recent version	0.1
1.3	Date of release	Still under development, hopefully late 1995
2	**Water erosion**	
3	**Contact person**	
3.1	Name	Mike Kirkby
3.2	Address LS2 9JT, UK	School of Geography, University of Leeds, Leeds
3.3	Tel	+44 113 233 3310
3.4	Fax	+44 113 233 6758
3.5	Email	mike@geog. leeds.ac.uk
1.		
4	**Model Author(s)**	M D McMahon, M Kirby, J B Thornes, J C Bathurst, F I Woodward
5	**Model components**	
5.1	Water erosion:	Water and sediment routed over rough surface
5.2	Wind erosion:	-
5.3	Hydrology:	Infiltration into rough surface, overland flow and network routing, lumped soil based on modified TOPMODEL
5.4	Site/topography:	DEM
5.5	Plant growth:	Models for uncultivated annuals, grass and shrubs
5.6	Management:	-
5.7	Soil:	Dynamic change with erosion in armour and composition
5.8	Chemistry:	Organic soil component using C budget
5.9	Weather:	Automatic Weather station data (5-15 minute) or generator from available data or scenario

6 Model characteristics

6.1 Spatial

6.1.1	Class of area:	Catchment
6.1.2	Flow routing system:	Stream network
6.1.3	Minimum area:	Erosion plot
6.1.4	Maximum area:	5000 km^2

6.2. Temporal

6.2.1	Timestep:	Hourly
6.2.2	Single or multiple event?	Multiple
6.2.3	Maximum simulation duration:	100 years

7 Model's representation of processes

7.1 Water erosion processes

7.1.1	Interrill:	Included in spectrum of surface roughness
7.1.2	Rill:	Ditto
7.1.3	Gully:	Ditto
7.1.4	Streambank:	Ditto for rills and gullies. Major channel modelled via hydraulic geometry and generated flood frequencies.
7.1.5	Deposition:	Included in integrated sediment routing
7.2	Wind erosion processes:	-
7.3	Hydrological processes:	
7.3.1	Evaporation/transpiration:	Modified Penman, allowing for soil layers, plant stress etc. or simpler, depending on data availability. At worst, from temperatures or radiation!
7.3.2	Runoff:	Overland flow routing over rough microtopography. Linearised network routing, incorporating hillslope contributions

7.3.3	Infiltration:	Spatially variable using simplified single layer model, linked to TOPMODEL subsurface flow component
7.3.4	Subsurface flow:	TOPMODEL
7.3.5	Return flow:	ditto
7.4	Plant processes:	
7.4.1	Light interception and photosynthesis:	Beer's law
7.4.2	Dry matter and residue:	Based on photosynthesis and transpiration; leaf fall etc.
7.4.3	Root growth:	Functional-group based partition of net growth with stems
7.4.4	Pests:	-
7.4.5	CO_2 sensitivity:	Implicit in water stress photosynthesis calculations
7.5	Soil:	Single layer, with rate of change parameters to allow for erosion and organic matter
7.5.1	Crust development:	Not modelled for stony soils
7.5.2	Aggregate properties:	-
7.6	Chemistry:	Only for carbon
7.6.1	Nutrients:	-
7.6.2	Carbon:	Used in logging organic soil accumulation, mixing decomposition
7.6.3	Pesticides:	-
7.6.4	Other contaminants:	-
7.7	Weather:	Stochastic generator used for future scenarios

8 Input Data (* = Mandatory)

8.1	Weather:	Hourly (or stochastic generator) for Precipitation*, temperature, net radiation, humidity, wind speed (AWS data) - enough to generate evapotranspiration *

8.2	Soil:	Grain size* including stoniness*, and rates of change with depth
8.3	Hydrology:	Infiltration curves*
8.4	Plant cover:	% shrub, grass*, annuals* and bare*, with detail as available
8.5	Soil surface cover:	Surface stoniness*, vegetation crown cover by functional; type
8.6	Management:	-
8.7	Topography/site characteristics:	DEM*, and some of land use, lithology, soil type etc.
8.8	Micro-topography:	RMS roughness related to gradient, lithology and land use
8.9	Other: each functional group	Physiological characteristics of dominant plants in

9 Output data

Runoff, soil moisture profiles, sediment transport and net erosion/deposition for subcatchments (of 1-20 km^2), integrated over selected time intervals. Vegetation and organic soil biomass, surface roughness and armour characteristics over time. Generalised within sub-catchments

10 Programming language C++

11 Computer requirements HP/Sun work-station or equivalent

12 Documentation

12.1	Scientific documentation:	Interim project reports only to data-available from author
12.2	User's guide:	Not yet available
12.3	Technical documentation:	Not yet available

13 Availability Not yet available

14 Other relevant information Currently still undergoing development

1 Model identification

1.1	Model name	NORGUL - Water and Thermoerosion
1.2	Most recent version	3.2
1.3	Date of release	December 1994

2 Water Erosion and Thermoerosion

3 Contact person

3.1	Name	Prof.A.Sidorchuk
3.2	Address	Lab of Soil Erosion and Fluvial Processes,Geographical Faculty, Moscow State University, 119899 Moscow, Russia
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3.4	Fax	+7 095 9328836
3.5	Email	sidor@yas.geogr.msu.su

4 Model author(s) Prof.A.Sidorchuk

5 Model components

5.1	Water erosion and thermoerosion:	Based on sediment budget equation
5.2	Wind erosion:	No
5.3	Hydrology:	Simulated or observed hydrograph
5.4	Site/topography:	Initial slope longitudinal profile
5.5	Plant growth:	No
5.6	Management:	No
5.7	Soil:	Multiple layers
5.8	Chemistry:	No
5.9	Weather:	For used hydrological model

6 Model characteristics

6.1	Spatial	
6.1.1	Class of area:	Catchment
6.1.2	Flow routing system:	Streamline
6.1.3	Minimum area:	Point
6.1.4	Maximum area:	No limit, in practice about 10-50 km
6.2.	Temporal	
6.2.1	Timestep:	Daily and less
6.2.2	Single or multiple event?	Multiple
6.2.3	Maximum simulation duration:	30-50 years

7 Model's representation of processes

7.1	Water erosion processes	
7.1.1	Interrill:	No
7.1.2	Rill:	Modelled at the upper part of catchment
7.1.3	Gully:	The main model
7.1.4	Streambank:	In form of mass movement on the gully sides
7.1.5	Deposition:	Modelled with low accuracy, better to exclude
7.2	Wind erosion processes:	No
7.3	Hydrological processes:	Simulated separately
7.4	Plant processes:	No
7.5	Soil:	Multiple layer system; properties changes when layer eroded away
7.6	Chemistry:	No
7.7	Weather:	No
7.8	Other: each hydrological event	1. Stable gully cross-section profile is modelled after 2. The critical velocity of erosion initiation is calculated, mainly for the upper soil layer with vegetation cover and residue.

3. The process of thermoerosion is simulated for the period of negative temperatures of the eroded layer.

8 Input Data (* = Mandatory)

8.1 Weather: Row of the air temperature for the thaw period

8.2 Soil:

Erosivity coefficient (not from USLE) for each soil layer: water resistant soil aggregates diameter mean soil particles diameter cohesion angle of internal friction density porosity elevations of top surface of soil layer (longitudinal profile) roughness coefficient (after Manning)

8.2 Soil: Erosivity coefficient (not from USLE) for each soil layer:

coefficient of the thermoerosion; coefficient of temperature conductivity; water resistant soil aggregates diameter; mean soil particles diameter; cohesion; angle of internal friction; density porosity; ice content; elevations of top surface of soil layer (longitudinal profile); roughness coefficient (after Manning)

8.3 Hydrology: Row of specific discharge values for the thaw period and warm period

8.4 Plant cover: No

8.5 Soil surface cover: Density of the grass roots in the upper soil layer

8.6 Management: No

8.7 Topography/site characteristics: Longitudinal profile in elevations along initial streamline; -catchment area change along this line

8.8 Micro-topography: No

8.9 Other:

1. Empirical relation between flow width and discharge

2. Empirical relation between stable gully bottom width and discharge

9 Output data

Gully longitudinal profile evolution during the simulation period in hydrological event resolution listing of:

- for each event number of erosion episodes and thermoerosion episodes
- elevations of bottom surface along the gully
- gully depth along the gully
- gully bottom and top width along the gully
- gully volume along the gully

10	**Programming language**	FORTRAN-90
11	**Computer requirements**	Any with FORTRAN translator
12	**Documentation**	
12.1	Scientific documentation:	

A. Sidorchuk (in press) Gully erosion and thermoerosion on the Yamal Peninsula.

12.2	User's guide:	In FORTRAN listing comments
12.3	Technical documentation:	Reports in Russian
13	**Availability**	On request from author
14	**Other relevant information**	No

1	**Model identification**	
1.1	Model name	WEPP - Water and Wind Erosion
1.2	Most recently realised version	95.0
1.3	Date of release	January 1995
2	**Water and Wind Erosion**	
3	**Contact person**	
3.1	Name	Mark Nearing
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3.5	Email	nearing@ecn.purdue.edu
1.		
4	**Model Author(s)**	Nearing, Flanagan, Nicks, Laflen, Gilley, Weltz, Alberts, Young, Foster, Savabi, Rawls, Lane, Stone
5	**Model components**	
5.1	Water erosion:	Entirely new and validated on >2000 plot years
5.2	Wind erosion:	No
5.3	Hydrology:	Green Ampt Infiltration. Kinematic Wave Routing
5.4	Site/topography:	Complex Topography, multiple land use
5.5	Plant growth:	Epic variant
5.6	Management:	Extensive data required. Tilage dates - harvest dates - etc.
5.7	Soil:	Basic information required
5.8	Chemistry:	No
5.9	Weather:	CLIGEN or measured input
6	**Model characteristics**	

6.1	Spatial	Field or small watershed
6.1.1	Class of area:	
6.1.2	Flow routing system:	Channels and hillslopes (maybe run separately)
6.1.3	Minimum area:	1 x 1 m
6.1.4	Maximum area:	640 to ha
6.2.	Temporal	Single storm or multi-year
6.2.1	Timestep:	Daily
6.2.2	Single or multiple event?	Both
6.2.3	Maximum simulation duration:	None recommended. No computational limits

7 Model's representation of processes

7.1	Water erosion processes	Erodibility from est. egs.
7.1.1	Interrill:	K_i I_g S_f C_f 6_f. Intensity rainfall $_g$ = runoff.
7.1.2	Rill:	Shear stress model/Yalin Transport
7.1.3	Gully:	Ephemeral channels only. No classical gullies
7.1.4	Streambank:	No
7.1.5	Deposition:	Yes and sediment sorting
7.2	Wind erosion processes:	-
7 .2.1 -	Creep/surface roll:	-
7.2.2	Saltation:	-
7.2.3	Suspension	-
7.3	Hydrological processes:	-
7.3.1	Evaporation/transpiration:	Penman or Hargraves+
7.3.2	Runoff:	Kinematic Wave
7.3.3	Infiltration:	Green Ampt
7.3.4	Subsurface flow:	Yes

7.3.5	Return flow:	Yes
7.4	Plant processes:	-
7.4.1	Light interception and photosynthesis:	EPIC derived
7.4.2	Dry matter and residue:	-
7.4.3	Root growth:	-
7.4.4	Pests:	-
7.4.5	CO_2 sensitivity:	Yes - in-house version
7.5	Soil:	Tillage, consolidation, freeze/thaw
7.5.1	Crust development:	Yes - rainfall energy calculated
7.5.2	Aggregate properties:	Yes - Foster/Young/Niebling method
7.6	Chemistry:	
7.6.1	Nutrients:	
7.6.2	Carbon:	
7.6.3	Pesticides:	
7.6.4	Other contaminants	
7.7	Weather:	CLIGEN or measured data

8 Input Data (* = Mandatory)

8.1	Weather:	Daily precipitation*, maximum minimum temperature*, sola radiation*, dewpoint* wind
8.2	Soil:	Texture, CEC, rocks, erodibility (est. equations provided)
8.3	Hydrology:	Computed internally
8.4	Plant cover:	Computed internally
8.5	Soil surface cover:	Computed internally
8.6	Management:	Plant parameters, tillage

		parameters, plant and harvest dates
8.7	Topography/site characteristics:	Slope at points along profile
8.8	Micro-topography:	Internally calculated
8.9	Other:	Irrigation, if active channel information

9 Output data

Daily runoff, peak runoff, soil loss, detachment, deposition, sediment yield, change in erodibility, infiltribility - also annual values crop yield (there are literally hundreds of output variables)

10 Programming language

FORTRAN/C

11 Computer requirements

386 W/Coprocessor or better

12 Documentation

12.1	Scientific documentation:	On-line Internet access to all documentation is coming
12.2	User's guide:	Currently on-line
12.3	Technical documentation:	Soon on-line

13 Availability

From Internet or by request

14 Other relevant information

This model represents the work of several USDA-ARS scientists spanning a 10-year period. It has been well-tested in hillslope applications and works very well. Watershed applications have not been as well validated. We are currently modifying the program to study the effect of CO_2 and temperature change on hydrologic and erosion processes.

SECTION II

EXPERIMENTAL METADATA

1 CONTACT PERSON

1.1	Name	Dr. Alain Albrecht
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1.6	List other researchers involved:	E. Blanchant ORSTOM, Martinique

2 WATER EROSION

2.1	mm^2 - cm^2:	-
2.2	m^2:	Physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff; biological processes soil organic matter evolution, roots and earthworms effects.

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

6.4	months:	Biological activities
6.5	years:	Biological activities

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	-
7.2	Topography:	-
7.3	Soils:	Fettelitic Soils/Vertisols
7.4	Vegetation:	-
7.5	Management:	Food crops vs. pastures

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Soil detachment
8.2	Location (town, state, country):	St Anne, Martinique, French West Indies.
8.3	Equipment involved:	Rainfall simulator.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

- Soil characterization
- Soil aggregation studies using L.A.S.E.R. diffraction method

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Albrecht, A., Rangon, L., Barnet, P. (1992) Effet de la matrice organique sur le stabilite structuale et le ditachabilite d'un vertisol et d'un ferrisol (Martinique). Lab. ORSTOM, Vol 27, 1: 121-133.

Fellen, C., Albrecht, A., Tessien, D. (1995). Aggregation and organic carbon storage in kaolin in nitric and smeetitic soils. Adv, Soil Science (in press)

1 CONTACT PERSON

1.1	Name	Dr. P. Andrieux (INRA) and Dr. G De Noni (ORSTOM)
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1.6	List other researchers involved:	A. Albrecht, J. Asseline and M. Viennot (ORSTOM), more INRA staff (Science du Sol).

2 WATER EROSION

2.1	mm^2 - cm^2:	Dynamics of soil aggregation
2.2	m^2:	Physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff; sub-surface dynamics (piping)Sub-surface flow in cultivated soils.
2.3	100m2 - 10 000 m2	Interrill and rill erosion; (ephemeral) gully erosion
2.4	small catchments (< 100 ha):	Gully erosion; sediment budgets

3 WIND EROSION

Not investigated.

4 MASS MOVEMENTS

Not investigated.

5 TILLAGE EROSION

Spatial scale considered: From mm^2 to 100 m^2

6 TEMPORAL SCALE OF EXPERIMENTS

6.1 events: The equipment covers all the time units.

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	Mediterranean climate.
7.2	Topography:	From 1 to 20/25%.
7.3	Soils:	Mediterranean soils.
7.4	Vegetation:	-
7.5	Management:	Cultivated soils (vineyard and some cereal plots).

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Splash and runoff.
8.2	Location (town, state, country):	ROUJAN catchment in HERAULT department (France).
8.3	Equipment involved:	Rainfall and runoff field simulators. Runoff plot Meterological equipment. Large scale video remote sensing.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

LCSC - ORSTOM laboratory. Chemical and physical (structural stability). Soil tests. Indoor rainfall simulators.

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Albrecht, A., Brossard, M., Chotte, J.L. and Feller, C. 1992. Les stocks organiques des principaux sols cultivés de la Martinique (Petites Antilles). Cah. ORSTOM, série Pédol. 27.

De Noni, G., and Viennot, M. 1992. Soil erosion and conservation research in Ecuador, In: Erosion, conservation, and small scale farming, ISCO, Ethiopie-Kenya, pp 549-559.

Leonard, J., and Andrieux, P. 1995. Spatial variability of infiltration on a small Mediterranean vineyard catchment and implications for the discretization of a rainfall-runoff model (to edit in Hydrological processes).

Volts, M., Andrieux, P., Bocquillon, C. and Rambal, S. 1994. La site atelier ALLEGRO, Languedoc In: Du concept de bassin versant représentatif expérimental, Actes du Séminaire National Hydrosystémes, Paris, 10-11 mai, pp 121-129.

1 CONTACT PERSON

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2 WATER EROSION

2.3	runoff plot 100, 200 and 1000 m^2	interrill

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

6.5	years:	Based on the length of the rainy season.
6.6	remarks:	Due to inter-annual variation of rainfall, many years observations are needed.

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	Rainfall (amount, intensity and frequency).
7.2	Topography:	Slope length and slope angle.
7.3	Soils:	Old vs. newly cleared lands on sandy alfisols Sudanese zone, North Cameroon.
7.4	Vegetation:	-
7.5	Management:	Conventional and reduced tillage.
7.6	Others:	Soil cover is organic mulch or plastic mesh.

