SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

Teaching activity at the University Mediterranea of Reggio Calabria – Department of Agriculture

Prof. Paolo Porto

Recent procedures to document soil erosion in Southern Italy –

The radiotracers technique

Università degli Studi di Reggio Calabria Mediterranea

Dipartimento di Agraria
Università degli Studi Mediterranea di Reggio Calabria

Reference Number: 598403-EPP-1-2018-1-RS-EPPKA2-CBHE-JP
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SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

Bachelor and master degrees with disciplines in soil erosion and torrent control in Italy

FOREST SCIENCES

Hydraulics, Surface hydrology, Torrent control (check-dams), Soil erosion, Naturalistic engineering

CIVIL ENGINEERING

Hydraulics, Hydrology, Hydraulic constructions (dams, check-dams, levees, bridges, etc.)

GEOLOGICAL SCIENCES

Geomorphology, Hydrogeology, Sedimentology

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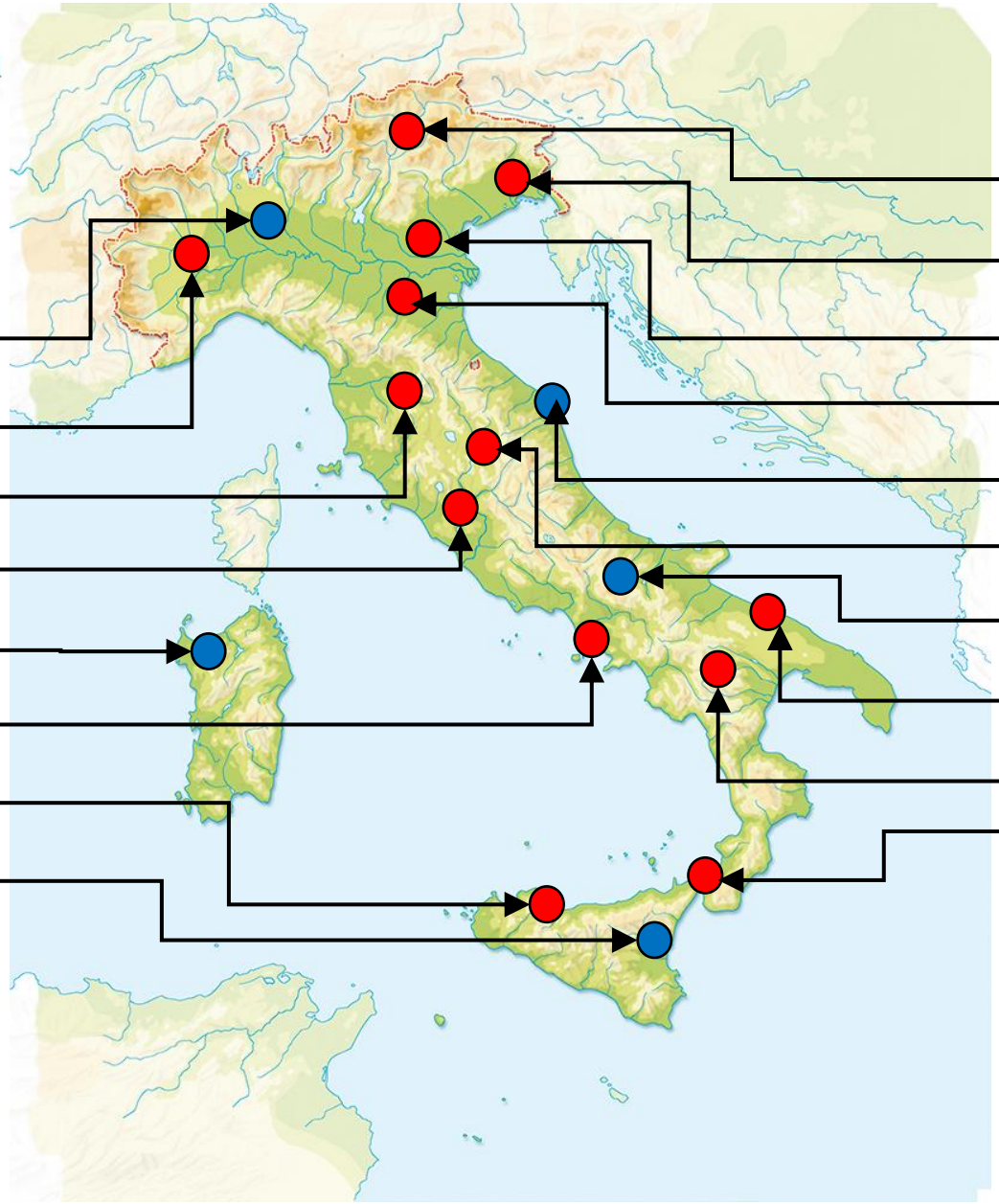
SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

UNIVERSITIES with courses on Forest Sciences (or similar)
Milano
Torino
Firenze
Viterbo
Sassari
Napoli
Palermo
Catania



UNIVERSITIES with courses on Forest Sciences (or similar)
Bolzano
Udine
Padova
Bologna
Ancona
Perugia
Campobasso
Bari
Potenza
Reggio Calabria

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SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

The University Mediterranea of Reggio Calabria

The Department of Agriculture

www.agraria.unirc.it
paolo.porto@unirc.it

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Agricultural Sciences and Technologies

Environmental and Forest Sciences

Food Sciences and Technologies

Bachelor Degree
3 Years
180 CFU

Master Degree
2 Years
120 CFU

PHD
3 Years

SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

Environmental and Forest Sciences – BACHELOR DEGREE

First year

COURSE	ECTS	SSD	SEMESTER
ELEMENTS OF MATHEMATICS	6	MAT/05	First semester
CHEMISTRY	8	CHIM/03	First semester
ENGLISH			First semester
- ENGLISH	3		First semester
- ENGLISH	3		First semester
GENETICA	6	AGR/07	Second semester
PLANT BIOLOGY	8	BIO/03	Second semester
ELEMENTI DI FISICA	6	FIS/01	Second semester
Forest Botany	6	BIO/03	Second semester

Second year

COURSE	ECTS	SSD	SEMESTER
FOREST ENTOMOLOGY	6	AGR/11	First semester
Mountain Agronomy and Zootechnics			First semester
- MOUNTAIN AGRONOMY	6	AGR/02	First semester
- PRINCIPI DI NUTRIZIONE ED ALIMENTAZIONE ANIMALE IN AMBIENTE MONTANO	6	AGR/18	First semester
FORESTAL ECONOMICS AND POLICY			First semester
- ELEMENTS OF FORESTAL ECONOMICS	6	AGR/01	First semester
Forest Chemistry			Second semester
- PLANT MOLECULAR PHYSIOLOGY	6	AGR/13	Second semester
- Chemistry of the Forest Floor	6	AGR/13	Second semester
Forest Plant Pathology	6	AGR/12	Second semester
FORESTAL ECONOMICS AND POLICY			Second semester
- FORESTAL ECONOMICS AND POLICY	6	AGR/01	Second semester
- FORESTAL AND ENVIROMENTAL LAW	6	IUS/03	Second semester

Third year

COURSE	ECTS	SSD	SEMESTER
General Microbiology	6	AGR/16	First semester
Dendrometry and Principles of Forest Arrangement	6	AGR/05	First semester
FOREST ECOLOGY, SILVICULTURE AND MANAGEMENT OF PROTECTED AREAS			First semester
- FOREST ECOLOGY AND GENERAL SILVICULTURE	6	AGR/05	First semester
- MANAGEMENT OF PROTECTED AREAS	3	AGR/05	First semester
Forest Appraisal	6	AGR/01	First semester
Logging Mechanization	6	AGR/09	First semester
CAD LABORATORY	3		First semester
MATERIE A SCELTA	12		First semester
APPRENTICESHIP TRAINING AND GUIDANCE	2		First semester
STAGE AND ESTERNAL TRAINING	2		First semester
FINAL TEST	4		First semester
FORESTRY BUILDINGS AND LANDSCAPE			Second semester
- COSTRUZIONI FORESTALI E PAESAGGIO	6	AGR/10	Second semester
- LAND SURVEYING AND REPRESENTATION	6	AGR/10	Second semester
IDRAULICA, IDROLOGIA E SISTEMAZIONI IDRAULICO FORESTALI			Second semester
- IDRAULICA E IDROLOGIA FORESTALE	6	AGR/08	Second semester
- SISTEMAZIONI IDRAULICO FORESTALI	6	AGR/08	Second semester

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SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

Environmental and Forest Sciences – MASTER DEGREE

First year

COURSE	ECTS	SSD	SEMESTER
Environmental Chemistry of Urban and Forest Ecosystems	6	AGR/13	First semester
Soil Protection and Conservation and Watersheds Planning			First semester
- Watersheds Planning and Management	3	AGR/08	First semester
- Soil Protection and Conservation and Hydraulic Rehabilitation	6	AGR/08	First semester
Plant diseases and phytosanitary protection			First semester
- MALATTIE DEL VERDE E DELLE PIANTE ORNAMENTALI	6	AGR/12	First semester
FOREST GEOBOTANY	6	BIO/03	First semester
Laboratory of GIS	5		First semester
Plant diseases and phytosanitary protection			Second semester
- Integrate Protection of the Forest Systems	3	AGR/11	Second semester
SOIL ECOLOGY	6	AGR/13	Second semester
Natural and Cultivated Mountain Systems	6	AGR/02	Second semester
Management of Forest Systems and Safety in Forestry Operations			Second semester
- Silviculture and arboriculture for timber production	9	AGR/05	Second semester
- Wood Harvesting and Safety in Forestry Operations	3	AGR/09	Second semester

Second year

COURSE	ECTS	SSD	SEMESTER
Forest Fire Protection	6	AGR/05	First semester
ECONOMICS AND ENVIRONMENT APPRAISAL	6	AGR/01	First semester
Ethology and wildlife management	6	AGR/19	First semester
Landscape planning and infrastructures in agro-forestry areas	6	AGR/10	First semester
MATERIE A SCELTA	12		First semester
APPRENTICESHIP TRAINING AND GUIDANCE	3		Second semester
STAGE AND ESTERNAL TRAINING	9		Second semester
Final project	13		Second semester

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SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

Environmental and Forest Sciences – BACHELOR DEGREE

Third year

COURSE	ECTS	SSD	SEMESTER
General Microbiology	6	AGR/16	First semester
Dendrometry and Principles of Forest Arrangement	6	AGR/05	First semester
FOREST ECOLOGY, SILVICULTURE AND MANAGEMENT OF PROTECTED AREAS			First semester
- FOREST ECOLOGY AND GENERAL SILVICULTURE	6	AGR/05	First semester
- MANAGEMENT OF PROTECTED AREAS	3	AGR/05	First semester
Forest Appraisal	6	AGR/01	First semester
Logging Mechanization	6	AGR/09	First semester
CAD LABORATORY	3		First semester
MATERIE A SCELTA	12		First semester
APPRENTICESHIP TRAINING AND GUIDANCE	2		First semester
STAGE AND ESTERNAL TRAINING	2		First semester
FINAL TEST	4		First semester
FORESTRY BUILDINGS AND LANDSCAPE			Second semester
- COSTRUZIONI FORESTALI E PAESAGGIO	6	AGR/10	Second semester
- LAND SURVEYING AND REPRESENTATION	6	AGR/10	Second semester
IDRAULICA, IDROLOGIA E SISTEMAZIONI IDRAULICO FORESTALI			Second semester
- IDRAULICA E IDROLOGIA FORESTALE	6	AGR/08	Second semester
- SISTEMAZIONI IDRAULICO FORESTALI	6	AGR/08	Second semester

