Land degradation and soil conservation in the Barlad Plateau, Romania: a case study from Racova catchment

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Methods

Several methods were deployed to estimate

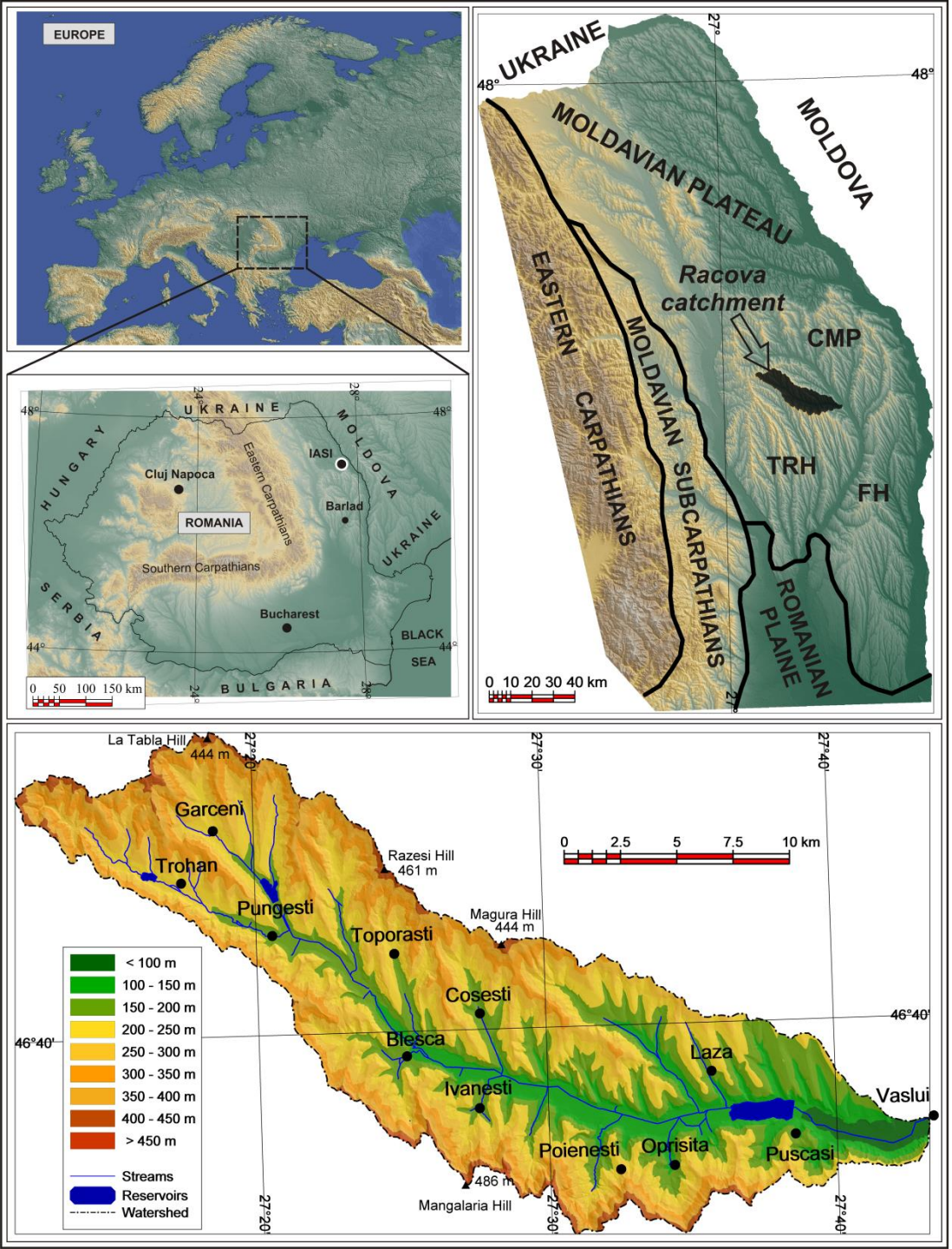
- **soil erosion losses,**
- **gully distribution,**
- **landslide inventory and**
- **reservoir sedimentation rates.**

- **Repeated levelling - topographic surveying usually with**
  - **Theo 020A,**
  - **Leica 407 TCR and**
  - **GPS South 82V-Trimble to obtain maps at scale 1:500**
  - **Midas Valeport Eco-sounder, type Bathy-500DF**

- **Aerial photographs (1960, 1970, 2005, 2009),**
  LiDAR images (2012),
  Topografic map of the floor of future Puscasi Reservoir (1969, ISPIF)
  Topographic maps (1974-1977, 1:5,000 scale)
  Topographic map of Moldavia (scale 1:20,000) and the Atlas of Moldavia (1894, scale 1:50,000)