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Runoff, sediments, suspensions, crop yield, rainfall and soil moisture are recorded/measured.
8.2	Location (town, state, country):	Mbissiri, Northern Province, Cameroon.
8.3	Equipment involved:	Rain guage (daily rotation); humidimeter, oven, scales balances, motor pumps, electronic scale balanced.
8.4	Remarks:	Different small materials needed.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

The experiment consist of runoff plots with size of 100 m^2 (5x20), 200 m^2 (5x40) and 1080 m^2 (18x60). The main two sites are about 1000 m apart, each site having a rainfall station with one rain recorder. (Daily rotation).

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Boli, Z.; Ziem, B.A. and Roose, E. (1994). Impact of Erosion on the productivity of Sandy alfisols under intensive cotton/maize cultivation in the Sudanese Savannah Zone of the Northern Cameroon: 8th ISCU Conference New-Delhi, 4-8 Dec. 1994.

Boli, Z.; Ziem, B.A. and Roose, E. Degradation. Erosion et restoration d'un sol ferrer gineux tropical sableux sous rotation intensive cotonnier/maï s en zone Sudanese, Northern Cameroon. Submitted to Aah. Pedo. ORSTOM.

1 CONTACT PERSON

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1.6	List other researchers involved:	Dr. Antonio Roldán Garrigós, D. Ignacio Querejeta Mercader

2 WATER EROSION

2.1	mm^2 - cm^2:	Dynamics of soil aggregation-
2.2	m^2:	Physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff; biological processes: plant cover evolution: degradation and recovery, dynamics of soil microbial populations.
2.6	Other scale or processes investigated:	Dynamics of soil moisture.

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

6.5 years: 3

Soil moisture dynamic (every two weeks).
Soil physical properties and biological processes, seasonally (every three months).
Hydroclimatology and soil losses (daily).

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1 Climate:

Rainfall: total rainfall, intensity and frequency.
Temperature.
Radication and evapotranspiration.

7.2	Topography:	Slope and length of hillslope.
7.3	Soils:	Physical properties: texture, aggregate stability, bulk density porosity, infiltration. Chemical properties: organic matter content, fertility.
7.4	Vegetation:	Plant cover. Species composition. Biomass
7.5	Management:	Soil rehabilitation techniques. Afforestation of degraded lands.
7.6	Others:	

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Rill and interill water erosion and its relation with land uses.
8.2	Location (town, state, country):	Región of Murcia (Spain).
8.3	Equipment involved:	Sets of experimental plots in field conditions. Automatic hydro-climatological station and datalogger. Sediment traps. Neutron probe and TDR equipment to analyze soil moisture dynamic.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

- Laboratory facilities for physical and chemical analysis of soil, water and sediments:
- Determination of soil erodibility percentage of stable aggregates, characterization of hydraulic properties of soils (pF, hydraulic conductivity) and evolution of soil organic matter and fertility.
- Facilities for experimentation with plants development in growth chamber conditions. Assessment of plants nutrients uptake. Determination of soil microbial populations.
- Advanced computer facilities for statistical and data analysis including software for geographical information systems.

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Albaladejo, J.; Castillo, V. and Roldán, A. (1991). Analysis evaluation and control of soil erosion processes in semiarid environment: S.E. Spain. En: Sala, Rubio y Garcia Ruiz (Eds): *Soil Erosion Studies in Spain*. 9-26; Editorials Geoforma. Logrono.

Roldán, A.; Díaz, G. and Albaladejo, J. (1992). Effect of VAM fungi on growth and phosphorus uptake of two Hedysarum species in a xeric terriorthent soil from S.E. Spain. *Arid Soil Research and Rehabilitation*. Vol. 6: 33-49.

Albaladejo, J.; Castillo, V. and Díaz, E. (1993). Runoff generation and soil loss in semiarid areas: effects of soil physical parameters. *Memorial Symposium to Jan De Ploey. Experimental geomorphology and landscape ecosystem changes*. Leuven. Belgium.

Roldán, A. and Albaladejo, J. (1993). Vesicular-Arbuscular Mycorrhiza (VAM) fungal population in a xeric Torriorthen receiving urban refuse. *Soil Biology and Biochemistry*, 25: 451-456. 1993.

Albaladejo, J.; Stocking, M.; Díaz, E. and Castillo, V. (1994). Land rehabilitation by urban refuse amendments in semiarid environment: effect on soil chemical properties. *Soil Technology*, 7: 249-260.

Albaladejo, J.; Castillo, V. and Martinez, M. (1994). Effect of vegetal cover on runoff and soil loss. *Annales Gephysicae Part II*. Supplement to Volume 12, p-142.

Albaladejo, J.; Martinez, M.; Garcia, C. and Castillo, V. (1994). changes in soil physical properties induced by soil degradation. *15th International Congress of Soil Science*. Vol. 2b, 250- 251.

Díaz, E.; Roldán, A.; Lax, A. and Albaladejo, J. (1994). Formation of stable aggregates in degraded soil by amendment with urban refuse and peat. *Geoderma*, 63: 277-288.

Albaladejo, J.; Castillo, V. and Martínez-Mena. (1994). EUROSEM: Preliminary validation in non-agricultural soil of semiarid Mediterranean area. In: R.J. Rickson (Ed): *Conserving Soil Resources: European Perspectives*. CAB International, Wallingford, UK.

Iax, A.; Díaz, E.; Castillo, V. and Albaladejo, J. (1994). Reclamation of physical and chemical properties of a salinized soil by organic amendment. *Arid Soil Research and Rehabilitation*. Vol. 8, pp 9-17.

Roldán, A.; García-Orenes, F. and Albaladejo, J. (1994). Mycrobial Populations in the Rhizosphere of *Brachypodium retusum* and their Relationship with stable aggregates in a semiarid soil of South-Eastern Spain. *Arid Soil Research and Rehabilitation*. Vol. 8, pp 105-114.

Roldán, A. and Albaladejo, J. (1994). Effect of mycorrhizal inoculation and soil restoration on the growth of *Pinus halepensis* seedlings in a semiarid soil. *Biology and Fertility of Soils*, 18: 143-149.

Albaladejo, J; Ortiz, R.; Guillen, F.; Alvarez, J.; Martinez, M. and Castillo, V. (1995). Erodibility of agricultural soils in the semiarid Mediterranean area of Spain. *Arid Soil Research and Rehabilitation*, 9: 219-216.

1 CONTACT PERSON

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1.6	List other researchers involved:	-

2 WATER EROSION

2.3	$100m^2$ - 10 000 m^2:	interrill and rill erosion

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE

Spatial scale considered:	Field scale. Experiments concern the measurement of the downslope movement of soil by tillage using tracers.

6 TEMPORAL SCALE OF EXPERIMENTS

Number of time units (below) the experiments cover;

Experiments mainly carried out to investigate mechanisms, independent of spatial scale.

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	-
7.2	Topography:	Effect of discharge slope on transporting capacity. Rill development.
7.3	Soils:	Effect of initial soil conditions on rill development. Effect of soil roughness on transporting capacity.
7.4	Vegetation:	
7.5	Management:	

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Interrill erosion, rill erosion, gully erosion.
8.2	Location (town, state, country):	Leuven, Belgium.
8.3	Equipment involved:	Experimental field plot equipped with interrill plots.
8.4	Remarks:	Study was carried out establishing a sediment budget at field scale.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

Experimental study of the transporting capacity of overland flow. Experimental study of the effect of initial soil conditions on rill generation and development. Experimental study on flow hydraulics, initiation of motion of in accelerated flow, grain mobility in overland flow.

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Rauws, G., Govers, G. 1988. Hydraulic and soil mechanical aspects of rill generation on agricultural soils. Journal of Soil Science 39, 111-124.

Govers, G. 1991. Time dependency of runoff velocity and erosion: the effect of the initial soil moisture profile. Earth Surface Processes and Landforms 16, 713-729.

Govers, G. 1992. Relationship between discharge, velocity and flow area for rills eroding loose, on-layered materials. Earth Surface Processes and Landforms 17, 515-528.

Govers, G. Evaluation of transporting capacity formulae for overland flow conditions, In: Overland low, Hydraulics and Erosion Mechanics. A.J. Parsons and A.D. Abrahams (eds.) UCL Press, London, 243-273.

Govers, G. and Loch, R.J. 1993. Effects of initial water content on the runoff erosion resistance of lay soils, Australian Journal of Soil Research, 31, 549-566.

Govers, G. Vandaele, K. Desmet, P. Poesen, J. 1994. Characterizing soil tillage as a geomorphological process. In: H.E. Jensen, P. Schjönning, S.A. Mikkelsen and K.B. adsen (eds.) Soil Tillage for Crop Production and Protection of the Environment, proceedings of the

13th ISTRO Conference, Aalborg, Denmark, 269-274.

Quine, T.A., Desmet, P.J., Vandaele, K., Govers, G. and Walling, D.E. 1994. A comparison of the roles of tillage and water erosion in landform development and sediment export on agricultural land, near Leuven, Belgium. Proc. of the IAHS symposium on variability in stream erosion and sediment transport. Canberra, December 1994.

Govers, G., Vandaele, K., Desmet, P., Poesen, J. and Bunte, K. in press. The role of soil tillage in oil redistribution on hillslopes. European Journal of Soil Science.

GCTE Focus 3 Erosion Network

Govers, G., Quine, T.A., Desmet, P.J.J. and Walling, D.E. The relative contribution of soil tillage and overland flow erosion to soil redistribution on agricultural land. Submitted to Earth surface Processes and Landforms.

1 CONTACT PERSON

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1.6	List other researchers involved:	Cammeraat, Bergkamp Cerdà, Boix-Fayos, Mulligen Mücher Kwaad.

2 WATER EROSION

2.1	mm^2 - cm^2:	-
2.2	m^2:	Biological processes in Mediterranean soils and from bacteria worms; sub-surface dynamics (piping), multiscaled research in Luxembourg.
2.3	runoff plot	-
2.4	small catchments (< 100 ha):	Have previous datasets from research programme in Luxembourg multi-scaled; gully erosion: previous research in Spain on gullies; sediment budgets: previous study in Luxembourg.
2.5	large catchments (> 100 ha):	Channel erosion: study in Luxembourg as part of sediment budget.

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

Mainly event or monthly

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	Yes: Transect studies.
7.2	Topography:	-
7.3	Soils:	-
7.4	Vegetation:	Effect of vegetation on soil properties infiltration - aggregation.
7.5	Management:	Effect on infiltration.

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Medalus Field Site in Guadalentin - soil, aggregation and infiltration on different land use types; Rainfall simulation studies. Monitoring of soil aggregation.
8.2	Location (town, state, country):	Various sites in SE Spain - Lorea - Benidorm.
8.3	Equipment involved:	Rainfall simulators; microcosm; micromorphology, TDR.. Fully instrumented catchments maintained in Luxembourg. Date available.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

Soil Physics Laboratory - fully equipped. Soil Micromorphology laboratory (Mücher). Soil Aggregation measurement equipment. Soil Erosion laboratory - Flumes; Runoff-erosion experiments. Soil Chemical laboratory -fully equipped

10 REMARKS

Have many types of data available from Research Projects to study soil erosion in Luxembourg and Spain. Many rainfall simulation experiments undertaken. Recent work is done often in context of 1g projects (MEDALUS; FPMES) which have "data bases" with useful reference information.

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1.6	List other researchers involved:	Dr. N. Danalatos

2 WATER EROSION

2.1	mm^2 - cm^2:	Dynamics of soil aggregation
2.2	m^2:	Soil surface dynamics: physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

6.1 events: events only

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.5 Management: The effect of land use on soil erosion rates.

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Plots 30 m^2 each (12 plots)
8.2	Location (town, state, country):	Spata, Attica, Greece

8.3 Equipment involved: Automatically recording of runoff in a data logger every 5 min.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Kosmas, C.S.; Moustakas, N.; Danalotos, N.G. and Yassoglou, N. (1995). The effect of land use change on soil properties and erosion along a catena. In: J. Thornes and J. Brandt (Eds), Mediterranean Desertification and Land Use. *J. Wiley and Sons*, Chichester (in press).

Kosmas, C.S.; Danalatos, N.G. and Yassoglou, N. (1995). The effect of parent material and land use on soil erosion rates under Mediterranean conditions. In: A. Grove (Ed), Mediterranean Europe: Desertification, sutainability, land and water management (in press).

Moustakas, N.; Kosmas, C.; Danalatos, N. and Yassoglou, N. Rock fragments I. (1995) Their effect on runoff, erosion and soil properties under field conditions, *Soil Use under Management J.* (in press).

1 CONTACT PERSON

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2 WATER EROSION

2.1	mm^2 - cm^2:	-
2.2	m^2:	soil surface dynamics: physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff
2.3	$100m^2$ - 10 000 m^2:	interrill erosion

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

Second (rainfall-runoff) to weekly (erosion - field - observations).

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	Rainfall.
7.2	Topography:	D.E.M.
7.3	Soils:	Pedology - soil moisture monitoring.
7.4	Vegetation:	Surface cover.
7.5	Management:	Working tools and practices.

7.6	Others:	Tracks of wheels.

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	-
8.2	Location (town, state, country):	Blosseville, Seine-maritime, Normandy, France.
8.3	Equipment involved:	Rainfall monitoring. tensionmeters - Neutron probe. Runoff/erosion plots. Rainfall simulator.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

Soil surface dynamics under simulated rainfall (1 m^2).
Physical degradation.
Runoff and interrill erosion.
Crust structure.
Dynamic of particle size distribution.

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Le Bissonnais, Y.; Bruand, A.and Jamagne, M. (1989). Laboratory experimental study of soil crusting: relation between aggregates breakdown and crust structure. *Catena*, 16, 377-392.

Le Bissonnais, Y. (1990). Experimental study and modelling of soil surface crusting processes. In: *Catena supplement 17: Soil Erosion-Experiments and models*. R.B. Bryan (Ed). 13-28.

Le Souder, C.; Le Bissonnais, Y.; Robert, M. and Bresson, L-M. (1990). Preventing crust formation with a mineral conditioner. In: *Soil Micromorphology,* Douglas (Ed). Elsevier. 81-87.

Le Souder, C.; Le Bissonnais, Y. and Robert, M. (1991). Influence of a mineral conditioner on the mechanisms of disaggregation and sealing of a soil surface. *Soil Science*. 152. 395-402.

Le Bissonnais, Y. and Singer, M.J. (1992). Crusting, runoff and erosion response to soil water content and successive rainfall events. *Soil Science Society American Journal* 56. 1898- 1903.

Le Bissonnais, Y.; Singer, M.J. and Bradford, J. (1993). Assessment of soil erodibility: the relationship between soil properties, erosion processes and susceptibility to erosion. In: *Farm land erosion in temperate plains environment and hills*. Wicherek (Ed). Elsevier. 87-96.

Le Bissonnais, Y. and Singer, M.J. (1993). Seal formation, runoff and interrill erosion from 17

California soils. *Soil Science Society American Journal*. 57. 224-229.

Le Bissonnais, Y. and Bruand, A. (1993). Crust micromorphology and runoff generation on silts soil materials during different seasons. *Catena supplement* 24. 1-16.

Singer, M.J. and Le Bissonnais, Y. (1994). Crusting and sealing in the soil erosion process. *Proc. of the Int. Conf. on Geomorphology*. Hamilton, J. thornes (Ed).

Le Bissonnais, Y. and Bruand, A. (1994). Relationship between aggregate breakdown, crust structure and interrill erosion. *Proceedings of the International Symposium on soil crusting*. February 1994. Brisbane, H.B. So (Ed),

Le Bissonnais, Y.; Renaux, B. and Delouche, H. (1994). Interactions between soil properties and moisture content in crust formation, runoff and interrill erosion from tilled loess soils. *Catena* (in press).

1 CONTACT PERSON

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1.6	List other researchers involved:	Professor Roland Schulze

2 WATER EROSION

2.1	mm^2 - cm^2:	Dynamics of soil aggregation
2.2	m^2:	soil surface dynamics: physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff, dependence of soil erodibility on water content; biological processes; bioessays of root densities in grassland soils/maize/cassava above ground biomass, buried biomass.
2.3	$100m^2$ - 10 000 m^2:	interrill and rill erosion: monitoring only; (ephemeral) gully erosion: monitoring only (specifically monitoring one gully in sugar cane estate).
2.4	small catchments (< 100 ha):	gully erosion: monitoring only; sediment budgets: monitoring 1 - 2 ha catchments.

2.6 other scale or processes investigated:

Nested catchment monitoring proposed in Umzindusi Valley.

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION

Plot studies. Maize, Sorghum (sugar cane main catchments + plots).

Cultivated forest with different preparation : pitting - ripping - ridging.

6 TEMPORAL SCALE OF EXPERIMENTS

Most experimental data is daily. Event based experimentation is break point. Catchment sediment sampling is flow based.

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	EI_{30}; rainfall vd EI_{30} monthly correlation studies. Daily rainfall. Temperature and Radiation, wind. Evaporation potential.
7.2	Topography:	Slopes. Aspect. Shape of slope. Convergence of flow.
7.3	Soils:	Physical and erosion mass yield. Hydraulic properties tested and/or extracted from surveys. Soil water status monitoring.
7.4	Vegetation:	Cover and type. RUSLE parameters.
7.5	Management:	Forestry preparation methods. Sugar cane terracing
7.6	Others:	-

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	(1) 1-2 ha monitoring of sediment yield, sugar cane fields. (2) RUSLE plots, including different vegetation preparations, w/c monitoring.
8.2	Location (town, state, country)	(1) Stanger, KwaZulu Natal, South Africa. (2) Throughout Kwazulu, Natal, South Africa.
8.3	Equipment involved:	(1) Sediment sampling; automatic and turbidity meter. Weather station. Runoff flumes infiltration characteristics testing (disc and double ring infiltrometer (2) USLE plot, with sediment sampling tanks. Weather station. Neutron probe soil water monitoring in USLE plots. (3) Automatic flow related sampling in stream and fertility.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied: Soils retention and hydraulic characteristics. Soils textures and density. Turbidity meter development and testing.