Environmental and Forest Sciences – MASTER DEGREE

Second year

COURSE	ECTS	SSD	SEMESTER
Forest Fire Protection	6	AGR/05	First semester
ECONOMICS AND ENVIRONMENT APPRAISAL	6	AGR/01	First semester
Ethology and wildlife management	6	AGR/19	First semester
Landscape planning and infrastructures in agro-forestry areas	6	AGR/10	First semester
MATERIE A SCELTA	12		First semester
APPRENTICESHIP TRAINING AND GUIDANCE	3		Second semester
STAGE AND ESTERNAL TRAINING	9		Second semester
Final project	13		Second semester

STAGE AND EXTERNAL TRAINING

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SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

Environmental and Forest Sciences

STAGE AND EXTERNAL TRAINING

Examples of field classes at the University of Reggio Calabria

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Examples of field classes at the University of Reggio Calabria

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SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

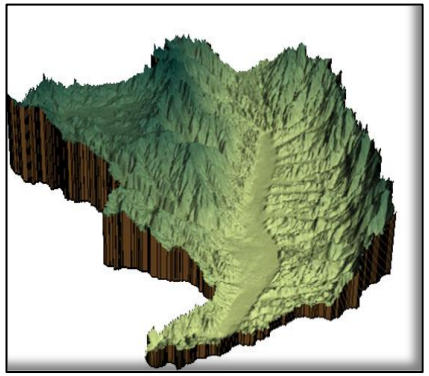
Methods for estimating surface erosion

Measurement techniques

experimental plots, catchments

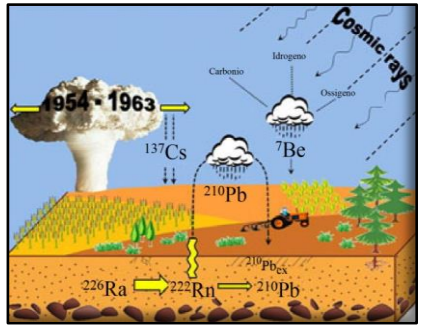
Mathematical models

(RUSLE) (WEPP) (SEDD) (LISEM) (EUROSEM) (AGNPS)



Environmental radionuclides

(^{137}Cs) (^{210}Pb) (^{7}Be)



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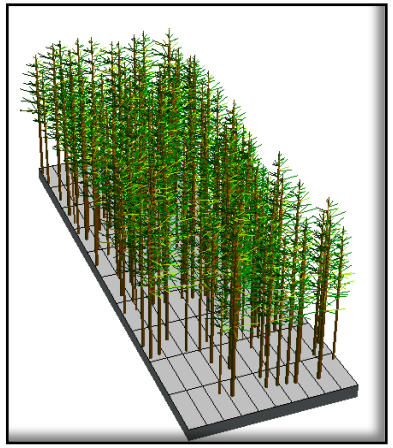
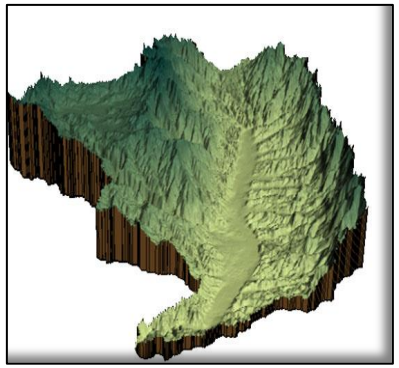
Mathematical models

USLE, RUSLE, MUSLE, SEDD, WEPP, EUROSEM, AGNPS, ANSWERS etc.

Plot

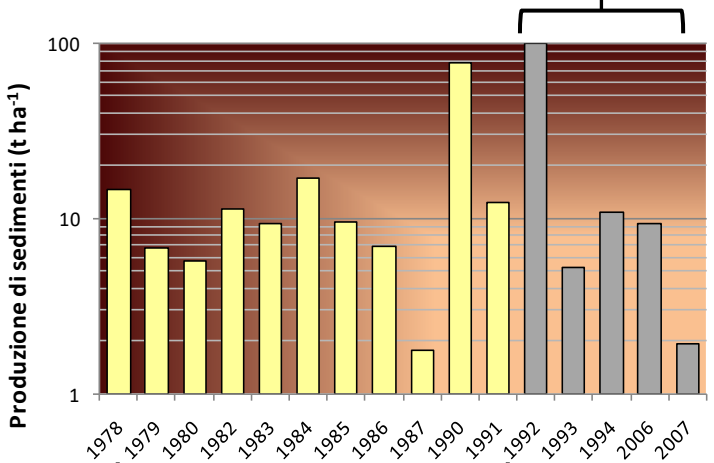


Catchment



CALIBRATION

VALIDATION



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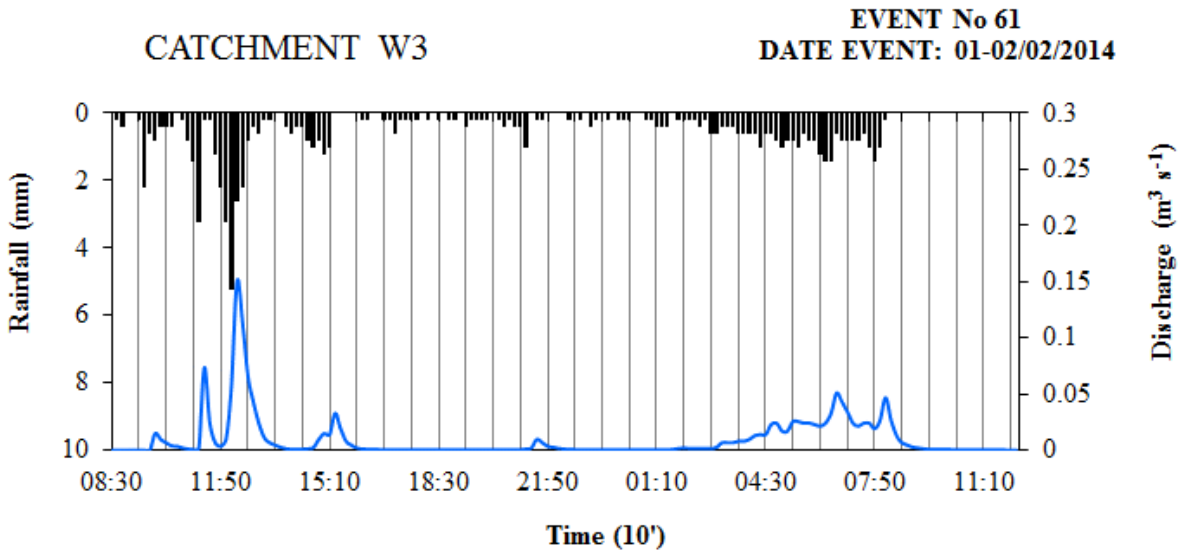
Measurement techniques

experimental plots and catchments

SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

THE EQUIPMENT – Rainfall and runoff measurements



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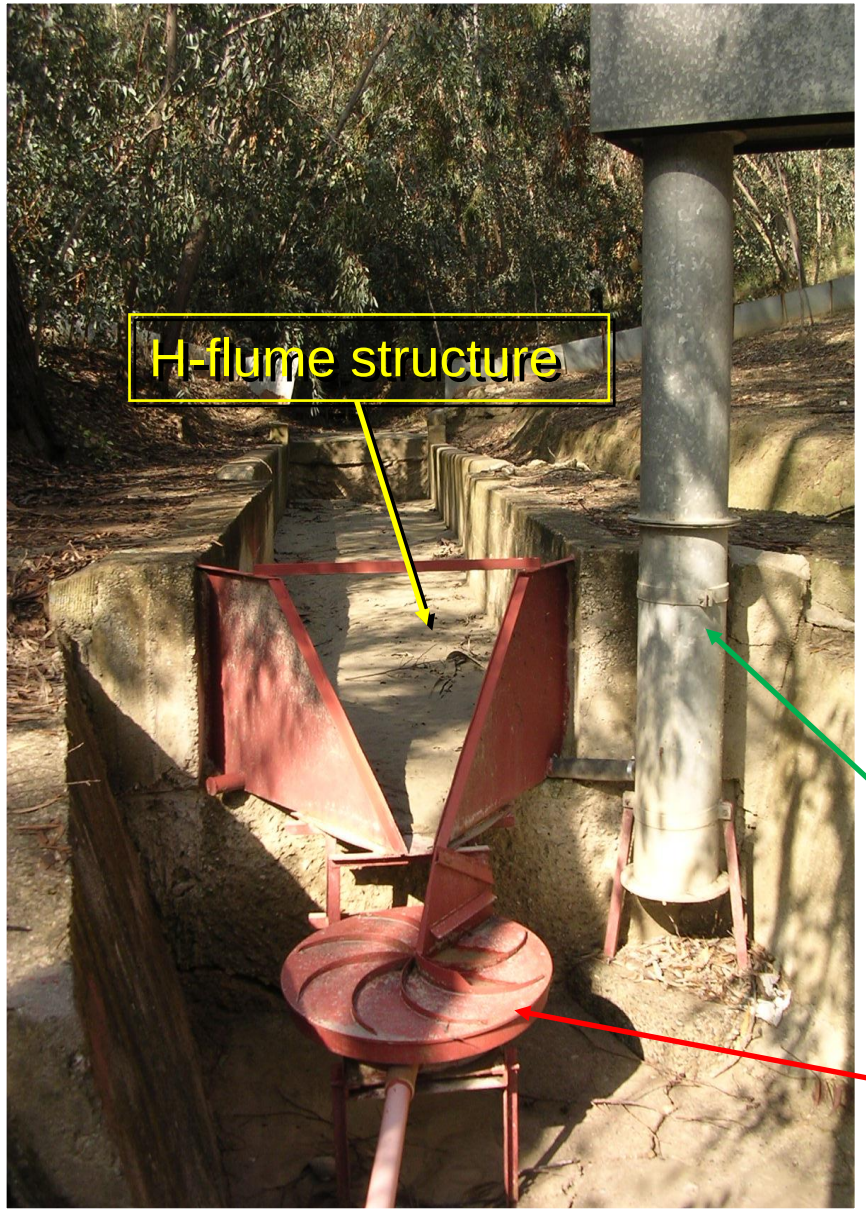
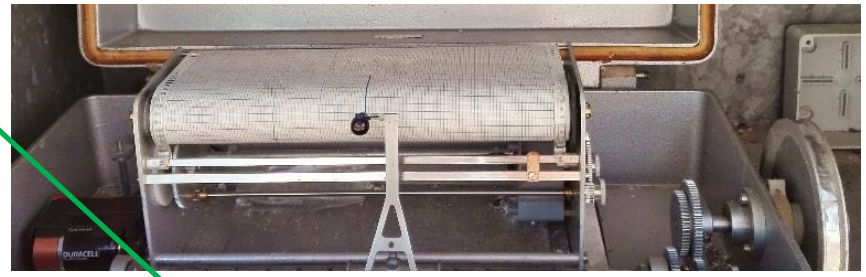
THE EQUIPMENT – Sediment yield measurements