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Kienzle and Lorentz (1993). Production of a soil erodibility map for the Henley Dam Catchment, Natal using a GIS approach. In: Lorentz *et al*. 6th South African National Hydrology Symposium XII Proceedings.

Howe and Lorentz (1995). Sediment yield modelling in the Henley catchment. South African Agricultural Engineering Journal (in press).

1 CONTACT PERSON

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2 WATER EROSION

2.1	mm^2 - cm^2:	Dynamics of soil aggregation
2.2	m^2:	soil surface dynamics: physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff: influence of tillage (mulched, ridged, ripped or ploughed) on run-off and infiltration; biological processes: the effect of ground cover (crop, mulch and weed) on run-off and subsequent soil loss.
2.3	100 m^2 - 10 000 m^2:	interrill and rill erosion: sheet erosion is quantified on arable land (cropped and bare plots).

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

Tillage erosion assessment on 300 m^2 run-off plots. Five tillage systems are being tested on their effect on erosion. Can newly developed conservation tillage techniques reduce erosion to tolerable levels? Conventional mould board ploughing serves as the basis for comparison.

6 TEMPORAL SCALE OF EXPERIMENTS

6.1	events:	Yes
6.2	days:	Yes

6.3	weeks:	Yes
6.4	months:	-
6.5	years:	Yes
6.6	remarks:	

+ the experiment has been on-going since 1988/89 and 1996/97 might be its final year. Validation of an already existing soil erosion model (SLEMSA) will be done.

Met data is collected daily. Run-off and soil loss quantification is done on an event basis i.e. after every storm. Ground cover, plant growth parameters and soil moisture measurements are carried out weekly. Yield assessment and some soil analyses are done annually.

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	Daily rainfall (quantity, intensity), evaporation.
7.2	Topography:	Slopes (length and steepness fixed).
7.3	Soils:	Hydraulic conductivity, water retention, bulk density, texture, organic matter, aggregate stability, soil moisture and analysis of sediments.
7.4	Vegetation:	None
7.5	Management:	Maize production suitable for small scale and communal farming, land is tilled using ox-drawn implements.

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	(1) Quantification of soil loss and run-off from 300 m^2 run-off plots. Treatments include one bare fallow and four tillage systems.
8.2	Location (town, state, country):	(1) Makoholi Research Station, Masvingo, Zimbabwe. (2) Domboshawa Training Centre, Harare, Zimbabwe.
8.3	Equipment involved:	Sediment tanks; spectrophotometer; double ring

infiltrometer; neutron probe weather station; crop cover frames.

8.4 Remarks: Neutron probe and weather station currently out of order.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

Soil retention:	pressure pots
Hydraulic conductivity:	permeameter
Aggregate stability:	wet sieving
Bulk density:	ring
Texture:	hydrometer

10 REMARKS

During three of the nine years (1993/94 to 1995/96) sediments have not only been quantified but they also have been analysed for N, P, K, Ca, Mg, organic matter, texture. The nutrients lost as a result of erosion will be compared relative to nutrient losses due to leaching and plant uptake.

Productivity loss due to erosion is being quantified, where topsoil is artificially removed from plots and yield assessed (scalping depths of 0; 5; 10; 15 and 20 cm).

11 LIST RELEVANT PUBLICATIONS

Moyo A. and J. Hagmann, 1994**.** Growth-effective rainfall in maize production under different tillage systems in semi-arid conditions and shallow granitic sands of southern Zimbabwe. In proceedings of 13th International Soil Tillage Research Organisation Conference, Vol. 1, pp 475-480. Aalborg, Denmark.

Moyo, A. 1996. The effect of soil erosion on soil productivity as influenced by tillage: with special reference to clay and organic matter losses. Paper presented at the ISCO Conference in Bonn, August, 1996. (In press).

Moyo, A. 1996. Summary results of the on-station results at Makoholi: 1988-1995. (Not yet published).

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2 WATER EROSION

2.1	mm^2 - cm^2:	Dynamics of soil aggregation
2.2	m^2: soil surface dynamics:	physical degradation: (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

6.1	events:	20 minutes to 1 hour.
	Temporal resolution	Annual.

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	-
7.2	Topography:	-
7.3	Soils:	-
7.4	Vegetation:	Semi-arid grassland and shrubland.

7.5 Management: -

7.6 Others: -

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1 Erosion process: Rainfall simulations.

8.2 Location (town, state, country): Tombstone, Arizona, USA. Las Cruces, New Mexico, USA.

8.3 Equipment involved: Fixed nozzle simulator on plots ranging in size from 1 m^2 to 500 m^2

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

Laboratory equipped to simulate shallow rain-impacted overland flow. Uses flumes. Variable-intensity rainfall simulator.

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Abrahams, A.D., Parsons, A.J. and Luk, S.H. (1986) Field measurement of the velocity of overland flow using dye tracing. Earth Surface Processes and Landforms, 11(6), 653-657.

Abrahams, A.D., Parsons, A.J. and Luk, S.H. (1986). Resistance to overland flow on desert hillslopes. Jour. Hydrology, 88 (3/4), 343-363.

Luk, S.H., Abrahams, A.D. and Parsons, A.J. (1986). A simple rainfall simulator and trickle system for hydro-geomorphological experiments. Physical Geography, 7, 344-356.

Parsons, A.J. and Abrahams, A.D. (1987). Gradient-particle size relations on quartz monzonite debris slopes in the Mojave Desert. Jour. Geol., 95, 423-432.

Abrahams, A.D., Parsons, A.J. and Luk, S.H. (1988). Threshold relations for the transport of sediment by overland flow on desert hillslopes, Earth Surface Processes and Landforms, 13(5), 407-419.

Abrahams, A.D., Parsons, A.J. and Luk, S.H. (1988). Hydrologic and sediment responses to simulated rainfall on desert hillslopes in Southern Arizona, Catena, 15(2), 103-117.

Abrahams, A.D., Parsons, A.J. and Luk, S.H. (1989). Distribution of depth of overland flow on desert hillslopes and its implications for modelling soil erosion, Jour. Hydrology, 106, 177-184.

Parsons, A.J. and Abrahams, A.D. (1989). A miniature flume for sampling interrill overland flow, Physical Geography, 10, 96-105.

Abrahams, A.D., Parsons, A.J. and Luk, S.H. (1990). Field experiments on resistance to overland flow, Arizona, Interl. Sci. Hydrology Bull., 189, 1-18.

Abrahams, A.D. and Parsons, A.J. (1990). Determining the mean depth of overland flow in field studies of flow hydraulics, Water Resources Research, 26, 501-503.

Parsons, A.J., Abrahams, A.D. and Luk, S.H. (1990). Hydraulics of interrill overland flow on a semi-arid hillslope, Southern Arizona, Jour. Hydrology, 117. 255-273.

Abrahams, A.D. and Parsons, A.J. (1991). Relation between infiltration and stone cover on a semiarid hillslope, Southern Arizona, Jour. Hydrology, 122, 49-59.

Abrahams, A.D., Parsons, A.J. and Luk, S.H. (1991). The effect of spatial variability in overland flow on the downslope pattern of soil loss on a semi-arid hillslope, Southern Arizona, Catena, 18, 255-270.

Parsons, A.J., Abrahams, A.D. and Luk, S.H. (1991). Size characteristics of sediment in interrill overland flow on a semi-arid hillslope, Southern Arizona, Earth Surface Processes and Landforms, 16, 143-152.

Abrahams, A.D. and Parsons, A.J. (1991). Relation between sediment yield and gradient on debris-covered hillslopes, Walnut Gulch, Arizona, Geographical Society of America, Bulletin, 103, 1109-1113.

Abrahams, A.D. and Parsons, A.J. (1991). Resistance to overland flow on desert pavement and its implications for sediment transport modelling, Water Resources Research, 27, 1827-1836.

Parsons, A.J., Abrahams, A.D. and Simanton, J.R. (1992). Microtopography and soil-surface materials on semi-arid piedmont hillslopes, Southern Arizona, Jour. Arid Environments, 22, 107-115.

Parsons, A.J. and Abrahams, A.D. (1992). Controls on sediment removal by interrill overland flow on semi-arid hillslopes, Israel Jour. Earth Sciences, 41, 177-188.

Luk, S.H., Abrahams, A.D. and Parsons, A.J. (1992). Sediment sources and sediment transport by rill flow and interrill flow on a semi-arid piedmont slope, Southern Arizona, Catena, 22, 93-111.

Parsons, A.J., Wainwright, J. and Abrahams, A.D. (1993). Tracing sediment movement in interrill overland flow on a semi-arid grassland hillslope using magnetic susceptibility, Earth Processes and Landforms, 18, 721-732.

Parsons, A.J., Abrahams, A.D. and Wainwright, J. (1994). Resistance to overland flow on semiarid grassland and shrubland hillslopes, Walnut Gulch, Southern Arizona, Jour. Hydrology, 156. 431-446.

Parsons, A.J., Abrahams, A.D. and Wainwright, J. (1994). Rainsplash and erosion rates in an interrill area on semi-arid grassland, Southern Arizona, Catena, 22, 215-226.

Abrahams, A.D. and Parsons, A.J. (1994). Hydraulics of interrill overland flow on stone-covered desert surfaces, Catena 23, 111-140.

Parsons, A.J., Abrahams, A.D. and Wainwright, J. (1994). On determining resistance to interrill overland flow, Water Resources Research 30, 3515-3521.

Wainwright, J., Parsons, A.J. and Abrahams, A.D. (1995). A simulation study of the role of splash erosion in the formation of desert pavements, Earth Surface Processes and Landforms 20, 277-291.

Abrahams, A.D., Parsons, A.J. and Wainwright, J. (1995). Controls and determination of resistance to overland flow on semiarid hillslopes, Walnut Gulch. Jour. Soil and Water Conservation, 50, 457-460.

Abrahams, A.D., Parsons, A.J. and Wainwright, J. (1995). Effects of vegetation change on interrill runoff and erosion, Walnut Gulch, Southern Arizona. Geomorphology, 13, 37-48.

Abrahams, A.D., Li, G. and Parsons, A.J. (1995). Rill hydraulics on a semi-arid hillslope, Southern Arizona, Earth Surface Processes and Landforms (in press).

Parsons, A.J., Abrahams, A.D. and Wainwright, J. (1995). Responses if interrill runoff and erosion rates to vegetation change in Southern Arizona, Geomorphology (in press).

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2 WATER EROSION

2.1 mm^2 - cm^2: Dynamics of soil aggregation

2.2 m^2: soil surface dynamics: physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff

3 WIND EROSION

Field plots. Small agricultural catchments.

4 MASS MOVEMENTS -

5 TILLAGE EROSION

Spatial scale considered: Catena scale.

6 TEMPORAL SCALE OF EXPERIMENTS

6.1 events: yes

6.2 days yes

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1 Climate: -

7.2 Topography: -

7.3 Soils: Effects of soil texture and rock fragment content.

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Gully erosion.
8.2	Location (town, state, country):	Leuven, Belgium. Almeria, Spain.
8.3	Equipment involved:	-
8.4	Remarks:	Volumetric measurements of soil loss by gullying.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

Laboratory for exp. geomorphology. Rainfall simulators. Interrill flumes. Hydraulic channels.

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Poesen, J. 1985. An improved splash transport model. Zeitschrist für Geomorphologie 29(2): 193-211.

De Ploey, J. and Poesen, J. 1985. Aggregate stability, runoff generation and interrill erosion. In: K. Richards, r. Arnett, and S. Ellis (eds.) Geomorphology and Soils. George Allen & Unwin, Hempstead, England: 99-120.

Govers, G. and Poesen, J. 1986. A field-scale study of surface sealing and compaction on loam and sandy loam soils. Part I: Spatial variability of soil surface sealing and crusting. In: F. Callebaut, D. Gabriels, and M. De Boodt (eds.) Assessment of soil surface sealing and crusting. R.U. Gent: 171-182.

Poesen, J. and Govers, G. 1986. A field-scale study of surface sealing and compaction on loam and sandy loam soils. Part II: Impact of soil surface sealing and compaction on water erosion processes. In: F. Callebaut, D. Gabriels and M. De Boodt (eds.) Assessment of soil surface sealing and crusting. R.U. Gent: 183-193.

Poesen, J. 1987. Transport of rock fragments by rill flow: a field study. In: r. Bryan (ed.) Rill erosion. Catena Supplement 8: 35-54.

Poesen, J. and Torri, D. 1988. The effect of cup size on splash detachment and transport measurements. Part I Field measurements. In: A. Imeson and M. Sala (eds.) Geomorphic Processes in Environments with strong seasonal contrasts. Volume 1 Hillslope Processes. Catena Supplement 12: 113-126.

Govers, G. and Poesen, J. 1988. Assessment of the interrill and rill contributions to total soil loss from an upland field plot. Geomorphology 1: 343-354.

Poesen, J. 1988. A review of the studies on the mechanisms of incipient rilling and gullying in the Belgian Loam Region. In: C.I. Ijioma, S. Ananaba and T. Boers (eds.) Proceedings of the International Symposium on Erosion in S.E. Nigeria. Federal University of Technology, Owerri, Nigeria 1: 13-20.

Poesen, J. and Bryan, R. 1989-90. Influence de la longuer de pente sur le ruissellement: role de la formation de la formation de rigoles et de croutes de sédimentation. Cahiers ORSTOM, série Pédologie, 25(1-2): 71-80.

Poesen, J. 1989. Conditions for gully formation in the Belgian Loam Belt and some ways to control them. Soil Technology Series 1: 39-52.

Poesen, J. and Torri, D. 1989. Mechanisms governing incipient motion of ellipsoidal rock fragments in concentrated overland flow. Earth Surface Processes and Landforms 14: 469- 480.

Poesen, J. and Govers, G. 1990. Gully erosion in the loam belt of Belgium : typology and control measures. In: J. Boardman, D.L. Foster, J.A. Dearing (eds.) Soil Erosion on Agricultural Land. J. Wiley, Chichester, U.K. 513-530.

Poesen, J. 1990. Conditions for the evacuation of rock fragments from cultivated upland areas during rainstorms. In Erosion, Transport and Deposition Processes, International Association of Hydrological Sciences Publication 189: 145-160.

Poesen, J. and Lavee, H. 1991. Effects of size and incorporation of synthetic mulch on runoff and sediment yield from interrills in a laboratory study with simulated rainfall. Soil and Tillage Research 21: 209-223.

Poesen, J. and Ingelmo-Sanchez, F. 1992. Runoff and sediment yield from topsoils with different porosity as affected by rock fragment cover and position. Catena, 19: 451-474.

Poesen, J. 1992. Mechanisms of overland flow generation and sediment production on loamy and sandy soils with an without rock fragments. In: A.J. Parsons and A.D. Abrahams (eds.) Overland Flow Hydraulics and Erosion Mechanics. UCL Press, London: 275-305.

Bunte, K. and Poesen, J. 1993. Effects of rock fragment covers on erosion and transport of noncohesive sediment by shallow overland flow. Water Resources Research 29(5): 1415-1424.

Poesen, J. and Lavee, H. 1994. Rock fragments in top soils: significance and processes. Catena 23: 1-28.

Torri, D., Poesen, J., Monaci, F. and Busoni, E. 1994. Rock fragment content and soil bulk density. Catena 23: 65-71.

Poesen, J., Torri, D. and Bunte, K. 1994. Effects of rock fragments on soil erosion by water at different spatial scales: a review. Catena 23: 141-166.

Vandaele, K. and Poesen, J. in press. Spatial and temporal patterns of soil erosion rates in an agricultural catchment, central Belgium. Catena.

1 CONTACT PERSON

1.1	Name	Dr. Adisak Sajjapongse
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1.6	List other researchers involved:	Collaborators: IBSRAM Network

2 WATER EROSION

2.1	mm^2 - cm^2:	Dynamics of soil aggregation
2.2	m^2:	soil surface dynamics: physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff; biological processes; sub-surface dynamics (piping)
2.3	$100m^2$ - 10 000 m^2:	interrill and rill erosion; (ephemeral) gully erosion

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

6.5	years:	Some sites running for five years now.
6.6	remarks:	-
	Temporal resolution	Daily - annual.

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	Usual parameters.
7.2	Topography:	-
7.3	Soils:	Vary from site to site.

7.4	Vegetation:	Various cover crops and tree hedgerows.
7.5	Management:	Variations in nutrient input.

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Runoff and soil loss.
8.2	Location (town, state, country):	China, Indonesia, Laos, Malaysia, Philippines, Thailand and Vietnam.
8.3	Equipment involved:	Meteorological station and runoff collection systems.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

All the cooperators have their own laboratory to analyze both physical and chemical properties of the soils collected from the experimental plots, including erosion samples. The analyses include N, P, K, OM, pH, CEC, Ca, Mg, aggregate stability, Db and mechanical analysis.

10 REMARKS

11 LIST RELEVANT PUBLICATIONS

Annual reports of the network. Proceedings. Network Newsletter "SLOPES".

1 CONTACT PERSON

1.1 Name Dino Torri

1.2 Address C.N.R. C.S. Genesi, Classificazione e Cartografia del Suolo P. Le delle Cascine, 15 50144 Firenze, ITALY.
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1.6 List other researchers involved: E Busoni, L. Borselli, C. Calzolary, S. Carnicelli, A. Colica, M. de Sette, U. Galligani, F. Monaci

2 WATER EROSION

2.2 m^2: Soil surface dynamics: physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff; sub-surface dynamics (piping) and seepage.

2.3 $100m^2$ - 10 000 m^2: Interrill and rill erosion; ephemeral) gully erosion

2.4 small catchments (< 100 ha): Gully erosion

2.6 other scale or processes investigated: Badland dynamics.

3 WIND EROSION -

4 MASS MOVEMENTS

Spatial scale and relevant processes sensitive to changes in climate and land use, and the hypothesis which is being tested.

10 ha; surficial mass movements (e.g. slumps and solifluctions) sensitive to climate and land use changes.

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

6.1	events:	50-60 2-5 minutes.
6.2	days:	-
6.3	weeks:	-
6.4	months:	-
6.5	years:	5, several months.
6.6	remarks:	-

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.	Climate:	Rainfall characteristics, temperature, wind.
7.2	Topography:	Aspect, slope, length, surface depression.
7.3	Soils:	Dynamics of aggregate size distribution and stability, cohesion, soil resistance dynamics.
7.4	Vegetation:	Effects on erosion - soil forming processes.
7.5	Management:	-
7.6	Others:	Lithology

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Rainfall simulation (rill/interrill/sealing/working/infiltration) pins and terrestrial photogrammetry, field survey.
8.2	Location (town, state, country):	Scarperia, Tuscany, Italy. Valley of the river Era, Tuscany, Italy. Valley of the river Orcia, Tuscany, Italy.
8.3	Equipment involved:	Rainfall simulators, profilometers, other equipment specifically designed (e.g. flow depth and velocity metering).

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

Rainfall simulator, overland flow transport flume, overland floe detachment flume, flow depth and velocity meter, soil surface profilometer, soil physics laboratory.

10 REMARKS -

11 LIST RELEVANT PUBLICATIONS

Torri, D., and Borselli, L. 1991. Overland flow and soil erosion: some processes and their interactions. Catena Supplement No 9, pp 129-137.

Torri, D., and Poesen, J. 1992. The effect of soil surface slope on rain drop detachment. Catena, 19, No 6, pp 561-578, Cremlingen.

Torri, D., Poesen, J., Monaci, F., and Busoni, E. 1994. Rock fragment content and fine bulky density. Catena, Vol 23m pp 65-71.

1 CONTACT PERSON

1.1	Name	Douwe S. Vanderwel
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1.6	List other researchers involved:	Ralph Wright Andrzej (Andy) Jedrych

2 WATER EROSION

2.1	mm^2 - cm^2:	Dynamics of soil aggregation
2.2	m^2:	soil surface dynamics:Correlation of t_c and WEPP K_r, K_i values to over 20 soil physical and chemical properties; physical degradation (surface sealing, crusting) and its impact on surface roughness, infiltration and runoff
2.3	$100m^2$ - 10 000 m^2	2 runoff plots < 200 m^2. 2 catchment field plots < 1 ha. Measurement of both Spring snowmelt and Summer rainstorm driven erosion events.
2.4	small catchments (< 100 ha):	-
2.5	large catchments (> 100 ha):	-
2.6	other scale or processes investigated:	Nested catchment monitoring proposed in boreal forest.

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

6.1	events:	Yes
6.2	days:	Yes

6.3	weeks:	Yes
6.4	months:	Yes
6.5	years:	Yes
6.6	remarks:	Precipitation/climate (1 minute), runoff (10 minutes), sediment (event total).

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	Wind, solar radiation, precipitation (rainfall intensity, snow), humidity, temperature.
7.2	Topography:	Complete topography.
7.3	Soils:	Soil moisture (continuous TDR 12 mo.), frost depth (continuous), soil temperature, bulk density.
7.4	Vegetation:	Crop, crop yield biomass, canopy cover, crop residue.
7.5	Management:	Crop rotation, cultivation, surface disturbance, tillage equipment.

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Rill erosion: introduced flowing water along constructed rills. Hydraulic and soil parameters measured. Soil detachment due to hydraulic shear, critical hydraulic shear measured.
8.2	Location (town, state, country):	25 sites throughout the Province of Alberta.
8.3	Equipment involved:	Flow meter, water supply, pumps, rill meters, scales, bottles, survey equipment.
8.4	Remarks:	A comprehensive and extensive field study with excellent results to date. Measurement of WEPP K_t and t_c parameters.

9 LABORATORY EXPERIMENTS

Description of the laboratory and the type of experiments and equipment involved for each of the erosion processes studied:

Interrill erosion: 25 soils are tested in a laboratory environment with a rainfall simulator. Soil loss is measured. Measurement of the WEPP K_i parameter.

10 REMARKS

Interrill erosion is measured in conjunction with rill erosion for soils throughout the Province of Alberta.

11 LIST RELEVANT PUBLICATIONS

1. Measuring WEPP rill erodibility parameters (K_r and t_c) in Alberta. C. R. Wright and D. S. Vanderwel, 34th Annual Alberta Soil Science Workshop, Calgary, Alberta. February 1997.

2. A method for determining WEPP rill erodibility parameters for use in water erosion modelling. C. R. Wright and D. S. Vanderwel. IRMD Applied Research Rep. 1995.

1 CONTACT PERSON

1.1	Name	Dr. Brad Wilcox
1.2	Address	Chief Scientific Officer, IAI, Av. dos Astronautas, 1758, 12227-010 Sao Jose dos Camos SP, BRAZIL
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1.6	List other researchers involved:	David Breshears, John Pitlick.

2 WATER EROSION

2.1	mm^2 - cm^2:	Dynamics of soil aggregation
2.2	m^2:	Numerous microplots (1-4m^2). 6 plots (30m^2).
2.3	100m^2 - 10 000 m^2:	3 hillslope scale study areas.

3 WIND EROSION -

4 MASS MOVEMENTS -

5 TILLAGE EROSION -

6 TEMPORAL SCALE OF EXPERIMENTS

6.1	events:	yes
6.2	days:	yes
6.3	weeks:	-
6.4	months:	-
6.5	years:	-
6.6	remarks:	Experiments began June 1993.

Data are collected continuously. At this point two years of data on the hillslope scale and four years of data at the plot (30 m^2) scale.

7 DESCRIPTION OF EROSION FACTORS STUDIED

7.1	Climate:	Wind, precipitation, temperature rel. humidity.
7.2	Topography:	Detailed surveys on each site.
7.3	Soils:	K_s, texture.
7.4	Vegetation:	Cover.
7.5	Management:	Semiarid natural. No domestic grazing.

8 FIELD EXPERIMENTS

Description of the field site and of the type of experiments and equipment involved for each of the erosion processes being studied:

8.1	Erosion process:	Runoff occurs from intense summer thunderstorms, snowmelt and prolonged frontal storms.
8.2	Location (town, state, country):	Los Alamos, New Mexico, USA.
8.3	Equipment involved:	TDR, soil temperature gauges, runoff plots, weather station, automatic data acquisition equipment.

9 LABORATORY EXPERIMENTS -

10 REMARKS

11 LIST RELEVANT PUBLICATIONS (continue on separate sheet, if necessary)

Wilcox, B. 1994 Runoff and erosion in P-J ecosystems. Journal of Range Management.

Wilcox, B. and Breshears, D. 1994. Hydrology: Ecology of P-J woodlands. Forest service conference on Pinyion -juniper.

Wilcox, B. *et al* 1995. Frijoletos Experimental Watershed. Journal of Soil and Water Conservations (in press).

SECTION III

MONITORING METADATA

1	**Contact person**	
1.1	Name	Dr J Albaladejo
1.2	Address	CEBAS-CSIC, P O Box 4195, 30080 Murcia, Spain
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1.6	Other researchers involved:	Dr V Castillo, Dr E Diaz, Dr Martinez-Mena.
2	**Survey Details**	
2.1	Dates of erosion monitoring survey:	From 1988
2.1	Water/wind erosion?	Water
2.3	Area monitored:	Fortuna Basin, S.E. Spain. 200 Km^2.
2.4	Character of area:	Catchment of marks with "bad-lands". Torriorthent and xerorthent soils. 40% agricultural land; 30% marginal land and 30% open matorral.
2.5	Frequency of monitoring:	Erosion parameters every event. Soil and site parameters every 6 months or yearly.
2.6	What fraction of fields in the monitored area were included in the survey?	The area with open matorral.
2.7	How were estimates of erosion made?	Total soil loss, hydrograph and pluviograph.
2.8	Were air photographs used?	Available

2.9 For each erosion site, information recorded:

a) Soil Data	Soil type; roughness; bulk density; moisture content; percentage stone cover; textural analysis; soil moisture characteristics; percentage of stable aggregates; saturated hydraulic conductivity; organic matter; total nitrogen; nutrients; soil temperature.
b) Site data.	Soil use and management; vegetation proportions; slope profile; number and size of rills and gullies; percentage stoniness; air temperature.
c) Vegetation.	Percentage cover; percentage basal cover; type of vegetation.
d) Event data.	Storm duration; rain-gauge chart; total runoff; hydrograph; sediment weight.

2.10	Data obtained from elsewhere:	None
2.11	Data calculated from above information:	Erosion rate, runoff coefficient hydrographs.

2.12	Meterological station density and type:	4 pluviographs connected to datalogger, 2 sensors of soil temperature.
2.13	Length of record of meterological data:	Automatic gauge from 1989.

3. Associated Work

3.1	Associated experimental or plot-based work:	Effect of urban refuse amendment. Changes in soil quality and degradation processes with vegetation removal.
3.2	Associated modelling work:	The data are being used for validation of EUROSEM (Albaladejo *et al*., 1994).

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

Albaladejo, J.; Ortiz, R. and Martinez, M. (1988). Evaluation and mapping of erosion risks: An example from S.E. Spain. Soil Technology, 1:77-87.

Albaladejo, J. and Stocking, M. (1989). Comparative evaluation of two models in predicting storm soil loss from erosion plots in semiarid Spain. *Catena*, 16:227-236.

Stocking, M. and Albaladejo, J. (1994). Refuse isn't Rubbish. *Ambio*, 23:229-232.

Albaladejo, J.; Stocking, M.; Diaz, E. and Castillo, V. (1994). Land rehabilitation by urban refuse amendments in semiarid environment: effect on soil chemical properties. *Soil Technology*, 7:249-260.

Diaz, E.; Roldan, A.; Lax, A. and Albaladejo, J. (1994). Formation of stable aggregates in degraded soil by amendment with urban refuse and peat. *Geoderma*, 63:277-288.

Albaladejo, J.; Ortiz, R.; Guillen, F.; Martinez, M. and Castillo, V. (1995). Erodibility of agricultural soils in the semiarid Mediterranean area of Spain. *Arid Soil Research and Rehabilitation*, 9:219-216.

Albaladejo, J. (1990). Impact of the degradation processes on soil quality in arid Mediterranean environments. In: Rubio and Rickson (Eds): *Strategies to combat desertification in Mediterranean Europe*. EUR 11175:193-215;. Editorial: Office for Official Publications of the European Communities.

Albaladejo, J.; Diaz, E. (1990). Degradacion y regeneracion del Suelo en el litoral Mediterraeno Espanol: Experiencias en el Proyecto LUCDEME. En: Albaladejo, Stocking y Diaz (Eds): *Soil Degradation and Rehabilitation in Mediterranean Environmental Conditions*. 191.214; Editorial CSIC. Murcia.

GCTE Focus 3 Erosion Network

Albaladejo, J.; Stocking, M. and Diaz, E. (1990) *Soil Degradation and Rehabilitation in Mediterranean Environmental Conditions*. Editorial CSIC. Murcia. 235pp.

Albaladejo, J.; Castillo, V. and Roldan, A. (1991). Analysis evaluation and control of soil erosion processes in semiarid environment: S.E. Spain. En: Sala, Rubio y Garcia Ruiz (Eds): *Soil Erosion Studies in Spain*. 9-26; Editorial Geoforma. Logrono.

Albaladejo, J; Castillo, V. and Martinez-Mena, M. (1994). EUROSEM: Preliminary validation in non-agricultural soil of semiarid Mediterranean area. In: R.J. Rickson (Ed): *Conserving Soil Resources: European Perspectives*. CAB International Wallingford, UK.

Albaladejo, J. (1995). Estimating erosion rates: Field experiments. In: D. Peter, J.L. Rubio and R. Fantechi (Eds): *Desertification in a European context: Physical and socioeconomic aspects.* Commission of the European Communities. Luxembourg. (En prensa).

Albaladejo, J.; Castillo, V. and Diaz, E. (1993). Runoff generation and soil loss in semiarid areas: effects of soil physical parameters. *Memorial Symposium to Jan De Ploey. Experimental Geomorphology and landscape ecosystem changes.* Leuven. Belgium.

Albaladejo, J.; Castillo, V. and Martinez, M. (1994). Effect of vegetal cover on runoff and soil loss. *Annales Gephysicae Part II.* Supplement to Volume 12, p-142.

4.2 Other relevant publications:

Roldan, A.; Diaz, G. and Albaladejo, J. (1992). Effect of VAM fungi on growth and phosphorus uptake of two Hedysarum species in a xeric terriorthent soil from S.E. Spain. *Arid Soil Research and Rehabilitation*. Vol. 6: 33-49.

Diaz, G.; Roldan, A. and Albaladejo, J. (1992). Influencia del tipo de suelo sobre las pautas de colonizacion y eficiencia en la simbiosis micorricia de seis especies de Glomus. *Cryptogamie-Mycologie*, 13(1): 47-56.

Roldan, A. and Albaladejo, J. (1993). Vesicular-Arbuscular Mycorrhiza (VAM) fungal population in a xeric Torriorthent receiving urban refuse. *Soil Biology and Biochemistry*, 25: 451-456. 1993.

Lax, A.; Diaz, E.; Castillo, V. and Albaladejo, J. (1994). Reclamation of physical and chemical properties of a salinized soil by organic amendment. *Arid Soil Research and Rehabilitation*. Vol. 8, pp 9-17.

Roldan, A.; Garcia-Orenes, F. and Albaladejo, J. (1994). Mycrobial Populations in the Rhizosphere of *Brachypodium retusum* and their relationship with stable aggregates in a semiarid soil of South Eastern Spain. *Arid Soil Research and Rehabilitation*. Vol. 8, pp 105-114.

Roldan, A. and Albaladejo, J. (1994). Effect of mycorrhizal inoculation and soil restoration on the growth of *Pinus halepensis* seedlings in a semiarid soil. *Biology and Fertility of Soils*. 18: 143-149.

Castillo, V. and Albaladejo, J. (1992). Modelos para la prediccion de la erosion hidrica: Estado actual y nuevas lineas de investigacion. *Ecosistemas*, 3: 28-30.

Roldan, A.; Thornes, J.B. and Albaladejo, J. Aggregate formation in a semiarid soil after treatment with different organic inputs. *Arid Soil Research and Rehabilitation* (In Press).

Lopez Bermudez, F. and Albaladejo, J. (1990). Factores ambientales de la degradacion de suelo en condiciones ambientales mediterraneas. En: J. Albaladejo, M. Stocking and E. Diaz (Eds): *Soil degradation and rehabilitation in Mediterranean Environmental Conditions*: 15-45; Editorial: CSIC. Murcia.

Albaladejo, J. (1995). Soil rehabilitation. Case study in Murcia. In: D. Peter; J.L. Rubio and R. Fantechi (Eds): *Desertification in a European Context: Physical and socio-economic aspects*. Commission of the European Communities. Luxembourg. (In Press).

5. Availability

5.1	Erosion/land use data:	On request subject to GCTE policy
5.2	Meterological data:	On request

6. Other Information

6.1	Is the monitoring survey ongoing?	Yes
6.2	Funding agency for the survey:	CSIC (research salary); EC for plot studies
6.3	Any other details:	

1 Contact person

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1.6	Other researchers involved:	None

2 Survey Details

2.1	Dates of erosion monitoring survey:	1982-91
2.1	Water Erosion	
2.3	Area monitored:	South Downs, Southern England c. 36 km^2 farmland
2.4	Character of area:	Rolling chalk downland; thin rendzina soils (c.20 cm); arable and grazing l and; cool temperate oceanic climate
2.5	Frequency of monitoring:	Varied depending on rainfall distribution; fields inspected c. 10x in winter; measurements 1-3x per season
2.6	What fraction of fields in the monitored area were included in the survey?	Only fields that eroded
2.7	How were estimates of erosion made?	Measurement of volume of rills and gullies; depth of fans
2.8	Were air photographs used?	Available for some years but not relied upon
2.9	For each erosion site, information recorded:	Location (National Grid Reference). Contributing area (ha - from map). Slope length (m - from map). Gradient (deg - from clinometer). Slope shape (convex etc. - from map). Erosion form (valleyside etc.). Volume soil moved (m^3). Crop type. -Soil type. Management factors (wheel tracks etc.)
2.10	Data obtained from elsewhere:	Rainfall responsible for erosion. Some soil samples taken and analysed

2.11	Data calculated from above information:	Erosion rate (m^3/ha). Timing of erosion (date)
2.12	Meterological station density and type:	Five NRA manual daily rain gauges in area; one automatic gauge c. ^{2} km from area
2.13	Length of record of meterological data:	Start of daily recording ranges from 1950 to 1975; one gauge closed 1988. Automatic gauge from 1990

3. Associated Work

3.1	Associated experimental or plot-based work:	Plots 1985-86 (Robinson and Boardman, 1988); aggregate stability. (Blackman, 1992); Caesium-137 (e.g. Quine and Walling, 1993)
3.2	Associated modelling work:	Rainfall Index (e.g. Boardman and Favis-Mortlock, 1993); GAMES. (Favis-Mortlock, 1994); GLEAMS. (Favis-Mortlock, 1994); EPIC (e.g. Favis-Mortlock et al., 1991) WEPP. (Favis-Mortlock, 1994)

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

Boardman, J. (1984). Erosion on the South Downs. *Soil and Water* **12**(1), 19-21.