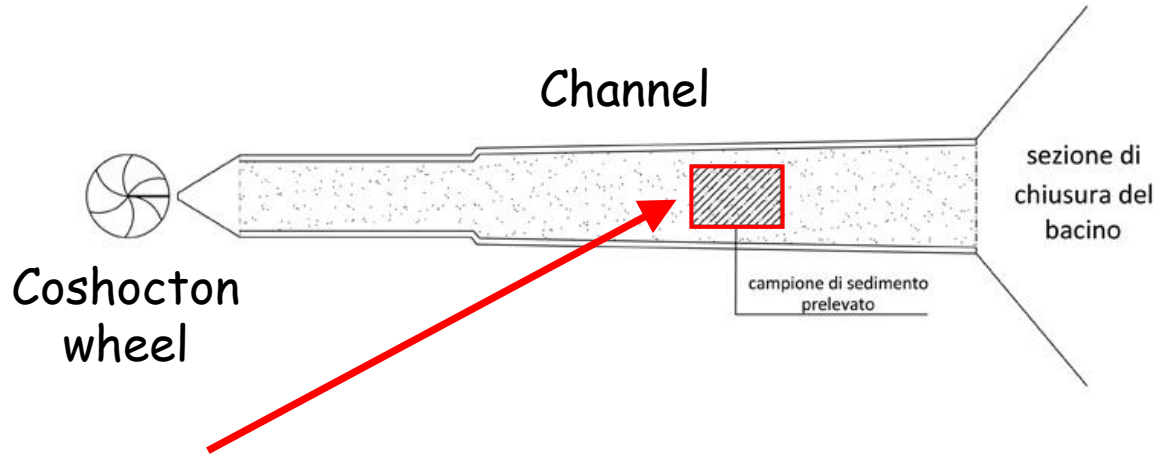


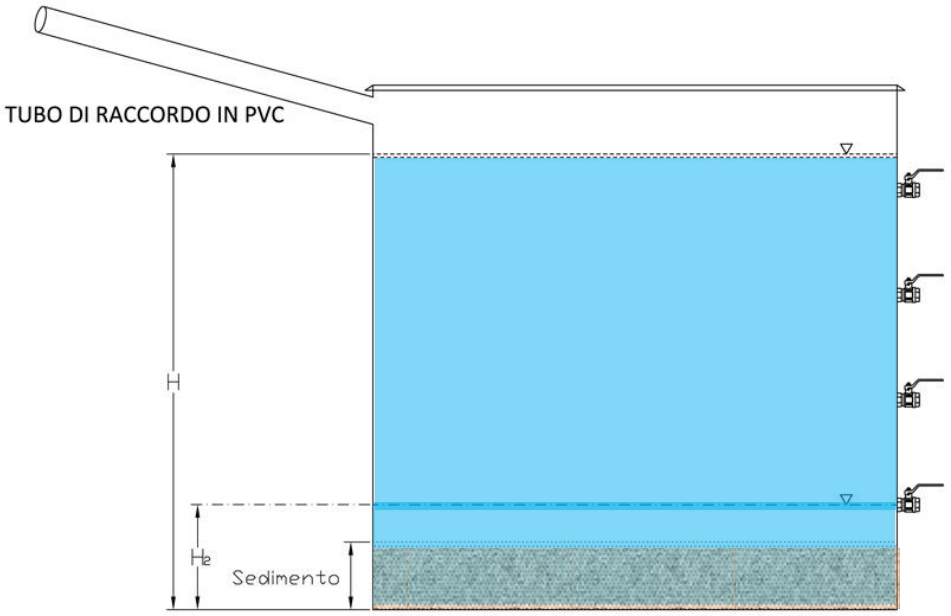


Streamgauge

Coshocton wheel

The sampling design





H= altezza torbida totale
H_2= altezza primo svuotamento

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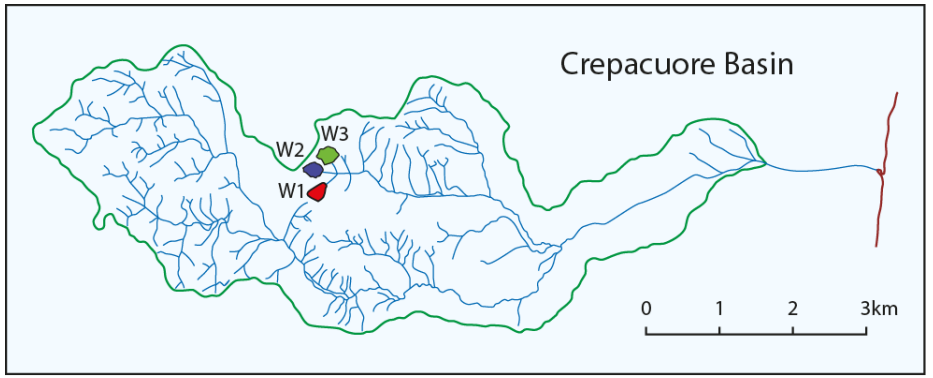
Catchment W1 – Rangeland (1.47 ha)



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Catchment W2 – ECNU (1.37 ha)

1978 cutting

1990 cutting

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Catchment W3 – ECU (1.65 ha)

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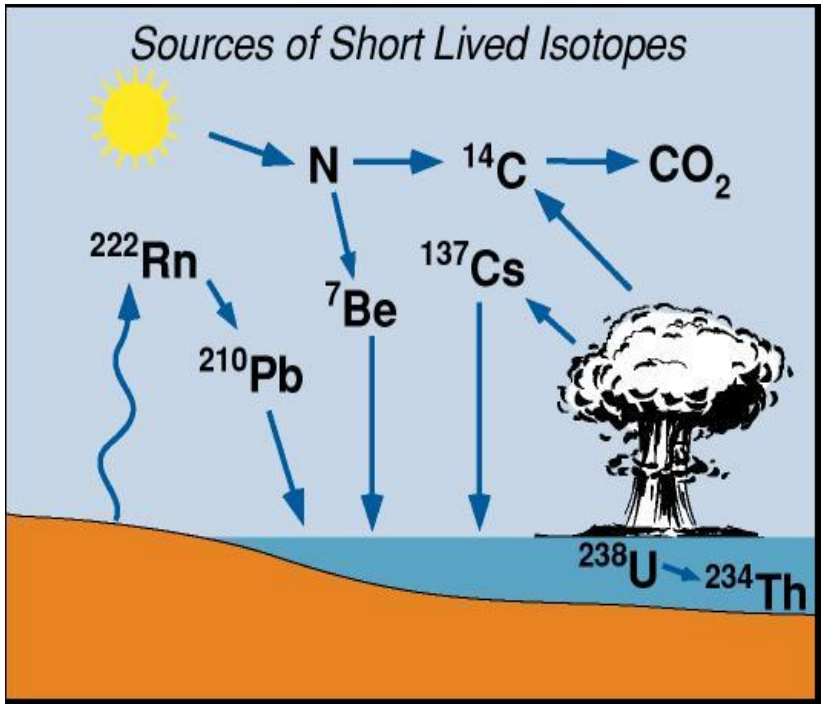
Environmental radionuclides

The use of environmental radionuclides, particularly ^{137}Cs, to estimate erosion rates has attracted increased attention and the approach has been shown to possess several important advantages.



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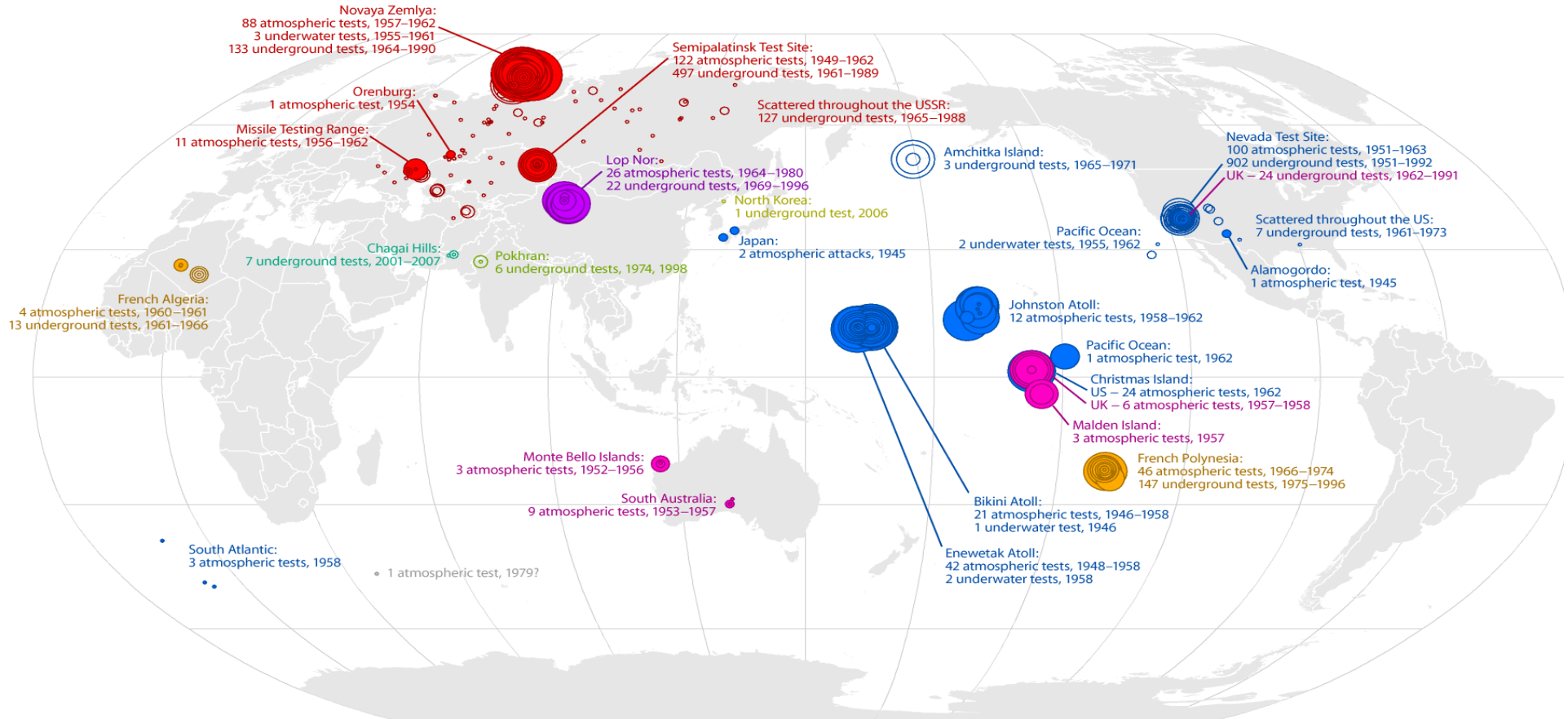
Nuclear Explosions since 1945



Country:	Year of first detonation:	Number of detonations: atmospheric	underground	underwater
United States	1945	206	912	5
USSR	1949	223	756	3
United Kingdom	1952	21	24	
France	1960	50	160	
China	1964	22	26	
Israel?	1967 ?			
India	1974		6	
South Africa?	1979 ?	1 ?		
Pakistan	1998		7	
North Korea	2006		1	

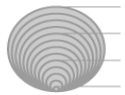
not all data is official, and some locations are approximate. data source: http://www.johnstonsarchive.net/nuclear/tests

Each explosion is represented by a circle.
Many of these circles overlap.