Boardman, J. (1988). Severe erosion on agricultural land in East Sussex, UK, October 1987. *Soil Technology* **1**, 333-348.

Boardman, J. (1990). Soil erosion on the South Downs: a review. In, Boardman, J., Foster, I.D.L. and Dearing, J.A. (eds), *Soil Erosion on Agricultural Land*, Wiley Chichester. pp. 87-105.

Boardman, J. (1992). Current erosion on the South Downs: implications for the past. In, Bell, M. and Boardman, J. (eds), *Past and Present Soil Erosion*, Oxbow Monograph 22, Oxbow Books, Oxford. pp. 9-19.

Boardman, J. (1993). The sensitivity of Downland arable land to erosion by water. In, Thomas, D.S.G. and Allison, R.J. (eds), *Landscape Sensitivity*, Wiley, Chichester. pp. 211-228.

Boardman, J., Ligneau, L., de Roo, A. and Vandaele, K. (1994). Flooding of property by runoff from agricultural land in North-Western Europe. *Geomorphology* **10**, 183-196.

4.2 Other relevant publications:

Bell, M. (1983). Valley sediments as evidence of prehistoric land-use on the South Downs. *Proceedings of the Prehistoric Society* **49**, 119-150.

Boardman, J. and Favis-Mortlock, D.T. (1993). Simple methods of characterizing erosive rainfall with reference to the South Downs, southern England. In, Wicherek, S. (ed.), *Farmland Erosion in Temperate Plains, Environments and Hills*, Elsevier, Amsterdam, The Netherlands. pp. 17-29.

Blackman, J.D. (1992). Seasonal variation in the aggregate stability of downland soils. *Soil Use and Management* **8**(4), 142-150.

Favis-Mortlock, D.T. (1994). *Use and Abuse of Soil Erosion Models in Southern England,* Unpublished PhD Thesis, University of Brighton. 336 pp.

Favis-Mortlock, D.T., Evans, R., Boardman, J. and Harris, T.M. (1991). Climate change, winter wheat yield and soil erosion on the English South Downs. *Agricultural Systems* **37**(4), 415-433.

Quine, T.A. and Walling, D.E. (1993). Use of caesium-137 measurements to investigate relationships between erosion rates and topography. In, Thomas, D.S.G. and Allison, R.J. (eds), *Landscape Sensitivity*, Wiley, Chichester. pp. 31-48.

Robinson, D.A. and Boardman, J. (1988). Cultivation practice, sowing season and soil erosion on the South Downs: a preliminary study. *Journal Agricultural Science, Cambridge* **10**, 169-177.

Stammers, R. and Boardman, J. (1984). Soil erosion and flooding on downland areas. *The Surveyor* **164**, 8-11.

5. Availability

5.1	Erosion/land use data:	On request subject to GCTE policy
5.2	Meterological data:	On request; however NRA source must be acknowledged

6. Other Information

6.1	Is the monitoring survey ongoing?	No
6.2	Funding agency for the survey:	Brighton Polytechnic (teaching salary); ICI for plot studies

1	**Contact person**	
1.1	Name	Dr. Ermanno Busoni
1.2	Address	C.N.R. C.S. Genesi, Classificazione Cartografia del Suolo P. le delle Cascine, 15 50144 Firenze - Italia
1.3	Tel	+39 O55 360517/352051
1.4	Fax	+39 O55 321148
1.6	Other researchers involved:	Torri Calzolari Colica, del Sette, Monaci, Chiaverini, Chiarucci, De Dominicis, Maccherini
2	**Survey Details**	
2.1	Dates of erosion monitoring survey:	(1990-1994) since 1990
2.1	Water/wind erosion?	Water erosion
2.3	Area monitored:	Upper and middle Orcia river valley, Central Italy 23.000 ha
2.4		Character of area:Pliocene marine fine sediments; distensive tectonics in neogenic basin; badlands erosion forms, gullies, Mediterranean climate
2.5	Frequency of monitoring:	Seasonally on field; some years interval photo interpretation
2.6		What fraction of fields in the monitored area were included in the survey? Fields showing erosional forms and mass movements, 2 pilot areas undergoing severe erosion
2.7	How were estimates of erosion made?	Terrestrial photogrammetry, DTM techniques, measures on aerophotos
2.8	Were air photographs used?	Yes, several, different scale and date flights; Landsat TM (April and September 1987)
2.9	For each erosion site, information recorded:	Location, contributing area, topography, morphology (slope length, gradient, elevation, aspect, surface roughness, slope shape), erosion features, soil volume removed, land cover (vegetation, land use), soil type

2.10	Data obtained from elsewhere:	Climatic data
2.11	Data calculated from above information:	Erosion rate
2.12	Meterological station density and type:	1 fully equipped meteo station (ours); 5 rain gauges (National Network); 1 thermopluviometric (National Network)
2.13	Length of record of meterological data:	Variable from 60 to 2 years depending on the station

3. Associated Work

3.1	Associated experimental or plot-based work:	Process based studies (TORRI)
3.2	Associated modelling work:	-

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

(Introductory papers Soriano M.D.; Colica A., Torri D.-Estudio preliminar de la influencia de la estructura y propietades de los materiales en la evolucion de badlands. Estudios de geomorfologia en Espana. Actas: II reunion nacional de geomorfologia, Murcia 23-25 Sept. 1992 Tomo I, p. 183-191 (1992).

Calzolari C., Ristori J., Sparvoli E. -Soils of "biancana" bad lands: distribution, characteristrics and genesis in Beccanello farm (Tuscany, Italy) C.N.R. Centro Studio Gen. Class. Cart. Suolo. Quaderni di Scienza del Suolo, Vol V. P.119-142, (1993).

Busonie., Salvador Sanchism. P., Calzolari C., Romagnoli A. Mass movements and erosion hazard patterns by multivariate analaysis of landscape integrated data: the Val d'Orcia case. Presented at: "Experimental geomorphology and landscape ecosystem changes, Leuven, 22-27 March 1993.

Calzolari C., Ristori J., Busoni E., Chiarucci A. -Morphology development in a "biancana" badland area and relationships with soils and vegetation. Presented at: "Soil erosion in semiarid Mediterranean areas" Taormina, Italy, Oct 28-30 (1993).

Chiarucci A., De Domincis V., Ristori J., Calzolari C. "Biancana" badland vegetation in relation to morphology and soil in Orcia Valley, central Italy. Phytogeologia, Berlin Stuttgart.

4.2 Other relevant publications:

5. Availability

5.1	Erosion/land use data:	On request subject to GCTE policy

5.2	Meterological data:	Mostly public data

6. Other Information

6.1	Is the monitoring survey ongoing?	Yes
6.2	Funding agency for the survey:	Consiglio Nazionale Ricerche
6.3	Any other details:	-

1 Contact person

1.1	Name	Dr. Ad P.J. De Roo
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1.4	Fax	+31 30 254 0604
1.5	Email	a.deroo@frw.ruu.nl
1.6	Other researchers involved:	Mr. F.J.P.M. Kwaad, University of Amsterdam, Mr. C.J. Ritsema & J. Stolte, Staring Centre, Wageningen.

2 Survey Details

2.1	Dates of erosion monitoring survey:	1988-1993
2.1	Water erosion.	
2.3	Area monitored:	South-Limburg, The Netherlands, three catchments (4 km2 in total) in farmland, with additional observations in the whole region.
2.4	Character of area:	Loess soils; arable and grazing land; cool temperate oceanic climate.
2.5	Frequency of monitoring:	Continuous rainfall and discharge measurements; sediment only during high discharges; measurements of important landscape factors 1-6x per year.
2.6	What fraction of fields in the monitored area were included in the survey?	All fields.
2.7	How were estimates of erosion made?	Sediment in discharge, location and widths/depths of rill/gullies.
2.8	Were air photographs used?	Not relied upon.
2.9	For each erosion site, information recorded:	For each catchment, maps of soil type, slope gradient, land use, soil cover, random roughness, location of rills, gullies and depositional fans, wheeltracks.
2.10	Data obtained from elsewhere:	In the Etzenrade catchment, 143 137Cs data are available temperature, daily rainfall (if missing),

		evaporation.
2.11	Data calculated from above information:	Total discharge, total soil loss, runoff percentage, timing of erosion.
2.12	Meterological station density and type:	Tipping bucket rain gauges: 1 in each of the two small catchments, 3 in the large catchment.
2.13	Length of record of meterological data:	Catsop catchment since 1987, Etzenrade catchment since 1988, Ransdaal catchment since 1991.

3. Associated Work

3.1 Associated experimental or plot-based work:

137Cs (De Roo, 1991), infiltration (De Roo & Riezebos, 1992), discharge/sediment load (De Roo, 1993).

3.2 Associated modelling work:

ANSWERS (De Roo et al, 1989), Monte Carlo & ANSWERS (De Roo et al., 1992), 137Cs and ANSWERS (De Roo & Walling, 1994), LISEM (De Roo et al., 1995).

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

De Roo, A.P.J. (1991), The use of ^{137}Cs as a tracer in an erosion study in South-Limburg (The Netherlands) and the influence of Chernobyl fallout. Hydrological Processes Vol.5, 215-227.

De Roo, A.P.J. and Riezebos, H. Th. (1992). Infiltration experiments on loess soils and their implications for modelling surface runoff and soil erosion. CATENA, Vol. 19, 221-239.

De Roo, A.P.J. (1993). 'Modelling surface runoff and soil erosion in catchments using Geographical Information Systems; Validity and applicability of the 'ANSWERS' model in two catchments in the loess area of South-Limburg (The Netherlands) and one in Devon (UK)'. Netherlands Geographical Studies, No. 157, Utrecht, pp. 304.

Cremers, N.H.D.T., Van Dijk, P.M., De Roo, A.P.J. and Verzandvoort, M.A. (1995). 'Spatial and temporal variability of soil surface roughness and the application in hydrologic and soil erosion modelling'. Hydrological Processes (in press).

Cremers, N.H.D.T., De Roo, A.P.J. and Van Der Zijp, M. (1995). Validating a splash detachment equation with field measurements. Earth Surface Processes and Landforms (under review).

4.2 Other relevant publications:

De Roo, A.P.J., Hazelhoff, L. and Burrough, P.A. (1989). Soil erosion modelling using 'ANSWERS' and Geographical Information Systems. Earth Surface Processes and Landforms, Vol. 14, 517-532. John Wiley & Sons Ltd.

De Roo, A.P.J., Hazelhoff, L. and Heuvelink, G.B.M. (1992). The use of Monte Carlo simulations to estimate the effects of spatial variability of infiltration on the output of a distributed hydrological and erosion model. Hydrological Processes, Vol. 6, No. 2, 127-143.

De Roo, A.P.J. and Walling, D.E. (1994). Validating the 'ANSWERS' soil erosion model using 137Cs. In: R.J. Rickson (ed.), Conserving Soil Resources. European Perspectives. CAB International, Cambridge, 246-263.

Boardman, J., Ligneau, L., De Roo, A.P.J. and Vandaele, K. (1994). Flooding of property by runoff from agricultural land in Northwestern Europe. Geomorphology, Vol. 10, 183-196.

De Roo, A.P.J., Wesseling, C.G. and Ritsema, C.J. (1995). 'LISEM: a single event physically-based hydrologic and soil erosion model for drainage basins. I: Theory, input and output'. Hydrological processes (in press).

De Roo, A.P.J., Offermans, R.J.E. and Cremers, N.H.D.T. (1995) 'LISEM: a single event physically-based hydrologic and soil erosion model for drainage basins. II: Sensitivity analysis, validation and application'. Hydrological Processes (in press).

5. Availability

5.1	Erosion/land use data:	On request subject to GCTE policy.
5.2	Meterological data:	On request; for the Etzenrade catchment source (Waterboard) must be acknowledged.

6. Other Information

6.1	Is the monitoring survey ongoing?	Yes, on a low level.
6.2	Funding agency for the survey:	Utrecht University, Waterboard.
6.3	Any other details:	

1 Contact person

1.1	Name	Dr Robert Evans
1.2	Address	Division of Geography, Anglia Polytechnic University, East Road, Cambridge CB1 1PT, UK
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1.4	Fax	+44 1223 352973
1.5	Email	-
1.6	Other researchers involved:	Ex and present day employees of the Soil Survey of England and Wales. (Now Soil Survey and Land Research Centre)

2 Survey Details

2.1	Dates of erosion monitoring survey:	Full scheme 1982-1986. Part scheme 1987
2.2	Water Erosion	-
2.3	Area monitored:	700 km^2 in 17 localities. (16 in England, 1 in Wales)
2.4	Character of area:	Great variety - sampled major arable landscapes (soils, relief, land use etc.) of England and Wales
2.5	Frequency of monitoring:	Twice - date air photos taken (in Spring or early Summer). Date field checking (late Summer, Autumn)
2.6	What fraction of fields in the monitored area were included in the survey?	All
2.7	How were estimates of erosion made?	Volumetrically - by estimating/measuring depth, width and length rills and gullies, depth and area deposits
2.8	Were air photographs used?	Yes
2.9	For each erosion site, information recorded:	Crop type direction of working from maps - areas affected by erosion. (+field work) - area catchment(s) within field Area field
	-	Soil type
	-	Steepest slope angle
	-	Relief and Morphology
2.10	Data obtained from elsewhere:	See 2.9

2.11	Data calculated from above information:	Soil type and erosion; crop type and erosion; relief and erosion; slope angle and erosion. Combinations of these (for 1982-1984 data); sediment delivery ratio
2.12	Meterological station density and type:	Daily rainfall, 1-3 (occurs locally more). Stations per monitored locality
2.13	Length of record of meterological data:	1982-1986

3. Associated Work

3.1 Associated experimental or plot-based work: None

3.2 Associated modelling work: None yet - not had time to assemble all data and put together in a model

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

Evans, R. and Skinner, R.J. (1987). A survey of water erosion. Soil and Water 13, 28-31.

Evans, R. (1988). Water erosion in England and Wales 19882-1984. Report for Soil Survey and Land Research Centre, Silsoe.

Evans, R., Bullock, P. and Davies, D.B. (1988). Monitoring erosion in England and Wales. In: Morgan, R.P.C. and Rickson, R.J. (eds.) Agriculture. Erosion Assessment and Modelling. Proceedings of a workshop held in Brussels, Belgium 2-3 December 1986, sponsored by the Commission of the European Communities, Directorate-General for Agriculture, Coordination of Agricultural Research. EUR 10860 EN, 73-91.

Evans, R. (1990). Water erosion in British farmers fields - some causes, impacts, predictions. Progress in Physical Geography 14, 199-219.

Evans, R. (1993). Rill erosion in contrasting landscapes. Soil Use and Management 8, 170-175.

Evans, R. (1993). Extent, frequency and rates of rilling of arable land in localities in England and Wales. In: Wicherek, S. (ed.) Farm Land Erosion: In Temperate Plains Environment and Hills. Amsterdam: Elsevier Science Publishers, 177-190.

4.2 Other relevant publications:

Evans, R. (1971). The need for soil conservation. Area 3, 20-23.

GCTE Focus 3 Erosion Network

Evans, R. and Morgan, R.P.C. (1974). Water erosion of arable land. Area 6, 221-225.

Evans, R. (1977). Overgrazing and soil erosion on hill pastures with particular reference to the Peak District. Journal of the British Grassland Society 32, 65-76.

Evans, R. and Nortcliff, S. (1978). Soil erosion in north Norfolk. Journal of Agricultural Science, Cambridge 90, 185-192.

Evans, R. (1980). Characteristics of water-eroded fields in lowland England. In: De Boodt, M. and Gabriels, D. (eds.) Assessment of Erosion. Wiley, Chichester, 77-87.

Evans, R. (1980). Mechanics of water erosion and their spatial and temporal controls: an empirical viewpoint. In: Kirkby, M.J. and Morgan, R.P.C. (eds.) Soil Erosion. Wiley, Chichester, 109-128.

Evans, R. (1981). Assessments of soil erosion and peat wastage for parts of East Anglia, England. A field visit. in: Morgan, R.P.C. (ed.) Soil Conservation: Problems and Prospects. Wiley, Chichester, 521-530.

Evans, R. (1984). Soil Erosion by Water. Leaflet 890, ADAS, MAFF, Alnwick.

Evans, R. and Cook, S. (1986). Soil erosion in Britain. SEESOIL 3, 28-59.

Evans, R. (1990). Erosion studies in the Dark Peak. Proceedings North of England Soils Discussion Group 24, 39-61.

Evans, R. (1990). Soils at risk of accelerated erosion in England and Wales. Soil Use and Management 6, 125-131.

Boardman, J., Evans, R., Favis-Mortlock, D.T. and Harris, T.M. (1990). Climate change and soil erosion on agricultural land in England and Wales. Land Degradation & Rehabilitation 2, 95-106.

Walling, D.E. and Quine, T.A. (1990). Use of caesium-137 to investigate patterns and rates of soil erosion on arable fields. In: Boardman, J., Foster, I.D.L. and Dearing, J.A. (eds.) Soil Erosion on Agricultural Land. Wiley, Chichester, 33-53.

Favis-Mortlock, D.T., Evans, R., Boardman, J. and Harris, T.M> (1991). Climate change, winter wheat yield and soil erosion on the English South Downs. Agricultural Systems 37, 415-433.

Walling, D.E. and Quine, T.A. (1991). The use of caesium-137 measurements to investigate soil erosion on arable fields in the UK: potential applications and limitations. Journal of Soil Science 42, 147-165.

Watson, A. and Evans, R. (1991). A comparison of estimates of soil erosion made in the field and from photographs. Soil & Tillage Research 19, 17-27.

Evans, R. (1992). Erosion of rough grazings in Britain. In: Boardman, J. (ed.) Post-Congress Tour Guide, First International ESSC Congress. European Society for Soil Conservation, 18-22.

Evans, R. (1992). Erosion at Dalicott Farm, Shropshire - extent, frequency and rates. In: Boardman, J. (ed.) Post Congress Tour Guide, First International ESSC Conference. European Society for Soil Conservation, 52-55.

Evans, R. (1992). Assessing soil erosion in England and Wales. In: Haskins, P.G. and Murphy, B.M. (eds.) People Protecting Their Land, Volume I. Proceedings 7th ISCO Conference, International Soil Conservation Organisation, Sydney, 82-91.

Evans, R. (1993). On assessing accelerated erosion of arable land by water. Soils and Fertilizers 11, 1285-1293.

Quine, T.A. and Walling, D.E. (1993). Use of caesium-137 measurements to investigate relationships between erosion rates and topography. In: Thomas, D.S.G. and Allison, R.J. (eds.) Landscape Sensitivity. Wiley, Chichester, 31-48.

Evans, R. and McLaren, D. (1994). Monitoring water erosion of arable land. Friends of the Earth, London, 13pp.

Evans, R. and Boardman, J. (1994). Assessment of water erosion in farmers' fields in the UK. In: Rickson, R.J. (ed.) Conserving Soil Resources: European Perspectives. CAB International, Wallingford, 13-24.

Evans, R. (1995). Some methods of directly assessing water erosion of cultivated land. Progress in Physical Geography 19, 115-129.

5. Availability

5.1	Erosion/land use data:	Pro forma sheets. Disk for 1982-1984 data
5.2	Meterological data:	Hard copy (from Met Office)

6. Other Information

6.1	Is the monitoring survey ongoing?	No
6.2	Funding agency for the survey:	Ministry of Agriculture
6.3	Any other details:	

Slope, relief, catchment data still to be obtained and analysed for 1985 and 1986. Would like to model data; crop cover and time of erosion are missing variables, but could be estimated.

1 Contact person

1.1	Name	Dr. V.N. Golosov
1.2	Address	Laboratory of Soil Erosion and Channel Processes, Department of Geography Moscow State University, 119899 Moscow, Russia
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1.4	Fax	+7 095 9328836
1.5	Email	golosov@river.geogr.msu.su
1.6	Other researchers involved:	Professor G.A. Larionov, Dr. L.F. Litvin, Dr. S.F. Krasnov, Dr. N.N. Ivanova

2 Survey Details

2.1	Dates of erosion monitoring survey:	1982-1995
2.1	Water/wind erosion?	Water
2.3	Area monitored:	Kaluga region, Protva river basic eight catchments with different area 3-15 ha
2.4	Character of area:	Rolling landscape, dernovo-podzo soils, arable and grazing land, temperate continental climate each snow-melting period
2.5	Frequency of monitoring:	-
2.6	What fraction of fields in the monitored area were included in the survey?	Only fields that eroded
2.7	How were estimates of erosion made?	Measurement of water discharge a collection of water samples for determination of erosion volume
2.8	Were air photographs used?	Seldom
2.9	For each erosion site, information recorded:	Site 1: S= 3.2 ha, gradient of slope 1-6 degree, length of slope 200-300 m; Site 2: S= 4,2 ham gradient of slope 2-7 degree, length of slope 50-230 m; Site 3: S= 2,2 ha, gradient of slope 1-3 degree, length of slope 190. Site 4: S= 12 ha, gradient of slope 2-4 degree, length of slope 50-250. Site 5, S= 1.25 ha, gradient of slope 2.5-3 degree, length of slope 10-150 m. Site 6: S= 0.5 ha, gradient of slope 2-3 degree, length of slope 160. Site 7: S= 4.3 ha, gradient of slope 1.5-2.5 ha, length of slope 40-4.

		Site 8: S= 3.4 ha, gradient 1.5-2.3 degrees Site 9, S= 11 ha, gradient of slope 2-5 degree, length of slope 50-2 m.
2.10	Data obtained from elsewhere:	Detail soil survey of each catchment, detail topographic survey of each catchment, some soil parameters and some other information
2.11	Data calculated from above information:	Erosion rate for snow-melting period (t/ha) for each 60 minute for light part of day and 3-4 hours for night
2.12	Meterological station density and type:	Our own observation for meteorological parameters (distribution of snow, temperate wind and so on) during period before snow-melting till the end of snow-melting. State meteorological state
2.13	Length of record of meterological data:	From 1982

3. Associated Work

3.1	Associated experimental or plot-based work:	Caesium-137, aggregate stability
3.2	Associated modelling work:	WEPP

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

Azhigirov A.A, Golosov V.N., Dobrovolskaya N.G. and other Study of water and sediment yield on he slope catchments in the Protva river basin, VINITI 6389-B87, Moscow, 1987, p.176.

Golosov V.N. Erosional and depositional processes and sediment budget in the Protva river basin. Vestnik MGU, ser. geograpfiya, N 6, p.19-24.

Golosov V.N., Kiryuhina Z.P. Erosional properties of dernovo-podzol soils of Kaluga region. Erosional properties of some soils of Russia, ed. G V Bastrakov, Bryansk, 1990, P. 51-58.

Golosov V.N., Litvin L.F. Soil erosion in the river basin. "Zemledeli N 8, 1987, p. 41-43.

Golosov V.N., Dobrovolskaya N.G and other. Soil erosion on field catchments. Zakonomernosti proyavleniya erozionnyh i ruslovyh prosessov v 2azlichnyh prirodnyh usloviyah, MGU, Moscow, 1987, p. 145-146.

Golosov V.N. Soil erosion and sedimentation on slopes of the southern of Non-Chernozemic zones. "Geomorphologiya", N 1, 1988, p. 51-57.

Ostrova I.V., Silant'ev A N., Litvin L.F. and other. Assessment of soil erosion and sedimentation processes using content of Cs-137 in soil. Vestn MGU, ser. geografiya, N 5, 1990, p. 79- 85.

4.2 Other relevant publications:

Golosov V.N., Samodurova L.S. About comparison erosion in snow-melting and rain-fall periods on the South of Non-Chernozemic zone RSFSR. Proceeding of YII delegate forum of VOP, Tashkent, 1985, V. 1, p. 149-150.

Antonov S.I., Golosov V N. Features of use of sediment budget approach for study of recent geomorfological processes in river basin. "Geomorfologiya", N 2, 1994, p. 25-37.

Butakov G.P., Ermolaev O.P., Kovalchuk and other. Form appearance of erosion and accumulation processes on small river catchments. Eroziya i ruslovye processy, ed. R.S. Chalov, Luzk, p. 36-47.

Alabyan A.M., Babich D.B., Ivanov V.V. Hydravlical resistance of relative stable channel of Protva river. Erosionnye i ruslovye prosessy, 8313-B87, M., 1987, p. 114-119.

Egorov Yu.V., Krasnov S.F., Petrov V.N. and other. Technical equipment for study of erosional processes. "Zemledelie", 1986, N.1, p.47-49.

5. Availability

5.1	Erosion/land use data:	From 1982
5.2	Meterological data:	From 1982

6. Other Information

6.1	Is the monitoring survey ongoing?	Yes
6.2	Funding agency for the survey:	1982-1991 government support. From 1991 some money from different scientific programs
6.3	Any other details:	-

1 Contact person

1.1	Name	Dr. Gerard Govers
1.2	Address	Laboratory for Experimental Geomorphology, Redingenstraat 16, 3000 Leuven, Belgium
1.3	Tel	+32 16 226920
1.4	Fax	+32 16 293307
1.5	Email	gerard.govers@geo.keleuven.ac.be
1.6	Other researchers involved in survey:	No

2 Survey Details

2.1	Dates of erosion monitoring survey:	1981-1985
2.1	Water Erosion	
2.3	Area monitored:	Central Belgium
2.4	Character of area:	Hilly area with silty loamy soils, mainly arable land
2.5	Frequency of monitoring:	Rill erosion rates were measured in the Spring (i.e. after the Winter season)
2.6	What fraction of fields in the monitored area were included in the survey?	<1%
2.7	How were estimates of erosion made?	Volumetric in case cements were made and converted to soil loss rates. Only rill erosion was measured. Spatial resolution of measurements was relatively high
2.8	Were air photographs used?	No
2.9	For each erosion site, information recorded:	Rill volume, topography, vegetation cover, surface state (degree of crusting), crop type. Bulk density, soil shear strength, grain size distribution, aggregate stability, organic matter content of top soil
2.10	Data obtained from elsewhere:	
2.11	Data calculated from above information:	Soil loss rates.
2.12	Meterological station density and type:	Daily precipitation values were available from KMI, Belgium on 3-5 stations (spaced ca. 20 km)

		in the area
2.13	Length of record of meterological data:	150 years

3. Associated Work

3.1 Associated experimental or plot-based work: Work on all development and interrill processes on the Muldenberg field site

3.2 Associated modelling work: Establishment of a statistical model describing the affect of topography, soil type and vegetation cover on rill development

4. Documentation

4.1 Published reports of the monitoring survey and/or results: -

4.2 Other relevant publications:

Govers, G., 1987. Spatial and temporal variation in rill development processes at the Huldenberg experimental site. In: Rill erosion: Processes and significance, Bryan, R. (ed.), Catena Supplement 8, 17-34.

Govers, G., Poesen, J., 1988. Assessment of the interill and rill contributions to total soil loss from an upland field plot. Geomorphology 1, 343-354.

Govers, G., 1991. Rill erosion on arable land in Central Belgium: rates, controls and predictability. Catena 18, 133-155.

5. Availability

5.1 Erosion/land use data: Data on erosion and land use are available for use within the network

5.2 Meterological data: Available from KMI, Ukkel, Belgium

6. Other Information

6.1 Is the monitoring survey ongoing? No, at least not in this form

6.2 Funding agency for the survey: National Fund for Scientific Research, Belgium

6.3 Any other details: -

1 Contact person

1.1	Name	n Hab.dr. B. Jankauskas
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1.4	Fax	+370 69 57242
1.5	Email	-
1.6	Other researchers involved:	G Jankauskiene

2 Survey Details

2.1	Dates of erosion	monitoring survey:1982-1988, 1995-2000
2.1	Water Erosion	
2.3	Area monitored:	Western Lithuania, Upland -emai-iai, Distr. Silale, Village Gineikiai.
2.4	Character of area:	Downy (hilly-rolling) relief; eroded soddy-podzolic sandy loam soil, arable land. Uniform slopes of: A - 2-5; B - 5-10 and C - 10-14 degrees. Cool - humid temperate oceanic - continental climate.
2.5	Frequency of monitoring:	a) soil moved is determined every spring and in summer depending on rainfall (downpour) frequency, b) agrophysical and agrochemical features are determined every six year period.
2.6	What fraction of fields in the monitored area were included in the survey?	Only slopes: 2-5, 5-10 and 10-14 degrees.
2.7	How were estimates of erosion made?	a) by measurement of volume of rills, b) by analysis of soil samples.
2.8	Were air photographs used?	Not available.

2.9 For each erosion site, information recorded:

Location: A - West slope (down), B - South slope (down), C - North (24 sites) and South(8 sites) slopes. Contributing area: A - 1.15 ha (32 sites at 0.036 ha each), B - 0.58 ha (32 sites at 0.018 ha each), C - 1.01 ha (24 sites at 0.036 ha each and 8 sites at 0.018 ha each).
Slope length: A - 100 m, B - 50 m, C - 24 sites at 100 m and 8 sites at 50 m.
Gradient: A - 2-5, B - 5-10, C - 10-14 degrees.

Slope shape - convex form at all sites.
Erosion form - water erosion from slopes. Volume - m^3
Crop type: 16 sites under field crop rotation*, 24 sites under grain - grass crop rotation*, 24 sites under grass - grain I (with Clover - Timothy - C+T) crop rotation* 24 sites under grass - grain II (with Orchard grass - red fescue grass - O+F) crop rotation*, and 8 sites under long-term grass stand*.
Soil type - soddy podzolic.
Management factor - usual management for each of crops.

2.10 Data obtained from elsewhere: Rainfall and water of snow thawing responsible for erosion. Some soil samples taken and analysed.

2.11 Data calculated from above information: Erosion rate (m^3/ha and t/ha according to dry bulk density of soil

2.12 Meterological station density and type: Post of measurement of volume of precipitations (rain gauge) c. 1 km from area and Meteorological station c. 15 km from area.

2.13 Length of record of meterological data: Rain gauge post from 1976. Meteorological station from 1925.

3. Associated Work

3.1 Associated experimental or plot-based work: None

3.2 Associated modelling work: None

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

Jankauskas, B. and Jankauskiene, G. (1990). Erosion - preventative crop rotations on hilly sandy loam soils of -emai-iai upland. The report of research work 1982-1988. Kaltinenai, 1-87. (In Lithuanian).

Jankauskas, B. (1990). Soil protection from erosion. Vilnius. 1-85. (In Lithuanian).

Jankauskas, B., Jankauskiene, G. (1993). The erosion - preventative crop rotations in hilly upland of Western Lithuania. Baltic region: Agriculture in acid soils. Vilnius. 232-235. (In English).

Jankausjas, B., Jankauskiene, G. (1995). Perennial grasses in composition of different erosion - preventative crop rotations. Proceedings of NJF seminar no. 245: "The use of catch or cover crops to reduce leaching and erosion". Knivsta, Sweden. 219-224. (In English).

Jankauskas, B. (1994). Soil erosion and agrarian erosion control measures. The work of doctor habilitatis. Dotnuva. 1-116. (In Lithuanian). Summary in English (80-102) and in Russian (102-106).

4.2 Other relevant publications:

Jankauskas, B. and Jankauskiene, G. (1988). To make more exact the projects of crop rotations. Journal "Agriculture" no. 9. 11-12 (In Lithuanian).

Jankauskas, B. and Jankauskiene, G. (1990). The erosion - preventative crop rotations for hilly fields of -emai-iai upland. Proceedings of scientific works conference of Agriculture Institute,. Vilnius. 11-13. (In Lithuanian).

Jankauskas, B. and Jankauskiene, G. (1992). Farming mode and soil erosion. Scientific - technical information. April-June, 3-4. (In Lithuanian).

Jankauskas, B. and Jankauskiene, G. (1989). Influence on degree of erosion of soil to fertilizing of crops. Intensification of agriculture and her influence to ecology. Minsk. 30-32. (In Russian).

Jankauskas, B. (1990). Steepness of slopes - degree of erosion - fertilizing of crops. Dissection of relief and problems of crops fertility. Vilnius. 68-70. (In Russian).

5. Availability

5.1 Erosion/land use data: On request subject to GCTE policy.

5.2 Meterological data: On request.

6. Other Information

6.1 Is the monitoring survey ongoing? No

6.2 Funding agency for the survey: Lithuanian Agricultural Institute.

6.3 Any other details: * Crop rotations

Field:	Grain-grass:	Grass-grin I:	Grass-grain II:
1. Rye	1. Rye	1. Rye	1. Rye
2. Potatoes	2. Barley	2. Barley	2. Barley
3. Barley	3. Barley	3. C+T, I y.u.**	3. O+F, I y.u.**
4. Barley	4. Barley	4. C+T, II y.u.	4. O+F, II y.u.
5. C+T, Iy.u.**	5. C+T, I y.u.**	5. C+T, III y.u.	5. O+F, III y.u.
6. C+T, II y.u.	6. C+T, II y.u.	6. C+T, IV y.u.	6. O+F, IV y.u.

Instead of field crop rotation long-term grass stand was grown on slope of 10-14 degrees (8 sites). ** year's use.