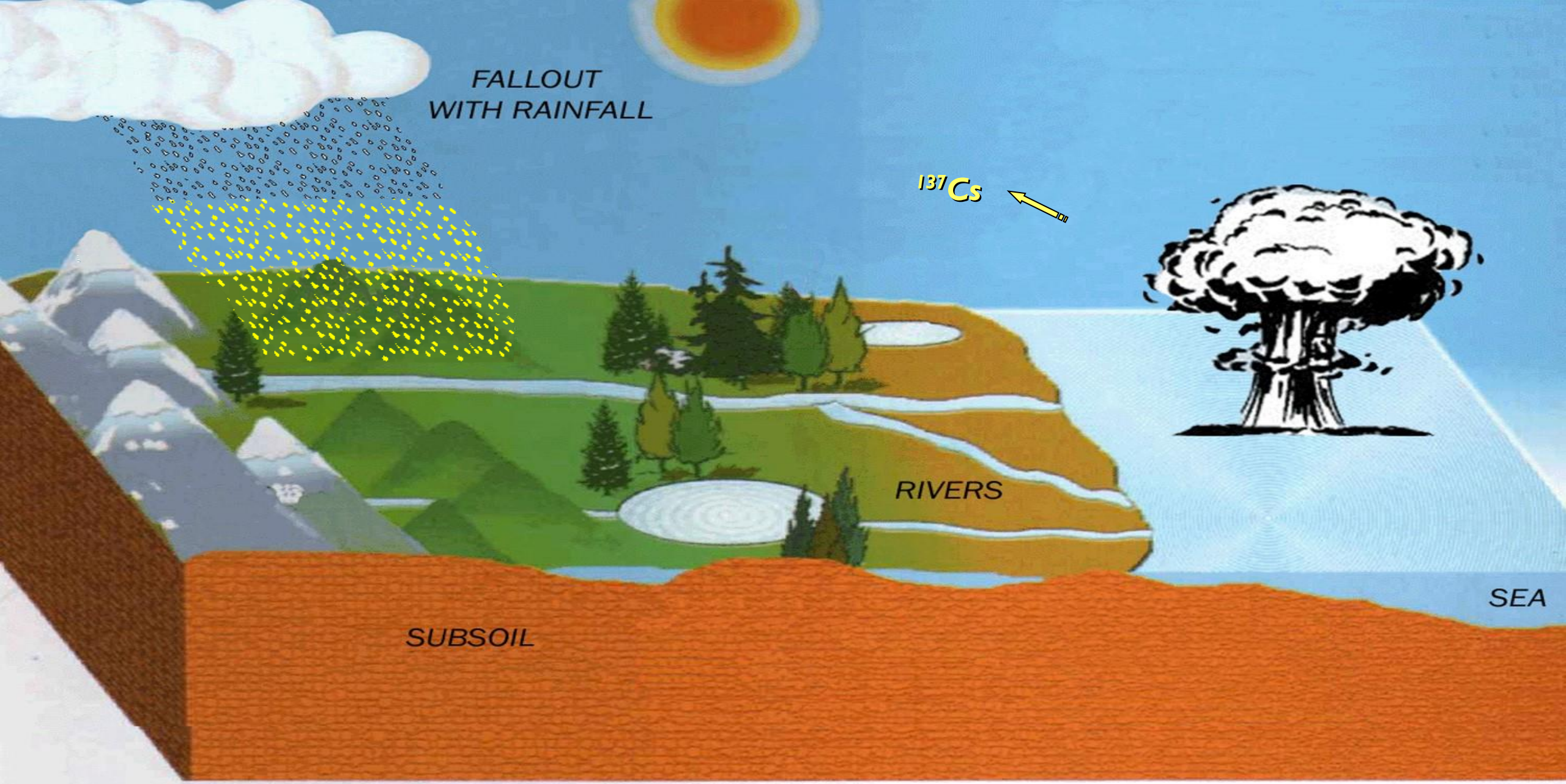
Filled circles are atmospheric detonations

Hollow circles are underground or underwater tests

The size of each circle represents the yield of the blast.
The scale is not linear:



more than 20 megatons
2.5–5.1 megatons
160–320 kilotons
less than 15 kilotons



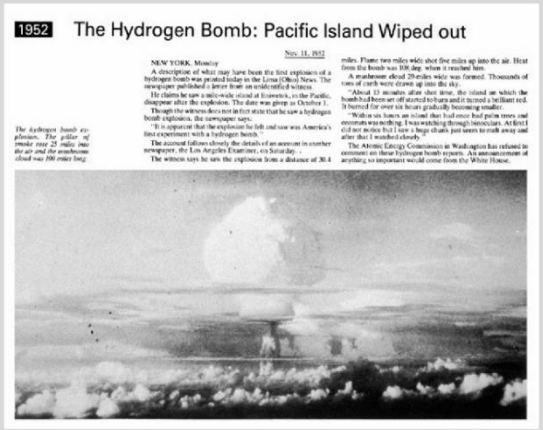
The ^{137}Cs technique

^{137}Cs fallout

CAESIUM-137

HALF-LIFE: 30.2 years

ORIGIN: Weapons Testing


1952 The Hydrogen Bomb: Pacific Island Wiped out

NEW YORK, Monday

A description of what may have been the first explosion of a hydrogen bomb was printed today in the Lima [Ohio] News. The newspaper published a letter from an unidentified witness.

He claims he saw a mile-wide island at Eniwetok, in the Pacific, disappear after the explosion. The date was given as October 1.

Though the witness does not in fact state that he saw a hydrogen bomb explosion, the newspaper says,

"It is apparent that the explosion he felt and saw was America's first experiment with a hydrogen bomb."

The account follows closely the details of an account in another newspaper, the Los Angeles Examiner, on Saturday.

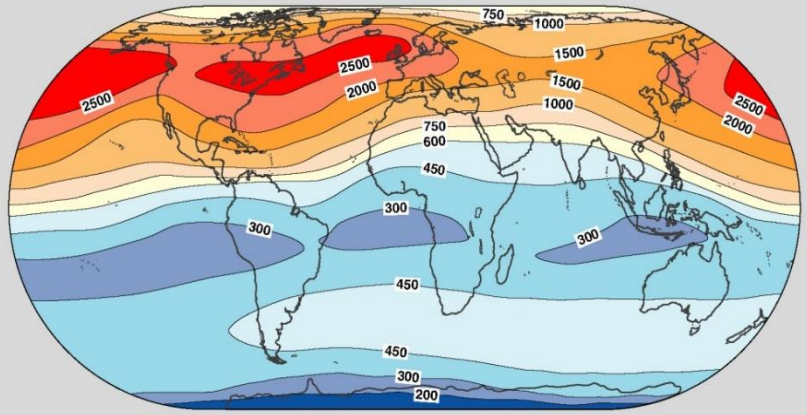
The witness says he saw the explosion from a distance of 30.4 miles. Flame two miles wide shot five miles up into the air. Heat from the bomb was 10K deg. when it reached him.

A mushroom cloud 25 miles wide was formed. Thousands of tons of earth were drawn up into the sky.

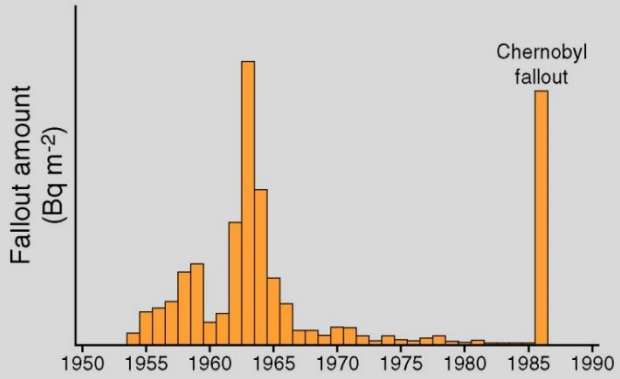
"About 13 minutes after shot time, the island on which the bomb had been set off started to burn and it turned a brilliant red. It burned for over six hours gradually becoming smaller.

"Within six hours an island that had once had palm trees and coconuts was nothing. I was watching through binoculars. At first I did not notice but I saw a huge chunk just seem to melt away and after that I watched closely."

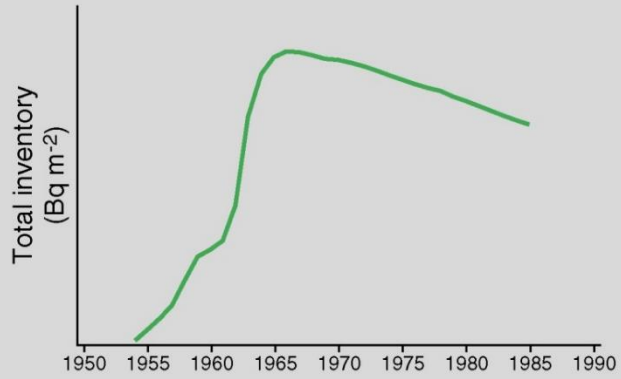
The Atomic Energy Commission in Washington has refused to comment on these hydrogen bomb reports. An announcement of anything so important would come from the White House.