1	**Contact person**	
1.1	Name	n. Hab.dr. B. Jankauskas
1.2	Address	Kaltinenai Research Station, LT 5926, Kaltinenai, Distr. Silale, Lithuania.
1.3	Tel	+370 69 57254
1.4	Fax	+370 69 572242
1.5	Email	-
1.6	Other researchers involved:	G. Jankauskiene
2	**Survey Details**	
2.1	Dates of erosion monitoring survey:	1994-2000-20007 and might be continued.
2.1	Water Erosion	
2.3	Area monitored:	Western Lithuania. Southern part of -emai-iai upland. Distr. Silale. Villages f: U-pelkiai (no 1), Milai-iai (no 2), Rezgaliai (no 3).
2.4	Character of area:	Hilly - rolling relief; eroded arable land. Uniform slopes: no 1 - loamy soil, no 2 - sandy soil, no 3 - clay soil; cool - humid temperate oceanic - continental climate.
2.5	Frequency of monitoring:	a) liquid overland flow depending on rainfall, b) soil removed (solid flow) depending on rainfall (downpour) frequency, c) subsoil flow by field lysimeter (planned), d) agrophysical and agrochemical features every six year period.
2.6	What fraction of fields in the monitored area were included in the survey?	Only slopes
2.7	How were estimates of erosion made?	a) liquid flow and soil removed (solid flow) by stationary collectors, b) solid flow by stationary collectors, bymeasurement of volume rills and by network of bench marks, c) by analysis of soil samples, liquid flow samples and solid flow samples.
2.8	Were air photographs used?	Not available.
2.9	For each erosion site, information recorded:	

Location: South slopes (no 1, no 2 and no 3).
Contributing area: no 1 - 0.5 ha (10 sites at 0.027 ha each), no 2 - 0.035 ha (10 sites at 0.0292 ha each), no 3 - 0.5 ha (10 sites at 0.0225 ha each).
Slope length: no 1 - 60 m, no 2 - 65 m and no 3 - 50 m.
Gradient: no 1 - 7-9, no 2 - 9-11 and no 3 - 7-9 degrees.
Slopes shape - convex at all sites.
Erosion form - water erosion from slopes.
Volume soil moved - t, m^3, lowed of soil surface - mm.
Crop type: 16 sites under field crop rotation with bare (black) fallow*, 6 sites under usual field crop rotation*, 6 sites under grain - grass crop rotation*, 6 sites under grass - grain crop rotation*, 3 sites under hayland (grass fallow), and 3 sites under non-employed grass fallow (lea land).
Soil type: soddy podzolic.
Management factor - usual management and fertilization for each of crops.

2.10	Data obtained from elsewhere:	Rainfall and water of snow thawing responsible for erosion. Some soil removed (solid flow) and liquid flow samples taken and analysed.
2.11	Data calculated from above information:	Erosion rate m^3/ha and t/ha according to dry bulk density of soil.
2.12	Meterological station density and type:	Post of measurement of volume of precipitations (rain gauge) c. 2 km frfrom area no 1, 2.5 km from area no 2 and 3.5 km from area no 3, and Meteorological Station c. 14-17 km from all areas.
2.13	Length of record of meterological data:	Rain gauge post from 1976. Meteorological station from 1925.

3. Associated Work

3.1	Associated experimental or plot-based work:	Analysis of liquid flow samples in Agrochemical Analysis Centre.
3.2	Associated modelling work:	None

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

None, because 1995 is second year of research.

4.2	Other relevant publications:	None

5. Availability

5.1	Erosion/land use data:	On request subject to GCTE policy.

5.2 Meterological data: At request.

6. Other Information

6.1 Is the monitoring survey ongoing? No

6.2 Funding agency for the survey: Lithuanian Agriculture Institute.

6.3 Any other details:

Crop rotations:

Field with bare fallow: Field usual:

1. Winter grains**1. Winter grains
2. Potatoes2. Potatoes
3. Barley3. Barley
4. C+T I y.u.4. Barley
5. Barley5. C+T I y.u.
6. Bare fallow6. C+T II y.u.

Grain - grass: Grass - grain:

1. Winter grains1. Winter grains
2. Barley2. Barley
3. Barley3. O+F I y.u.
4. Barley4. O+F II y.u.
5. C+T I y.u.5. O+F III y.u.
6. C+T II y.u.6. O+F IV y.u.

** Winter wheat - no 1 and no 3, rye - no 2.
C+T - Clover + Timothy, O+F - Orchard grass + Fescue grass. y.u. - year of use.

Project might be changed or added (supplemented) according to wishes of GCTE.

1 Contact person

1.1	Name	Dr. C. Kosmas
1.2	Address	Agricultural Univ. of Athens Lab. of Soils & Agr. Chemistry, Iera Odos 75, Botanikos 11855, Athens, Greece
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1.6	Other researchers involved:	-

2 Survey Details

2.1	Dates of erosion monitoring survey:	1991-1995
2.1	Water/wind erosion?	Water
2.3	Area monitored:	Plots 30 m2 each
2.4	Character of area:	Hillslope, shallow to moderately deep Xerochrepts, olives, vines and annual vegetation. Thermo-mediterranean climate
2.5	Frequency of monitoring:	Varied depending on rainfall
2.6	What fraction of fields in the monitored area were included in the survey?	Plots
2.7	How were estimates of erosion made?	Collection of sediments
2.8	Were air photographs used?	No
2.9	For each erosion site, information recorded:	Location (topo map 1: 250), biomass, cover soil moisture curves, hydraulic conductivity, chemical soil properties, soil moisture content
2.10	Data obtained from elsewhere:	No
2.11	Data calculated from above information:	Erosion rate
2.12	Meterological station density and type:	One automatic meteo station installed nearby
2.13	Length of record of meterological data:	1991-1995

3.	**Associated Work**	
3.1	Associated experimental or plot-based work:	-
3.2	Associated modelling work:	-
4.	**Documentation**	
4.1	Published reports of the monitoring	survey and/or results: All the data were collected in standardized sheets written in Lotus format and a database was created in Amsterdam
4.2	Other relevant publications:	There are publications in journals or in books
5.	**Availability**	
5.1	Erosion/land use data:	On request; however MEDALUS must be acknowledged
5.2	Meterological data:	On request
6.	**Other Information**	
6.1	Is the monitoring survey ongoing?	Yes
6.2	Funding agency for the survey:	European Commission and Agricultural University of Athens
6.3	Any other details:	

1 Contact person

1.1	Name	Dr. S.A. Lorentz
1.2	Address	Dept. of Agricultural Engineering, University of Nepal, Box XO1, Scottsville, 3209, South Africa.
1.3	Tel	+27 331 260 5701
1.4	Fax	+27 331 260 5818
1.5	Email	lorentz@aqua.ccwr.ac.sa
1.6	Other researchers involved:	-

2 Survey Details

2.1	Dates of erosion monitoring survey:	1990 - present
2.1	Water/wind erosion?	Water
2.3	Area monitored:	1. Sugar cane fields on sensitive soils ± 5km^2 1+2 ha main catchments. 2. Forestry/Grassland erosion plot studies. Kwazula/Natal. 3. Regional Erosion estimation: Mgeri Basin ± 400 km^2 + intensive sub-catchment studies : 170 km^2.
2.4	Character of area:	1. Sugar cane - subcatchment monitoring. 2. S/tropical savannah and cultivated pine forests. 3. S/tropical savannah, farm land, sugar cane plantations and cultivated forests.
2.5	Frequency of monitoring:	1. Approximately 3 per year. 2. Continuously, weekly plot data. 3. One-off study - continuing.
2.6	What fraction of fields in the monitored area were included in the survey?	1. 10%. 2. 80%. 3. 100%.
2.7	How were estimates of erosion made?	1. RUSLE + main-catchment sediment yield (1995). 2. RUSLE + plot yield. 3. RUSLE
2.8	Were air photographs used?	1. Ground photographs. 2. No. 3. Yes + ground photography.

2.9 For each erosion site, information recorded:1.

Photographic data of cover. Up to 1995 and continuing. Soils texture and physical and hydraulic properties. Small catchment sediment yield. Met. data. Full station autographic. Starting 1995. 2. Plot data, runoff, yield. Soil moisture, physical and hydraulic properties. Met. data. Full station. Autographic. 3. Air photo interpretation of cover. Soil survey information.

Met. data. Daily. Subcatachment : sediment yield events : Autographic raw measurement.

2.10 Data obtained from elsewhere: -

2.11	Data calculated from above information:	1. RUSLE parameters; sediment yield mass kinetic E of rain. 2. RUSLE parameters; erosion mass, K-E of rainfall. 3. RUSLE parameters. Subcatachment sediment yield, K-E of rainfall. Runoff.
2.12	Meterological station density and type:	1. 1 full met. station of 3 mini catchments 1-2 ha. ± 5 km apart. 2. 1 full met station on site. 3. Daily rainfall and met stations ± 1/50 km^2.
2.13	Length of record of meterological data:	1. Start 1995. 2. Start 1988 - present. 3. 10-50 years rainfall.

3. Associated Work

3.1 Associated experimental or plot-based work:

1. Lab. analysis of soils, physical and hydraulic small catchments monitoring 1-2 ha. 2. RUSLE plots in grassland. Cultivating forestry with different prep. 3. Subcatchment sediment yield monitoring.

3.2 Associated modelling work: 1. ACRU sediment yield and RUSLE. 2. RUSLE. 3. ACRU sediment yield + RUSLE.

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

Design documentation only.
Reports to the South African Water Research Commission.
Kienzle and Lorentz. 1995. Simulating the Hydrology and Water Quality of the Mgeri catchment. Report to the South African Water Research Commission.

4.2 Other relevant publications:

Kienzle and Lorentz. 1993. Production of a Soil Erodibility Map for the Henley Dam Catchment, Natal. Using a GIS approach. In: Lorentz *et al*. 6th South African National Hydrology Symposium XII Proceedings.

Howe and Lorentz. 1995. Sediment Yield Modelling in the Henley catchment. South African Agricultural Engineering Journal. (In press).

5. Availability

5.1 Erosion/land use data: Available with costs of extraction.

5.2	Meterological data:	Available with costs of extraction.

6. Other Information

6.1	Is the monitoring survey ongoing?	Yes.
6.2	Funding agency for the survey:	1. South African Department of Agriculture. 2. South African Water Research Commission. 3. South African Water Research Commission.
6.3	Any other details:	-

1 Contact person

1.1	Name	Dr Arlin D. Nicks
1.2	Address	USDA-ARS-SPA-NAWQL, PO Box 1430, Durant, OK 74702, USA
1.3	Tel	+1 405 924 5066
1.4	Fax	+405 924 5307
1.5	Email	adnicks@ftsmail.com
1.6	Other researchers involved:	R.D. Williams, J. Daniel

2 Survey Details

2.1	Dates of erosion monitoring survey:	1977-94
2.1	Water/wind erosion?	Water
2.3	Area monitored:	Fort Reno, Central Oklahoma, 1,6 ha winter wheat
2.4	Character of area:	Formerly native grasslands; sub-humid climate
2.5	Frequency of monitoring:	Continuous precipitation, runoff, soil and nutrient loss
2.6	What fraction of fields in the monitored area were included in the survey?	All of catchment
2.7	How were estimates of erosion made?	Sediment concentration from pumping sampler
2.8	Were air photographs used?	No
2.9	For each erosion site, information recorded:	Incremental precipitation, runoff, sediment concentration, nitrogen and phosphorus concentration, tillage dates, methods, chemical application rates and dates, soil samples
2.10	Data obtained from elsewhere:	Long term climate records (precip and temp) from NWS station for weather generator
2.11	Data calculated from above information:	Runoff volume and sediment and chemical yields
2.12	Meterological station density and type:	Weighing recording rain gauge on the catchment
2.13	Length of record of meterological data:	1977-94

3. Associated Work

3.1	Associated experimental or plot-based work:7	other similar plots in the area, range and grain sorghum
3.2	Associated modelling work:	CREAMS/GLEAMS (Williams and Nicks), WEPP (Nicks and Williams)

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

Williams, R.D. and Nicks, A.D. Using CREAMS to evaluate filter strip effectiveness in erosion control. Journal of Soil and Water Conservation 43(1) pp. 108-112. 1988.

4.2 Other relevant publications:

Nicks, A.D. Modelling hydrologic impacts of global change using stochastically generated climate change scenarios In: Eckstien, Y. and Zaporozec, A. (ed.) Proceedings 2nd US/CIS Joint Conference on Environmental Hydrology and Hydrogeology; Global and Regional issues in Environmental Hydrology. Water Environment Federation, Alexandria, VA. pp. 25-38. 1993

5. Availability

5.1	Erosion/land use data:	On request subject to GCTE policy
5.2	Meterological data:	On request

6. Other Information

6.1	Is the monitoring survey ongoing?	Yes
6.2	Funding agency for the survey:	USDA-ARS
6.3	Any other details:	-

1 Contact person

1.1	Name	Professor Jean Poesen
1.2	Address	Laboratory for Experimental Geomorfologie, k.u. Leuven, Redingenstraat 16 Bis, B-3000 Leuven, Belgium
1.3	Tel	+32 16 226920
1.4	Fax	+32 16 293307
1.5	Email	jean.posen@geo.kuleuven.ac.be
1.6	Other researchers involved:	Karel Vandaele

2 Survey Details

2.1	Dates of erosion monitoring survey:	1982-1994
2.2	Water/wind erosion?	Water (ephemeral gullies, bank gullies)
2.3	Area monitored:	Central Belgium (Loess loam belt) Area between (Leuven and Brussels)
2.4	Character of area:	Extensively cropped [loam, sandy loam soils
2.5	Frequency of monitoring:	Monthly
2.6	What fraction of fields in the monitored area were included in the survey?	-
2.7	How were estimates of erosion made?	Volumetric measurements
2.8	Were air photographs used?	Yes
2.9	For each erosion site, information recorded:	Gully catchments, slopes, soil horizons, land use
2.10	Data obtained from elsewhere:	-
2.11	Data calculated from above information:	-
2.12	Meterological station density and type:	-
2.13	Length of record of meterological data:	-

3. Associated Work

3.1 Associated experimental or

plot-based work: Laboratory experiments on hydraulic erosion

3.2 Associated modelling work: -

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

Poesen, J. 1988. A review of the studies on the mechanisms of incipient rilling and gullying in the Belgian Loam Region. In Ijioma, C.I. Ananaba, S. & Boers, T. (eds.). Proceedings of the International Symposium on Erosion in S.E. Nigeria. Federal University of Technology, Owerri, Nigeria 1:13-20.

Poesen, J. 1989. Conditions for gully formation in the Belgian Loam Belt and some ways to control them. Soil Technology Series 1:39-52.

Poesen, J. & Govers, G. 1990. Gully erosion in the loam belt of Belgium : typology and control measures. In Boardman, J., Foster, D.L. & Dearing, J.A. (eds.). Soil Erosion on Agricultural Land. J. Wiley, Chichester, U.K.:513-530.

Govers, G., Everaert, W., Poesen, J. Rauws, G., De Ploey, J. and Lautridou, J.P. 1990. A long flume study of the dynamic factors affecting the resistance of a loamy soil to concentrated flow erosion. Earth Surface Processes and Landforms 15:313-328.

Poesen, J. 1992. Gully erosion in the loess belt of North Western Europe : typology and control measures. In Luk, S.H. (ed.). Geographical Information System for Soil Erosion Management Proceedings International Conference, Taiyuan, Shanxi Province, China, 163-174.

Poesen, J. 1993. Gully typology and gully control measures in the European loess belt. In Wicherek, S. (ed.) Farm Land Erosion in Temperate Plains Environment and Hills. Elsevier Science Publishers, Amsterdam: 221-239.

Vandaele, K. & Poesen, J. in press. Spatial and temporal patterns of soil erosion rates in an agricultural catchment, central Belgium. Catena.

5. Availability

5.1 Erosion/land use data: -

5.2 Meterological data: -

6. Other Information

6.1 Is the monitoring survey ongoing? Yes

6.2 Funding agency for the survey: National Fund for Scientific Research

1	**Contact person**	
1.1	Name	Dr. John N Quinton
1.2	Address	Depart. of Water Management, Silsoe College, Cranfield University, Silsoe, Bedford, MK45 4DT, UK
1.3	Tel	+44 1525 863000
1.4	Fax	+44 1525 863001
1.5	Email	j.quinton@cranfield.ac.uk
1.6	Other researchers involved:	Professor J A Catt, Rothamsted Experimental Station, Harpenden, Herts, UK
2	**Survey Details**	
2.1	Dates of erosion monitoring survey:	October 1988 - Present
2.1	Water/wind erosioN?	Water
2.3	Area monitored:	8 x O.1ha erosion plots
2.4	Character of area:	Loamy sand soil, c 11% slopes in arable agriculture
2.5	Frequency of monitoring:	3 plots with automatic sampling (1 minute resolution). 5 plots assessed after each storm
2.6	What fraction of fields in the monitored area were included in the survey?	-
2.7	How were estimates of erosion made?	Collection of all material
2.8	Were air photographs used?	No
2.9	For each erosion site, information recorded:	Soil loss- Runoff- Hydrographs and sedigraphs on 3 plots. Particle size distribution of sediment. Full chemical analysis on runoff and sediment. Crop cover, height, stem density. Soil cohesion, roughness, particle size distribution. Rill density and geometry. Full meteorological station 500m from site
2.10	Data obtained from elsewhere:	Chemical data supplied by Rothamsted
2.11	Data calculated from above information:	-

2.12	Meterological station density and type:	Full station 500m from site
2.13	Length of record of meterological data:	In excess of 100 years

3. Associated Work

3.1	Associated experimental or plot-based work:	None
3.2	Associated modelling work:	EUROSEM

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

Catt, J.A., Quinton, J.N. and Styles, P.D.R. 1994. Nutrient losses and crop yields in the Woburn Erosion Reference Experiment. In: Conserving soil resources: European perspectives. (ed. R.J. Rickson), CAB International, Wallingford.

4.2 Other relevant publications:

Vivian, B. and Quinton, J.N. 1994. Automated water sampling in ephemeral hydrological systems. Earth Surface Processes and Landforms 18: 863-868.

Quinton, J.N. and Rickson, R.J. 1993. The role of soil erosion in the movement of contaminants. p. 141-156 In: Soil Monitoring: early detection and surveying of soil contamination and degradation (eds. R. Schulin, A. Desaules, r. Webster and B. von Steiger), Birkhauser Veriag, Basel.

5. Availability

5.1	Erosion/land use data:	On request
5.2	Meterological data:	Enquiries to Rothamsted Experimental Station

6. Other Information

6.1	Is the monitoring survey ongoing?	Yes
6.2	Funding agency for the survey:	European Union
6.3	Any other details:	-

1	**Contact person**	
1.1	Name	Dr Karel Vandaele
1.2	Addres	S Laboratory for Experimental Geomorphology, k.u. Leuven, Redingenstraat 16815, B-3000 Leuven, Belgium
1.3	Tel	+32 16 226920
1.4	Fax	+32 16 293307
1.5	Email	karel.vandaele@geo.kuleuven.ac.be
1.6	Other researchers involved:	-
2	**Survey Details**	
2.1	Dates of erosion monitoring survey:	1989-1994
2.1	Water/wind erosioN?	Water erosion - rill ephemeral gully erosion
2.3	Area monitoRed:	Central Belgium, Loess loam belt (between Leuven - Brussels). Three cultivated catchments (20 - 200 ha)
2.4	Character of area:	Intensively cropped. Loamy soils
2.5	Frequency of monitoRing:	Monthly
2.6	What fraction of fields in the monitored area were included in the survey?	All
2.7	How were estimates of erosion made?	Volumetric measurement. Cross sections
2.8	Were air photographs used?	Yes
2.9	For each erosion site, information recorded:	Rainfall data (intensity). Volumetric measurements of erosion and sedimentation land use. Crop cover %. Spatial location of erosion features
2.10	Data obtained from elsewhere:	-
2.11	Data calculated from above information:	Erosion rates Sediment budget
2.12	Meterological station density and type:	3 stations in 10 km^2 - Raingauge

2.13 Length of record of meterological data: 3 years

3. Associated Work

3.1 Associated experimental or plot-based work: -

3.2 Associated modelling work: Predicting the location of ephemeral gully erosion

4. Documentation

4.1 Published reports of the monitoring survey and/or results:

Vandaele, K., 1993. Assessment of factors affecting ephemeral gully erosion in cultivated catchments of the Belgium Loam Belt. In: Farm Land Erosion in Temperate Plains Environments and Hills. Proceedings of the International Symposium on Farm Land Erosion in Temperate Plains Environments and Hills, Saint-Cloud, Paris, France, May 1992. Wicherek, S. (ed.), Elsevier Science Publishers B.V., 125-136.

Vandaele, K., 1993. Soil erosion and floods in the Hammeveld catchments (Leefdaal). In excursion guide "Geomorphological Processes in the Belgian Loess belt", March 1993. Memorial symposium Prof. J. De Ploey: "Experimental Geomorphology and Landscape Ecosystems Changes", 29-43.

Vandaele, K., 1993. Soil erosion and floods in the Hammeveld catchments. (Leefdaal). In: Proceedings of the Environmental Platform 1993, K.U. Leuven, 14 mei 1993, Verachtert, H. (editor), 261-264.

Vandaele, K., 1993. Bodemerosie en Moddstromen in kleine landelijke stroombekkens (Leefdaal). In: excurseigids "Geomorfologische Processen in de Leemstreek", Vliebergh-Senciecentrum Geografie, 23 October 1993, K.U. Leuven, 29-43.

Boardman, J., Ligneau, L., de Roo, A., Vandaele, K., 1994. Flooding of property by runoff from agricultural land in northwest Europe. Geomorphology 10, 183-196.

Govers, G., Vandaele, K., Desmet, P., Poesen, J., 1994. Characterizing soil tillage as a geomorphological process. In: H.E. Jensen, P. Schönning, S.A. Mikkelsen and K.B. Madsen (eds.), Soil Tillage for Crop Production and Protection of the Environment, Proceedings of the 13th ISTRO Conference, Aalborg, Denmark, 269-274.

Vandaele, K., Poesen, J., in press. Spatial and temporal patterns of soil erosion in agricultural catchments. Central Belgium. Catena.

Vandaele, K., Waelkens, M., in press. Weathering effects on building stones at Sagalassos. Acta Archaeological Lovaniensia Monographiae, 7.

Poesen, J., Govers, G., Paulissen, E., Vandaele, K., Waelkens, M., in press. A geomorphological evaluation of the erosion risk at Sagalassos. Acta Archaeologica Lovaniensia Monographiae, 7.

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Quine, T.A., Desmet, P.J.J., Govers, G., Vandaele, K., Walling, D.E., 1994. A comparison of the roles of tillage and water erosion in landform development and sediment export on agricultural land, near Leuven, Belgium. Proc. of the IAHS symposium on variability in stream erosion and sediment transport, Canberra, December 1994.

Vandaele, K., Van Ommeslaeghe, J., accepted for publication. Monitoring soil redistribution patterns using sequential aerial photographs. Earth Surface Processes and Landforms.

4.2 Other relevant publications: -

5. Availability

5.1 Erosion/land use data: -

5.2 Meterological data: -

6. Other Information

6.1 Is the monitoring survey ongoing? Partly

6.2 Funding agency for the survey: University

6.3 Any other details: -

1 Contact person

1.1	Name	Dr. Shi Xuezheng
1.2	Address	The Institute of Soil Science, Academia Sinica, PO Box 821, Nanjing, China
1.3	Tel	+86 25 3367354
1.4	Fax	+86 25 3353590
1.6	Other researchers involved:	Professor Shi Demin

2 Survey Details

2.1	Dates of erosion monitoring survey:	1990-1994
2.1	Water/wind erosioN?	Water
2.3	Area monitored:	16 km^2
2.4	Character of area:	Red soil and purple soil; cultivated land; barren land; subtropical monsoon climate
2.5	Frequency of monitoring:	Varied depending on the times of rain
2.6	What fraction of fields in the monitored area were included in the survey?	Only fields that eroded
2.7	How were estimates of erosion made?	Measurement of volume of runoff, soil loss
2.8	Were air photographs used?	Available for some years but not relied upon
2.9	For each erosion site, information recorded:	Location (Xingguo County, Jiangxi Province). Contributing area (km^2-from map). Slope length (m-from map). Gradient (deg-from clinometer). Slope shape (convex etc.-from map). Erosion form (interrill, rill and gully erosion). Volume soil moved (ton). Crop type (some rice). Management factors (mostly barren land). Soil type (red soil, etc.).
2.10	Data obtained from elsewhere:	Rainfall responsible for erosion. Soil samples taken and analysed
2.11	Data calculated from above information:	Erosion rate (ton/ha). Timing of erosion (date)
2.12	Meterological station density and type:	One manual daily raingauges in area. One automatic gauge

2.13	Length of record of meterological data:	Start of daily recording ranges from 1984 to 1994

3. Associated Work

3.1	Associated experimental or plot-based work:	No
3.2	Associated modelling work:	No

4. Documentation

4.1 Published reports of the monitoring survey and/or results:Report in Press

4.2	Other relevant publications:	-

5. Availability

5.1	Erosion/land use data:	-
5.2	Meterological data:	-

6. Other Information

6.1	Is the monitoring survey ongoing?	No
6.2	Funding agency for the survey:	-
6.3	Any other details:	-

SECTION IV

ANNEXES

Annex I GCTE Erosion Network: Formal Membership, 1997

Full contact details are given in the main text

GCTE Erosion Network: Membership, models and datasets

NAME	**Introduction**	**Model**	**Experimental Data Sets**	**Monitoring Data Sets**
Albaladejo, J.	CEBAS-CSIC (Spain)			1
Albrecht, A.	ORSTOM/LCSC (France)		1	
Andrieux, P.	ORSTOM/LCSC (France)		1	
Baboule, Z.B.	IRA, Foumbot (Cameroon)		1	
Boardman, J.	University of Oxford (UK)			1
Busoni, E.	Consiglio Nazionale Ricerche, Firenz (Italy)			1
Castillo, V.M.	CEBAS-CSIC (Spain)		1	
De Noni, G.	ORSTOM/LCSC, Montpellier (France)		1	
De Roo, P.J.	Utrecht University (The Netherlands)	LISEM		1
Evans, R.	Polytechnic University, Cambridge (UK)			1
Favis-Mortlock, D. *	University of Oxford (UK)			
Golosov, V.N.	Moscow State University (Russia)			1
Govers, G.	k.u. Leuven (Belgium)		1	1
Imeson, A.C.	University of Amsterdam (Netherlands)		1	
Jankauskas, B.	Kaltinenai Research Station (Lithuania)			2
Kirkby, M.	University of Leeds (UK)	MEDRUSH MEDALUS CSEP		
Kosmas, C.	University of Athens (Greece)		1	1

Le Bissonnais, Y.	INRA, Ardon (France)		1	
Lorentz, S.A.	University of Nepal (South Africa)	ACRU	1	1
Morgan, R.P.C.	Cranfield University, Silsoe (UK)	EUROSEM		
Moyo, A.	Makoholi Research Station (Zimbabwe)		1	
Nearing, M.	USDA-ARS, Purdue University (USA)	WEPP		
Nicks, A.D.	USDA-ARS, Durant (USA)		1	1
Parsons, A.J.	University of Leicester (UK)		1	
Poesen, J.	k.u. Leuven (Belgium)		1	1
Quinton, J.	Cranfield University, Silsoe (UK)			1
Sajjapongs, A.	IBSRAM (Thailand)		1	
Sidorchuk, A.	Moscow State University (Russia)	AUSGUL NORGUL		
Skidmore, E.L. *	USDA-ARS, Kansas State University (USA)			
Torri, D.	C.N.R. Firenze (Italy)		1	
Valentin, C.*	ORSTOM (Niger)			
Vandaele, K.	k.e. Leuven (Belgium)			1
Vanderwel,D.S.	Alberta Agriculture (Canada)		1	
Wilcox, B.	LANL, Los Alomos (USA)		1	
Williams, J.	USDA-ARS, Temple (USA)	APEX EPIC		
Xuezheng, S.	Institute of Soil Science (China)			1

TOTAL:	36	11	17	16

* Invited Specialists

Annex II The GCTE Erosion Network: A Contribution to GCTE Core Research

The GCTE Erosion Network, and its constituent projects, has been accepted by the GCTE Scientific Steering Committee (SSC) as contributing to the GCTE Core Research Programme. GCTE Core Research is defined as large-scale, integrative research that is global in scope and significance. The projects within the GCTE Core Research Programme specifically meet GCTE objectives, as set out in the GCTE Operational Plan (IGBP Report No. 21), and come from two sources: (i) initiation directly by the SSC; and (ii) projects, or components thereof, accepted by the SSC which contribute directly to the Operational Plan, and which form a part of a formal GCTE structure (network, consortium, etc.).

Formal participation in the Network, and hence as a contributor to the GCTE Core Research Programme, brings several advantages, together with some obligations on the part of the member. It:

- facilitates the planning of research projects addressing aspects of global change and terrestrial ecosystems by providing a soundly-based intellectual and organizational framework for research, with overall aims, approach and implementation developed and endorsed by the international science community.

- adds to the scientific value of individual experimental, observational and modelling studies and assists in their interpretation by organising networks and consortia which, for example widen the range of observational studies and extend their temporal and spatial coverage, promote common methodologies and protocols, and provide data sets for model validation and intercomparison.

- promotes the rapid communication of scientific ideas and results through meetings and publications, and by facilitating disciplinary and interdisciplinary liaison at the international level between individuals and research groups.

- provides assistance to contributing projects in obtaining funds from national and international sources by writing letters of support and lobbying, where appropriate.

- assists in the cost-effective deployment of major capital equipment and facilitates such as FACE by providing the scientific framework for their phased deployment and assisting in their collaborative use.

- encourages the full involvement of developing countries through GCTE participation in the START regional research networks.

- promotes close working links with other relevant international programmes and studies, particularly those of IGBP, IHDP, WCRP, ICSU, SCOPE, IUBS and the CGIAR.

- promote the concepts of GCTE and IGBP science, and the results obtained from the GCTE Core Research Programme, to ensure their wider recognition among the international research and policy communities.

Participation in the GCTE Core Research Programme requires a commitment to:

- participate in the relevant GCTE Task(s) for which the project was accepted through activities such as implementation and synthesis workshops, model intercomparisons, and joint observational studies.

- carry out the project in accordance with the relevant aspects of the GCTE Operational Plan (IGBP Report No.21) using agreed methods and protocols wherever possible.

- make data and models available to the wider GCTE community, in accordance with protocols for data and model exchange developed by GCTE networks and consortia, and with due regard to publication "rights".

- keep the GCTE Core Project Office informed on an annual basis of (i) major changes to the project objectives, description, and participating research organisation changes in the annual budget and the major funding agencies; and (ii) changes to the number of scientific and technical staff working on the project, and provide the Core Project Office with a list of publications arising from the project.

- acknowledge participation in the GCTE Core Research Programme in publications arising from the project by inserting in the Acknowledgements the sentence "This work contributes to the Global Change and Terrestrial Ecosystems (GCTE) Core Project of the International Geosphere-Biosphere Programme (IGBP)".

Annex III Applying to join the GCTE Erosion Network

Interested scientists who wish to join the GCTE Erosion Network should apply to the GCTE Erosion Working Group through the GCTE Focus 3 Office. An application consists of (i) completed metadata forms (available from the Office) for a erosion model and/or experimental and/or monitoring dataset(s), and (ii) a signed application form, agreeing to abide by the terms as laid out in the GCTE Data and Model Sharing Policy (see Annex IV).

If accepted by the GCTE Erosion Working Group as being of both high scientific value and strictly pertinent to Network objectives, the Focus 3 Office forwards the application to the GCTE Scientific Steering Committee for ratification as a formal component of the GCTE Erosion Network, the Network itself already being an official contribution to the GCTE Core Research Programme.

Criteria for acceptance of research into the Network

A general principle is that the submitted work must address the Task's stated objectives and be both pertinent and of sufficient scientific quality. *Experiments* from temperate regions must be multi-spatial and/or multi-temporal scale; and from topical regions (where the availability of suitable data is generally scarce) they must be scientifically acceptable, and preferably multi-scale. *Models* must have been validated, and therefore must be encoded. *Monitoring studies* must be over 2 years, and multi-scale studies are preferred.

Annex IV GCTE Data and Model Sharing Policy

It is intended that participation in the GCTE Programme will require collaboration not only in methodology but also in the exchange of data. A clear statement about the ownership of data was deemed necessary.

1. All data and computer code remain the property of the research worker(s) who obtained it. No participant shall pass on to a third party, either within or outside the network, data or code without the owner's express permission. No attempt to use data or code will be made in GCTE publications, other than with the permission of the research worker(s) concerned.

2. Each worker is encouraged to publish their work in the normal way, and is requested to include reference to GCTE. Reprints of, or references to, such works would be gratefully received by the GCTE Office, as part of the coordination exercise.

3. One of the aims of the GCTE Programme is to compare experimental variables measured across varied gradients in environmental space and then to conduct syntheses of the data from each research site. Once synthesised, data from specific sites will lose their individuality, and become part of the GCTE regional, or ultimately global picture. Those conducting a synthesis exercise on behalf of GCTE may feel they have derived sufficient data to merit publication in its own right, and they should be encouraged to publish in an appropriate journal. Any such paper would include suitable acknowledgement of contributing research workers, and state that it constitutes part of the GCTE Programme. Should published data be used in the synthesis, references must be made in the normal style of a review.

Any contributor whose data is used in a significant way and whose data collection is wholly or largely intended for the network is entitled to become a co-author. It must however be recognised that there is a level of participation (or data use) below which addition of a further co-author would be inequitable to major authors. Any concern regarding inclusion or not of a given co-author will be subject to arbitration by the Chairman of GCTE.

4. All members participating in the collaborative programme must undertake to make all data and code available to all other current members of the network under these conditions.

This modus operandum is not legally enforceable, of course, but it is expected that signatories to the agreement undertake to abide by the rules.

Annex V GCTE Report Series

No. 1 GCTE Core Research: 1993 Annual Report (1994). 135 pp

No. 2 GCTE Focus 3 Wheat Network: 1993 Model and Experimental Meta Data (1994). 147 pp

Second Edition: 1996 Model and Experimental Metadata (1996).

No. 3 GCTE Task 3.1.3 Global Change Impact on Pastures and Rangelands: Implementation Plan (1994). 59 pp

No. 4 GCTE Activity 3.5 Effects of Global Change on Managed Forests: Implementation Plan (1994). 35 pp

No. 5 GCTE Core Research: 1994/95 Report (1996). 156 pp

No. 6 GCTE Focus 3 Erosion Network: Model, Experimental and Monitoring Metadata (1997).

No. 7 GCTE Focus 3 Soil Organic Matter Network: Model and Experimental Metadata (1996).

No. 8 GCTE Focus 3 Rice Network: Model and Experimental Metadata (1996).

No. 9 GCTE Focus 3 Potato Network: Model and Experimental Metadata (1996).

No. 10 GCTE Focus 2 Functional Types Project (1996).

No. 11 GCTE Activity 3.2 Changes in Pests, Diseases and Weeds: Implementation Plan (1996). 45 pp

No. 12 GCTE Activity 3.3 Effects of Global Change on Soils: Implementation Plan (1996). 56 pp

No. 13 GCTE Activity 3.4 Effects of Global Change on Multi-species Agroecosystems: Implementation Plan (1996).

No. 14 Workshop Summary and Synthesis, Living with Global Change: Linking Science and Policy in Southeast Asia 13-15 August 1996, Bogor, Indonesia, BIOTROP-GCTE Southeast Asian Impacts Centre, ICSEA Report No.2