Fallout Record



Cumulative Inventory



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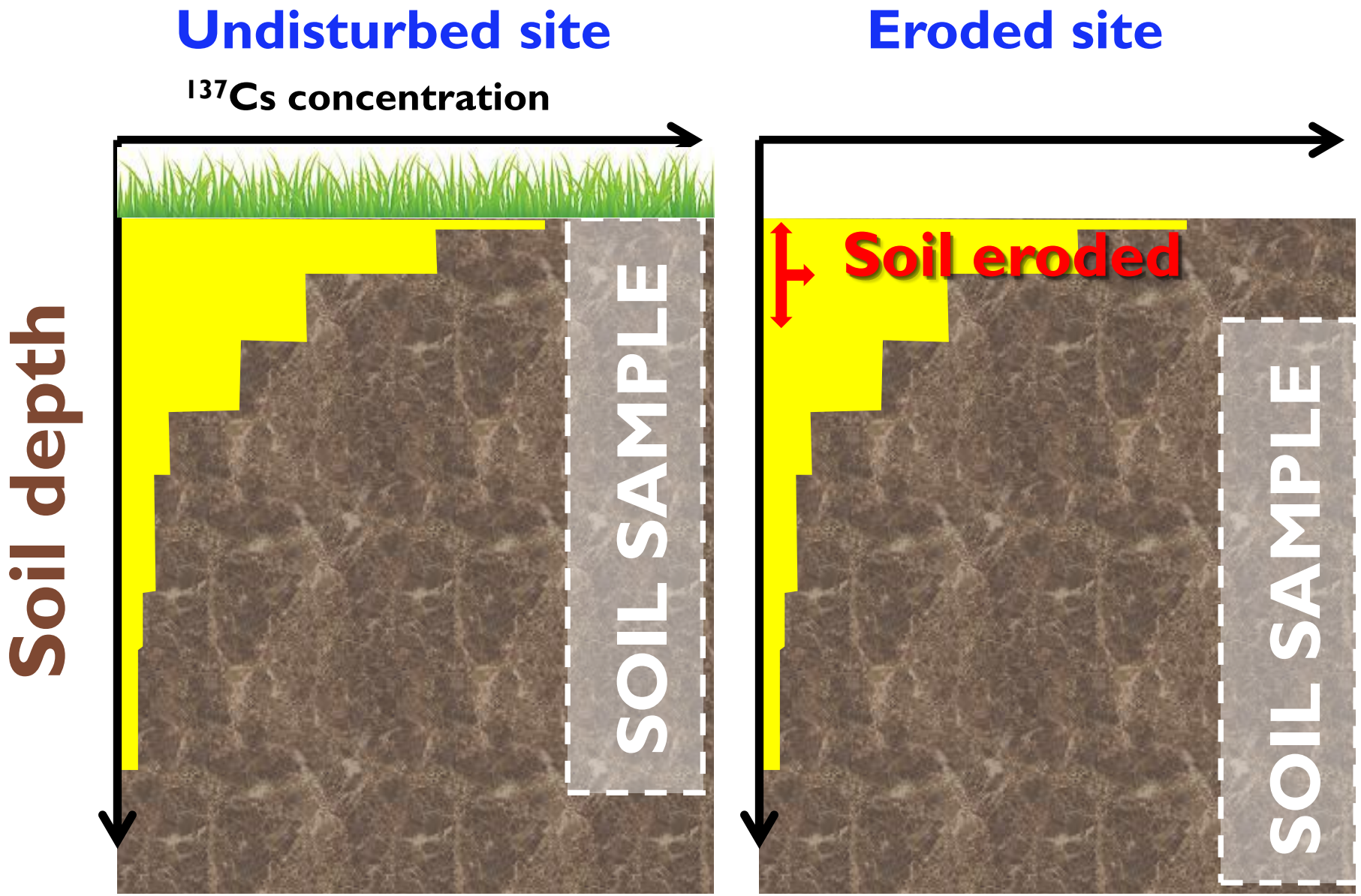
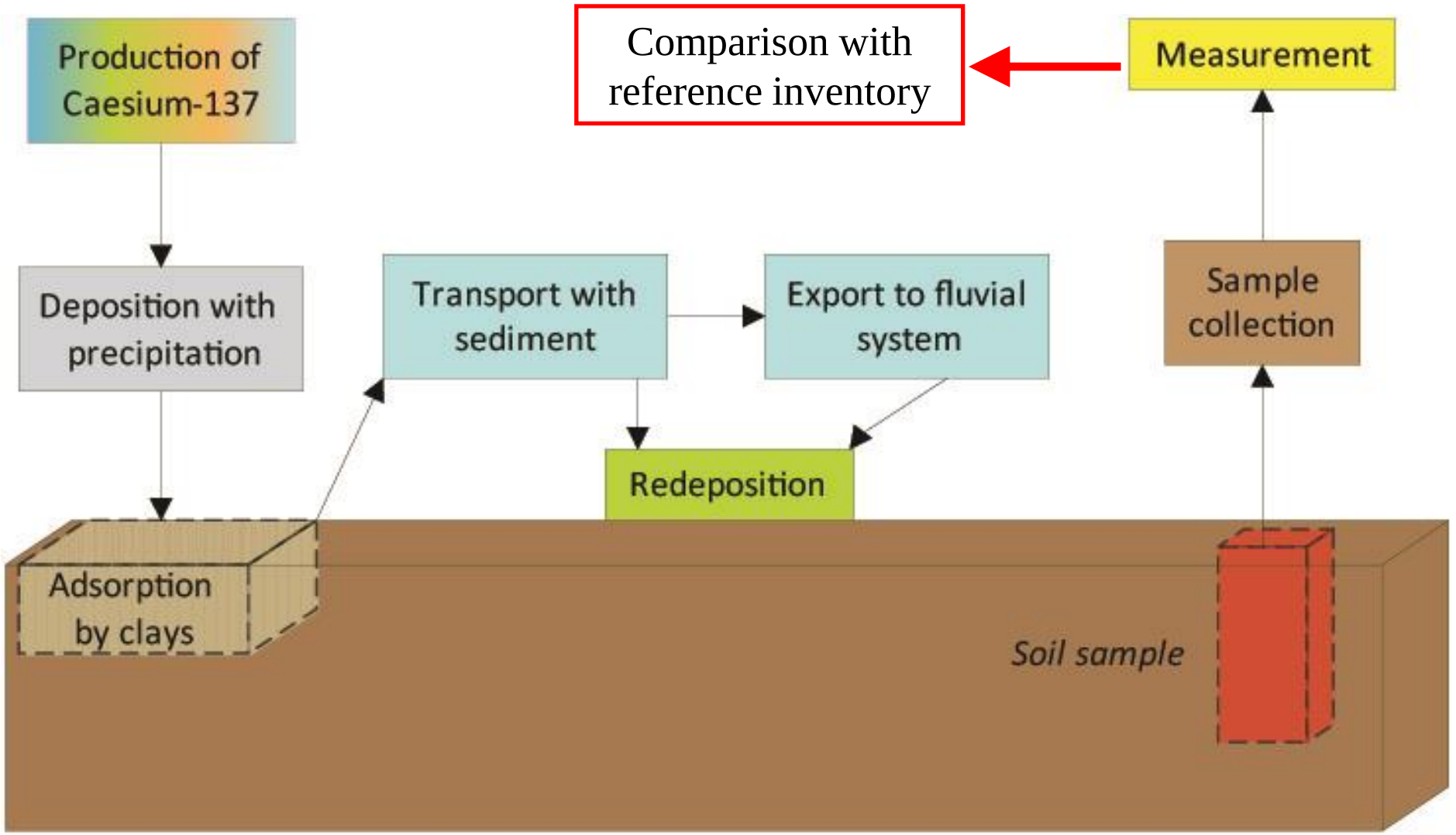
THE ^{137}Cs APPROACH



THE CESIUM-137 TECHNIQUE



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COMPARISON WITH THE REFERENCE VALUE

If	.... then....
Equal to	STABLE
Less than	EROSION
Greater than	DEPOSITION

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➢Advantages

- No need for traditional monitoring techniques, such as experimental plots or catchments
- Spatial variability
- Calibration and validation of soil erosion models
- Possibility to provide sediment budgets for large areas

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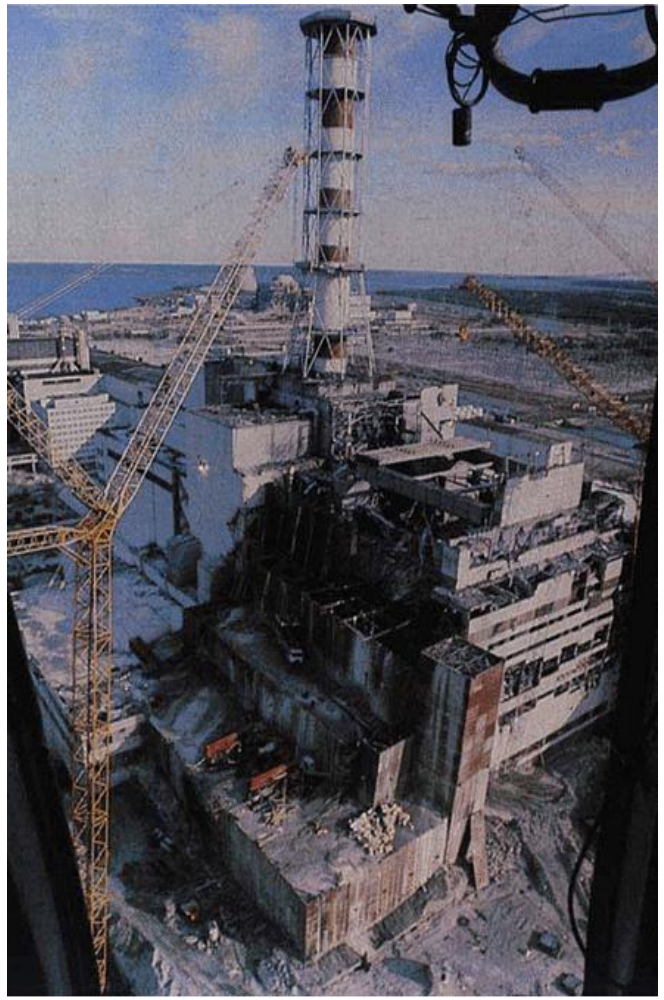
Chernobyl – Reactor dammaged after the nuclear accident occurred on April 26, 1986



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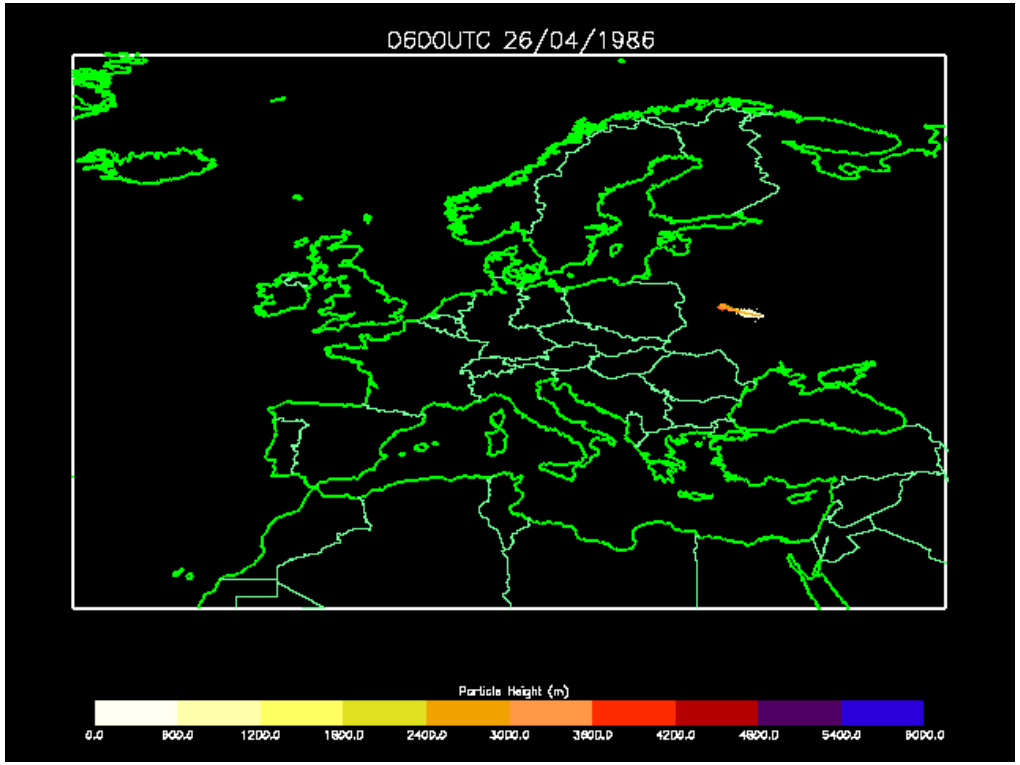
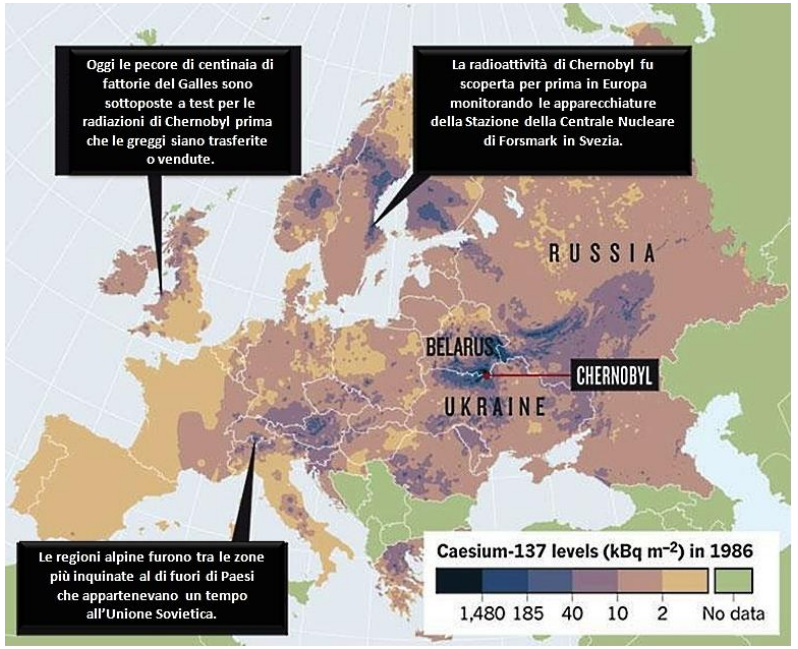
The Chernobyl accident



The Chernobyl nuclear accident occurred on Saturday, April 26, 1986, at 1:23:58 a.m. local time.



Greenpeace estimates talk about 93,000 people dead, based on information given by National Academy of Science (Bielorussia)

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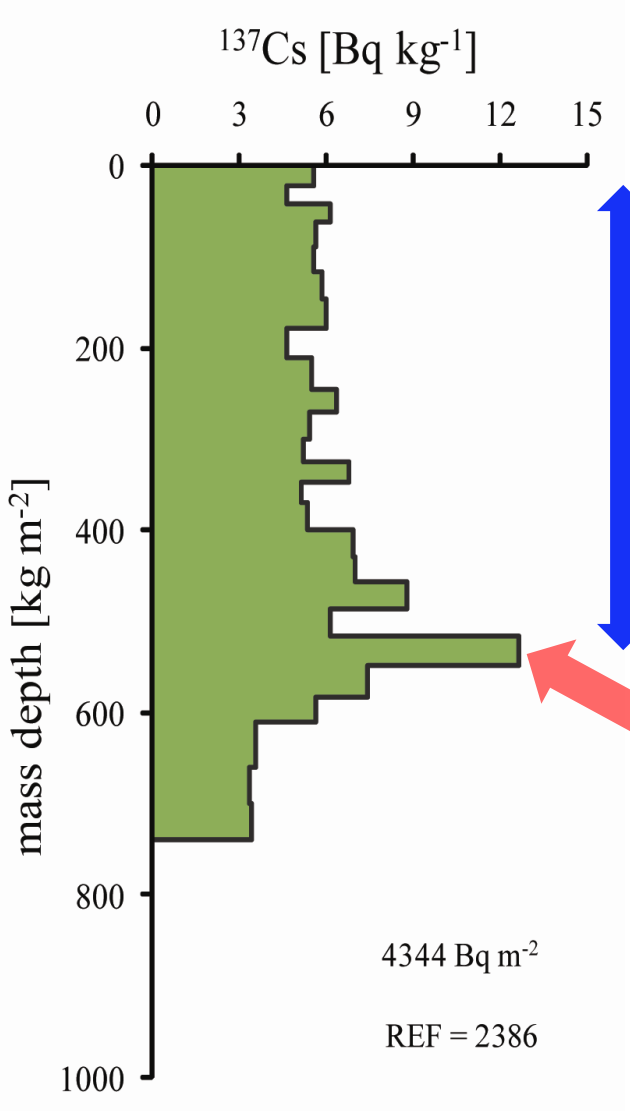
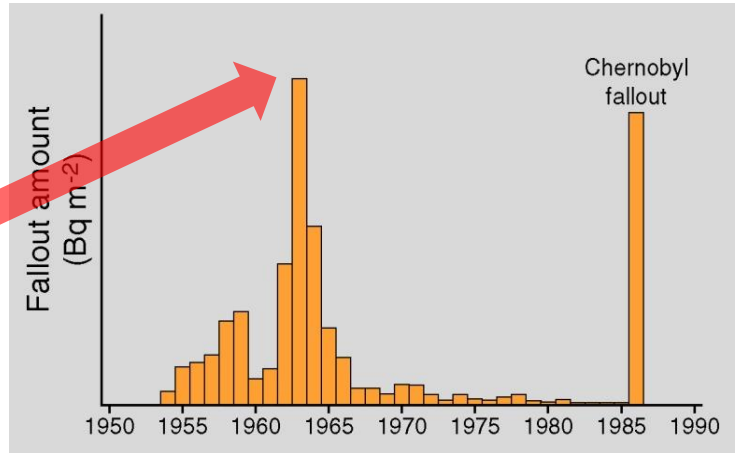
EXAMPLE OF A FLOODPLAIN PROFILE



Soil deposited

1963 peak



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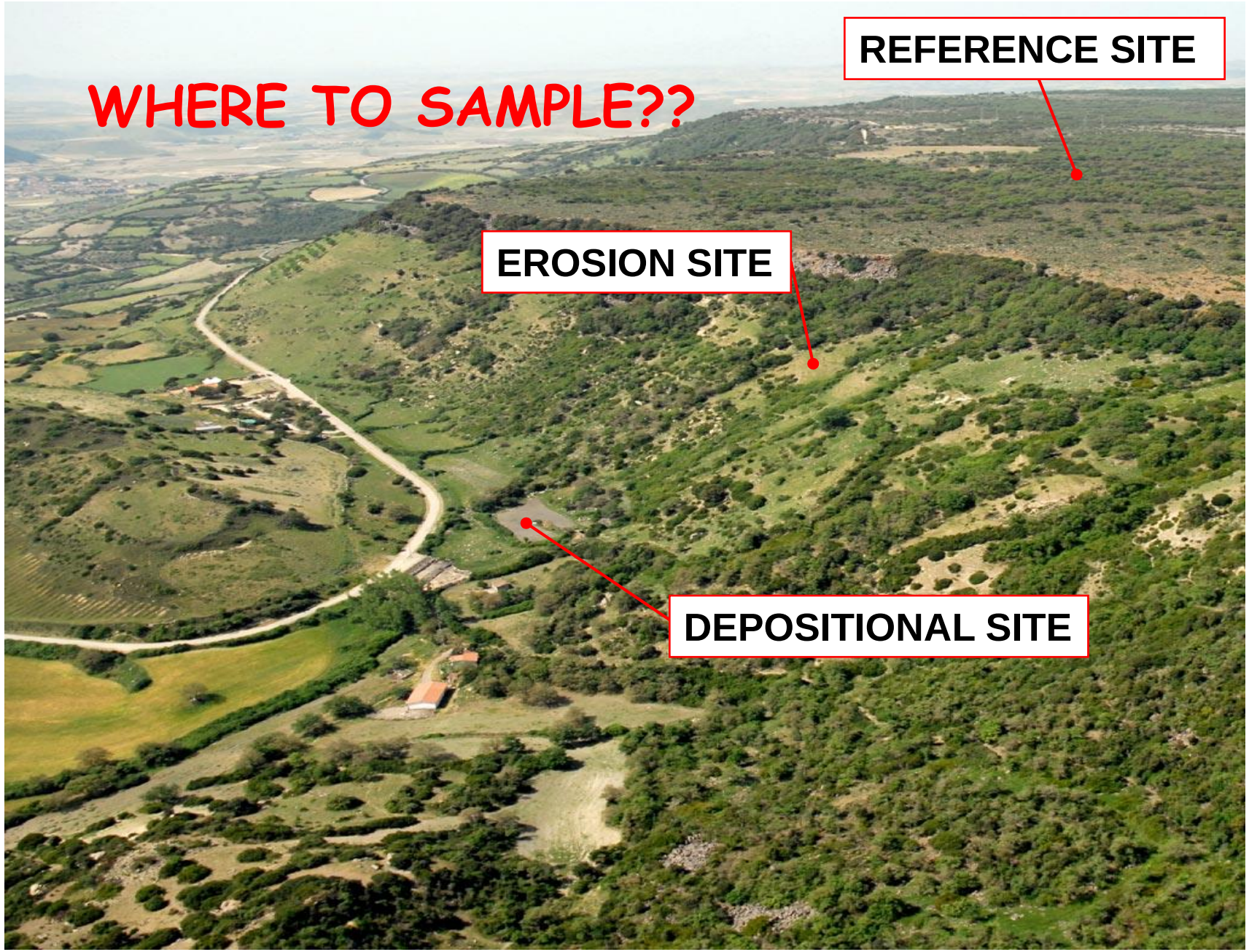
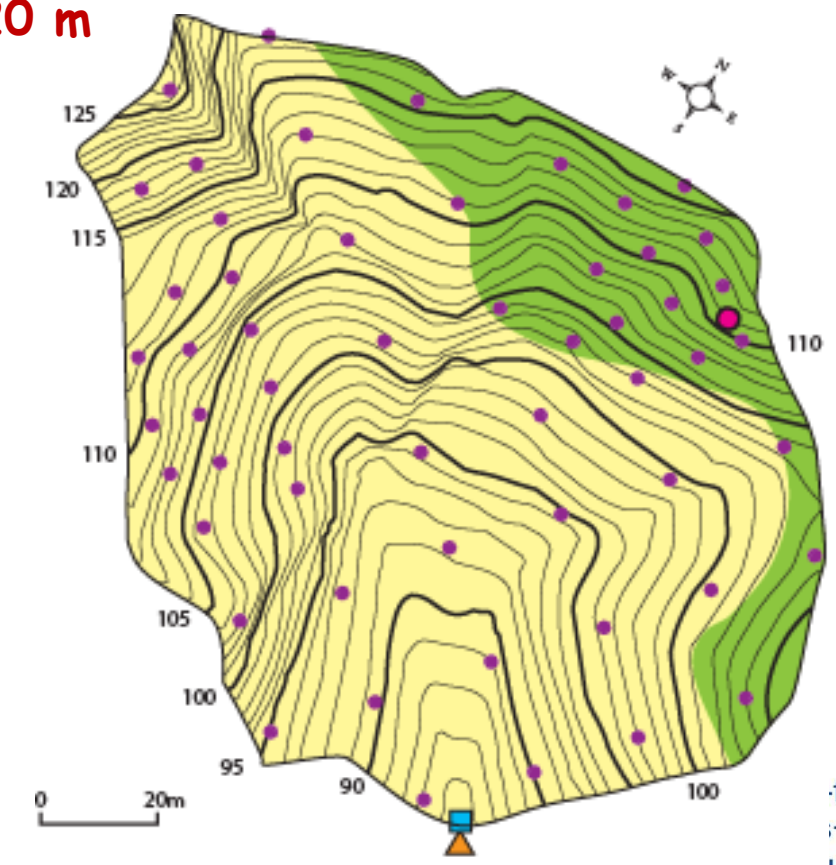

WHERE TO SAMPLE??
REFERENCE SITE
EROSION SITE
DEPOSITIONAL SITE

THE SAMPLING PROGRAMME

W2 → 55 bulk soil cores collected

Grid sampling 20 m x 20 m

- Sampling point
- Area with discontinuous forest cover
- Rain gauge
- Stream gauge
- Coshocton wheel sampler
- 90 Contour (m)



W2 Catchment

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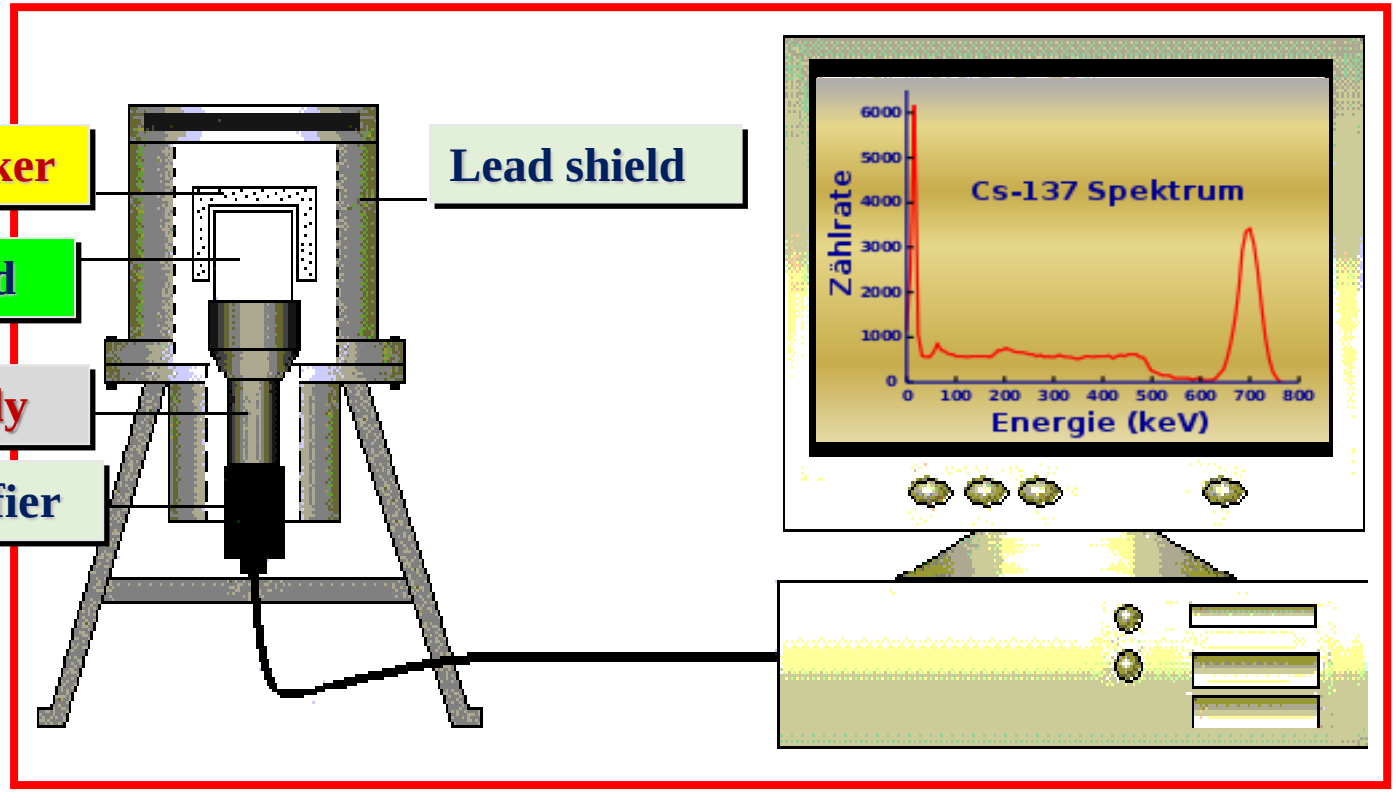
THE MEASUREMENTS

Soil samples are dried, sieved, and analysed at the University of Reggio Calabria



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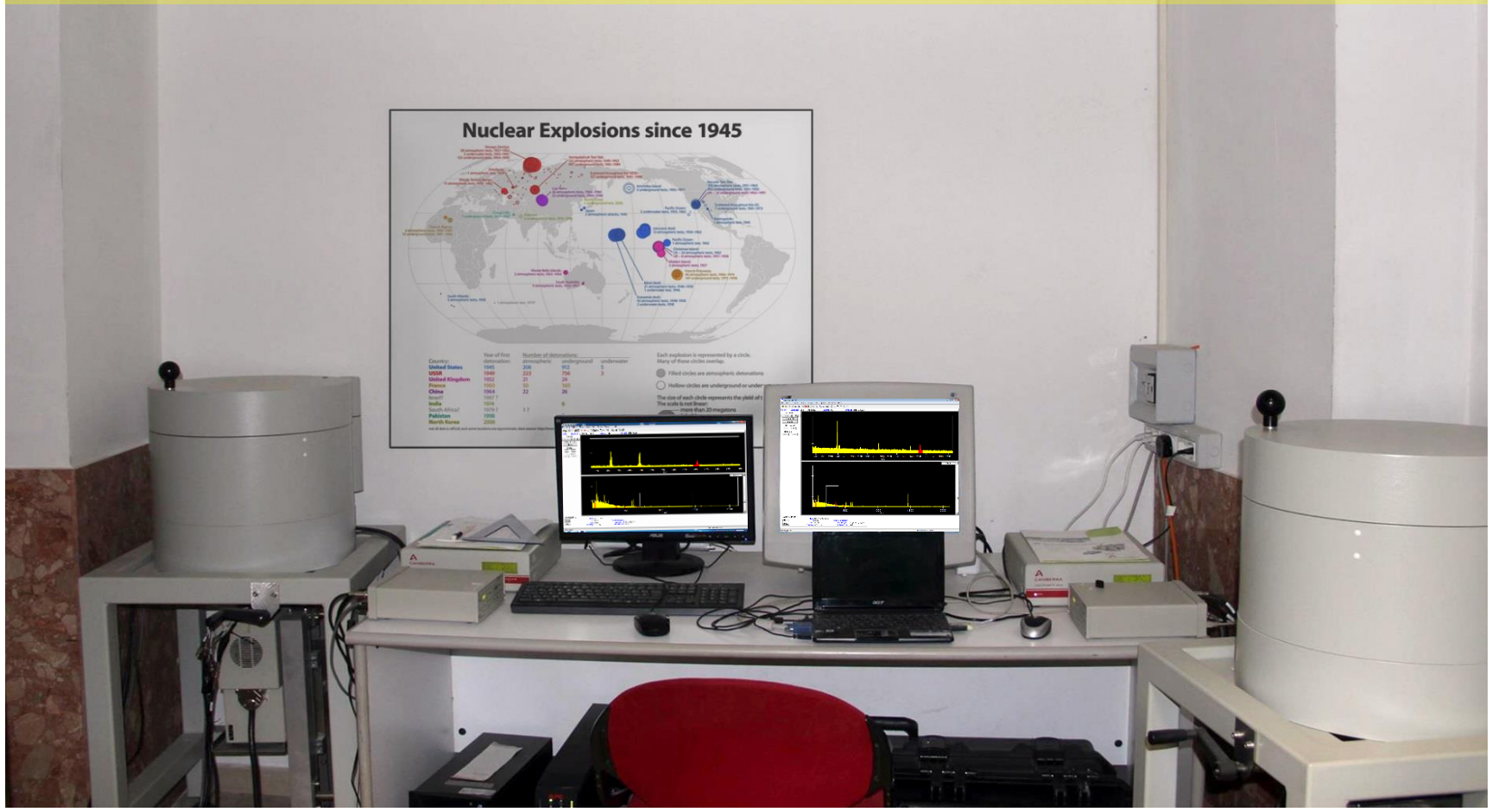
^{137}Cs analyses at the University Mediterranea

High resolution HPGe detectors were used at Reggio Calabria
Count times were at least 80,000 s



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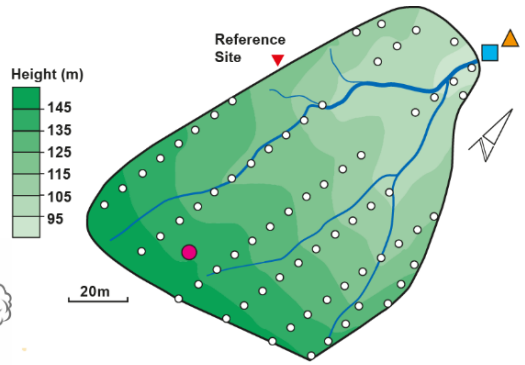
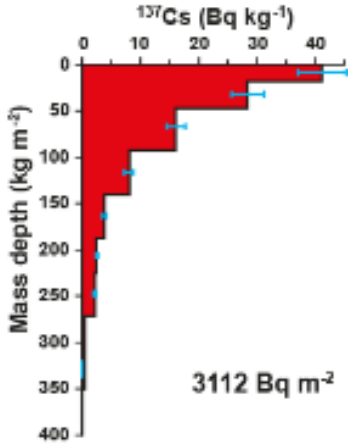
THE ^{137}Cs APPROACH





Sampling

Fallout period

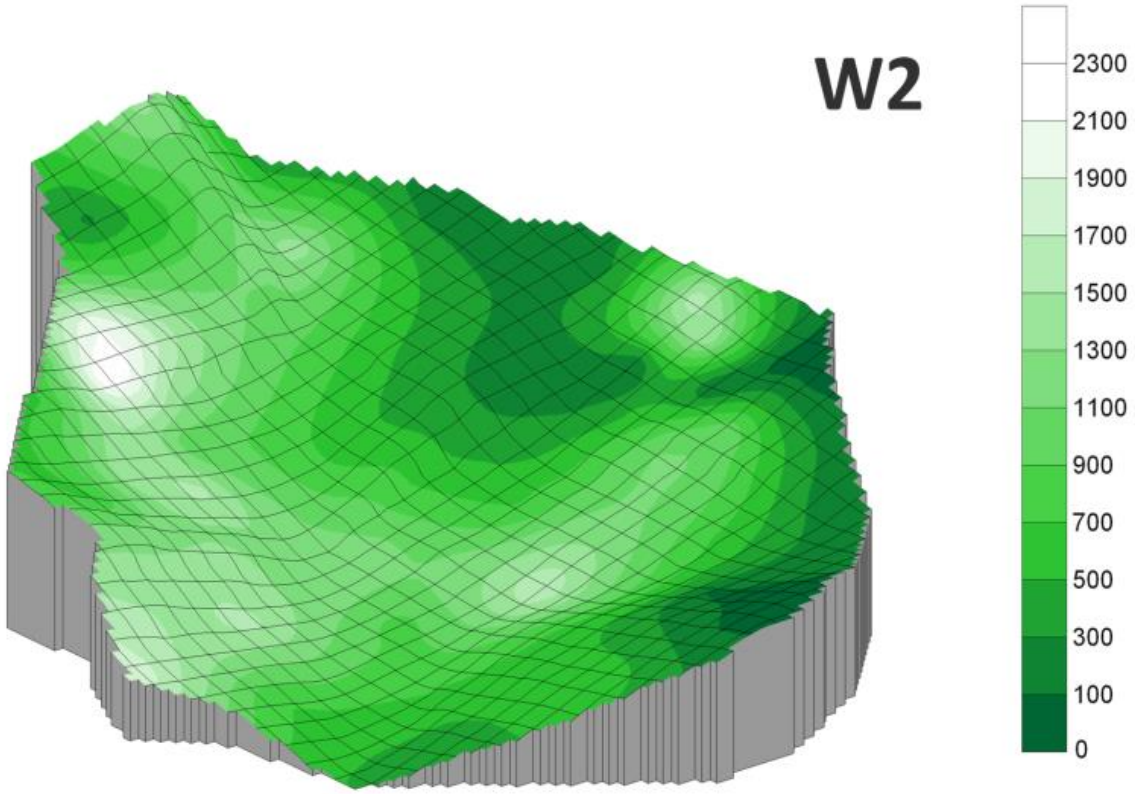
^{137}Cs

Mean erosion rate

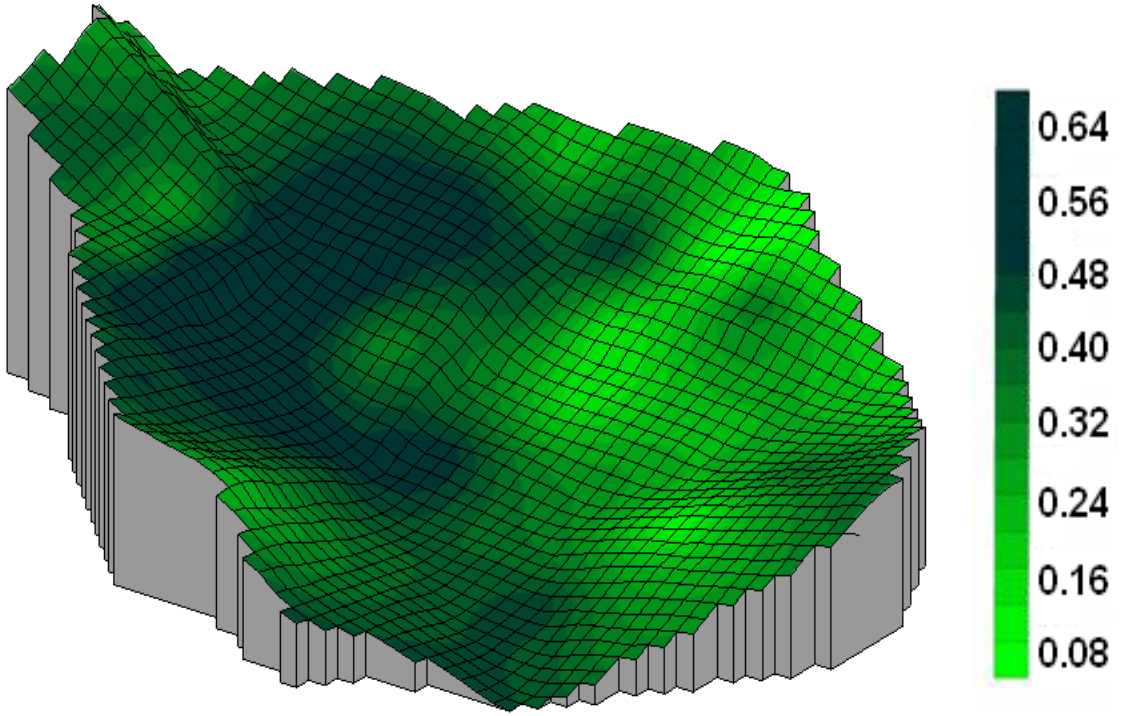
1954 1964 1990 2018 2030

Effect of afforestation

Caesiographic Map



Canopy cover Map



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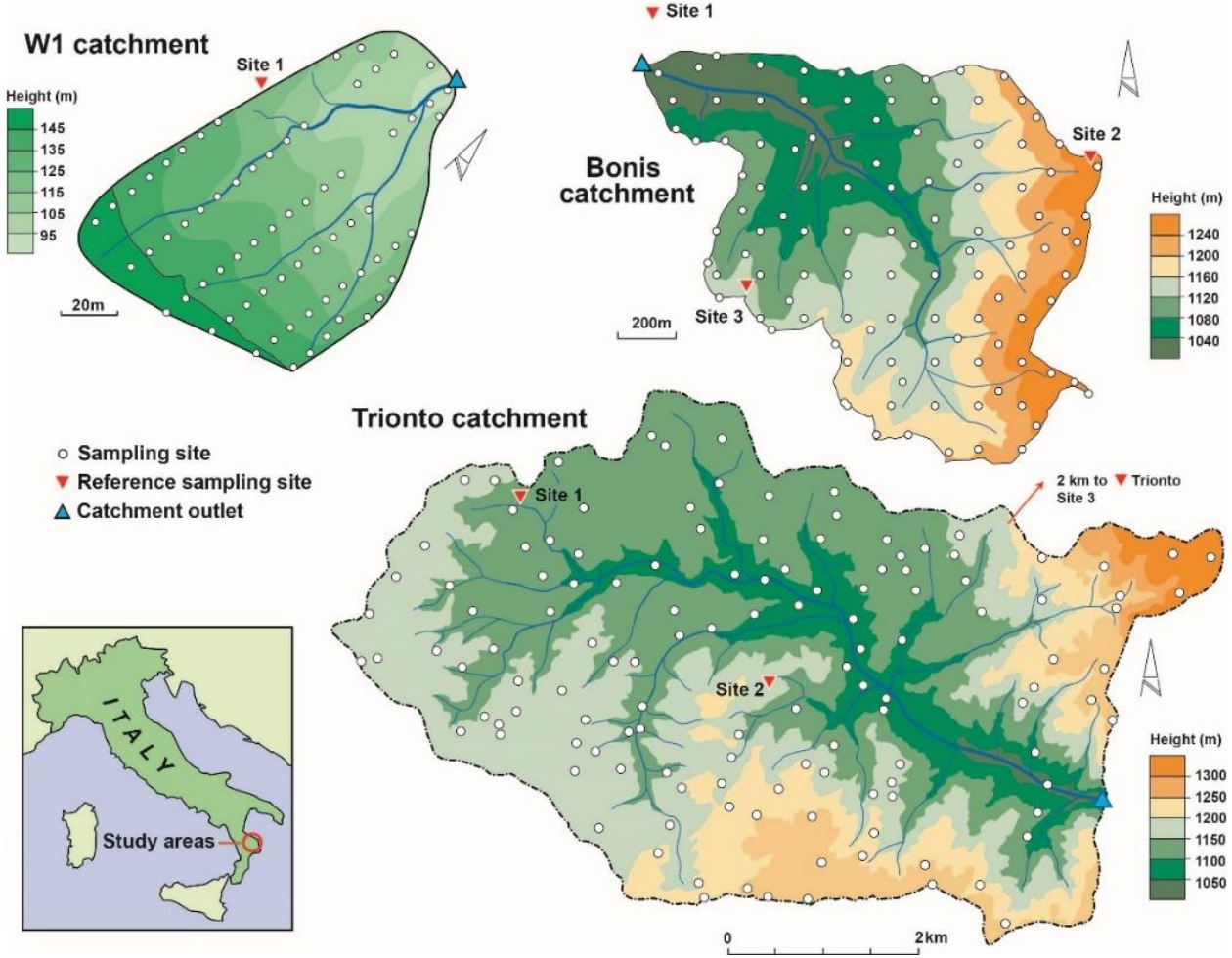
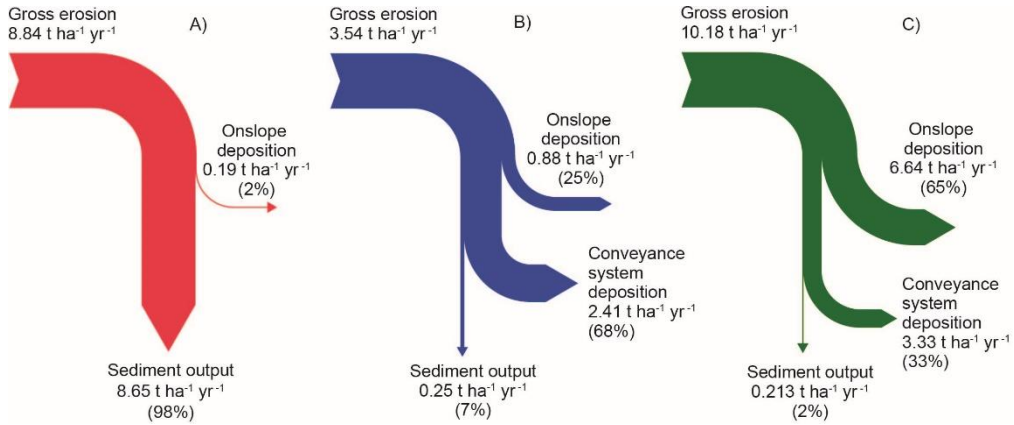
SETOF Soil Erosion and TOrrential Flood Prevention: Curriculum Development at the Universities of Western Balkan Countries

New trends of erosion and torrent control in Italy



THE SEDIMENT BUDGET

using radionuclides



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CONCLUSIONS

In order to address sediment-related environmental problems, there is a need to develop an improved understanding of the sediment cascade from source to sink. The sediment budget provides a framework for addressing this need.

However, establishing a sediment budget requires information not provided by traditional monitoring programmes. Sediment tracing techniques can provide this information. There is currently considerable interest in soil and sediment tracing techniques, particularly in Europe.

Recent advances in the development and application of sediment tracing techniques (e.g. Guzman et al., 2013) are now beginning to provide unique means of documenting catchment sediment budgets that meet these new information requirements.

Equally, there is a need to synthesise existing and forthcoming new information related to the structure and functioning of catchment sediment budgets that will be provided by these novel tracing techniques, to provide a firm basis for its use within the EU

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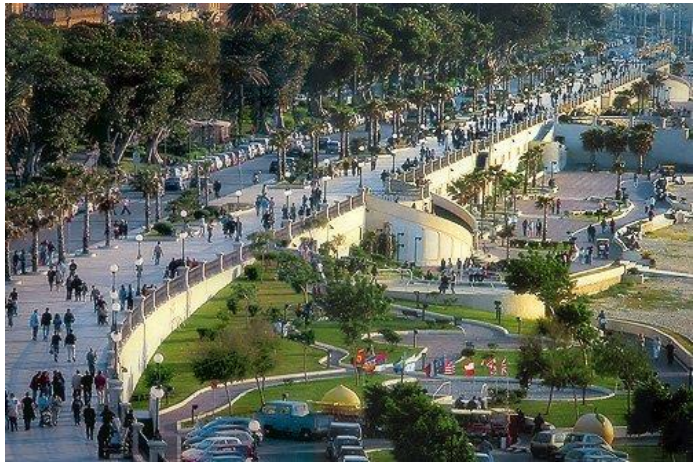
Questions?
Suggestions?



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