- **The Cs-137 technique (Gamma spectroscopy, associated with the Canberra MCA S100 system equipped with a Ge (Li) detector)** along gully floors to estimate the impact of soil conservation measures (check dams and afforestation)

Study area



Location of the study area within the Moldavian Plateau

Area - 32,908 ha

83 % - sculptural landsforms

H max - 485 m
H min - 89 m

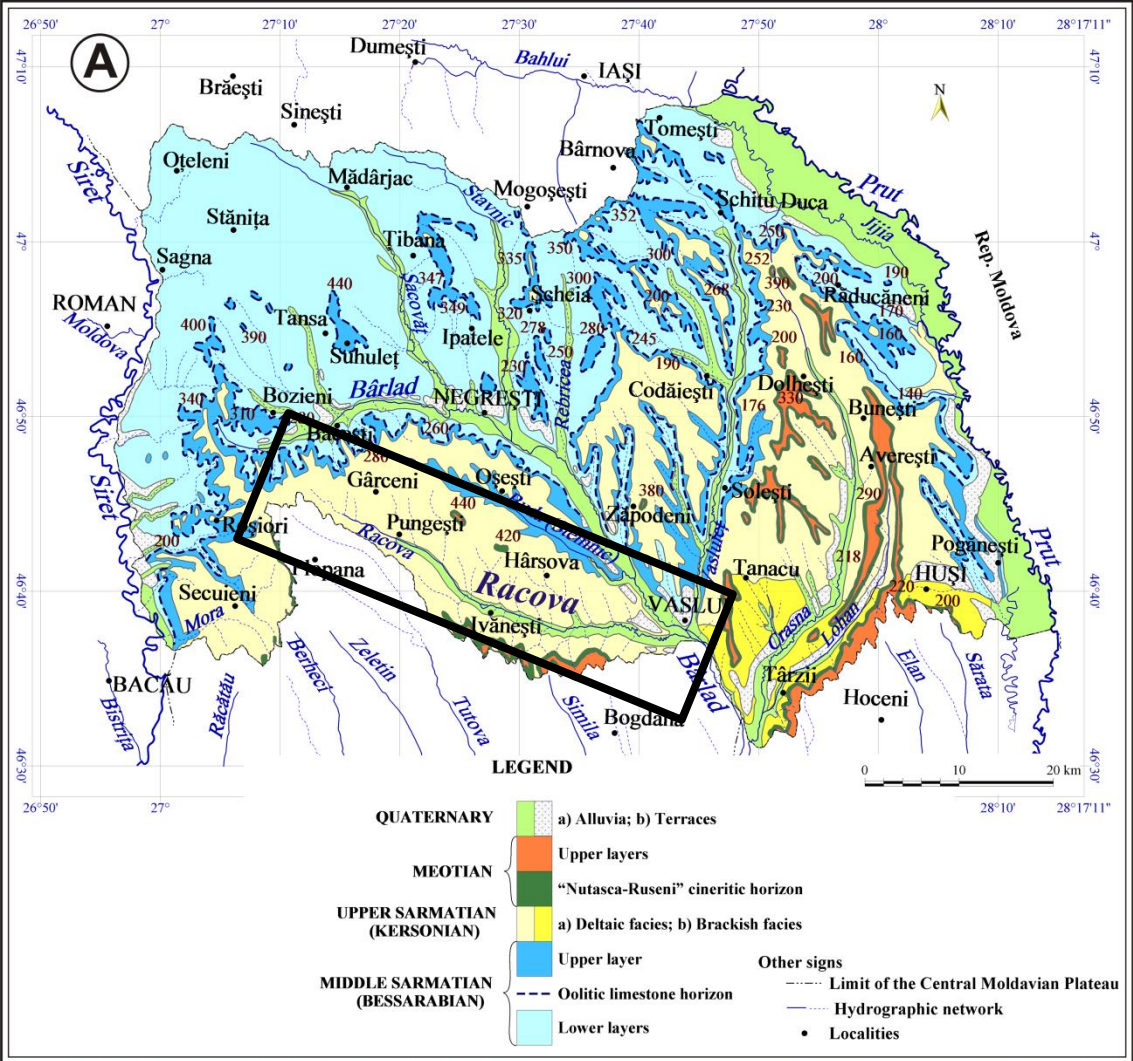
Avg. Slope = 18.7 %

Study area

Geology of the study area

Late Miocene (Sarmatian and Maeotian) layers have outcropped due to erosion

- clayey-sandy and sandy-clayey formations, almost exclusively deposited in deltaic facies



Soil cover
(accord. WRB)

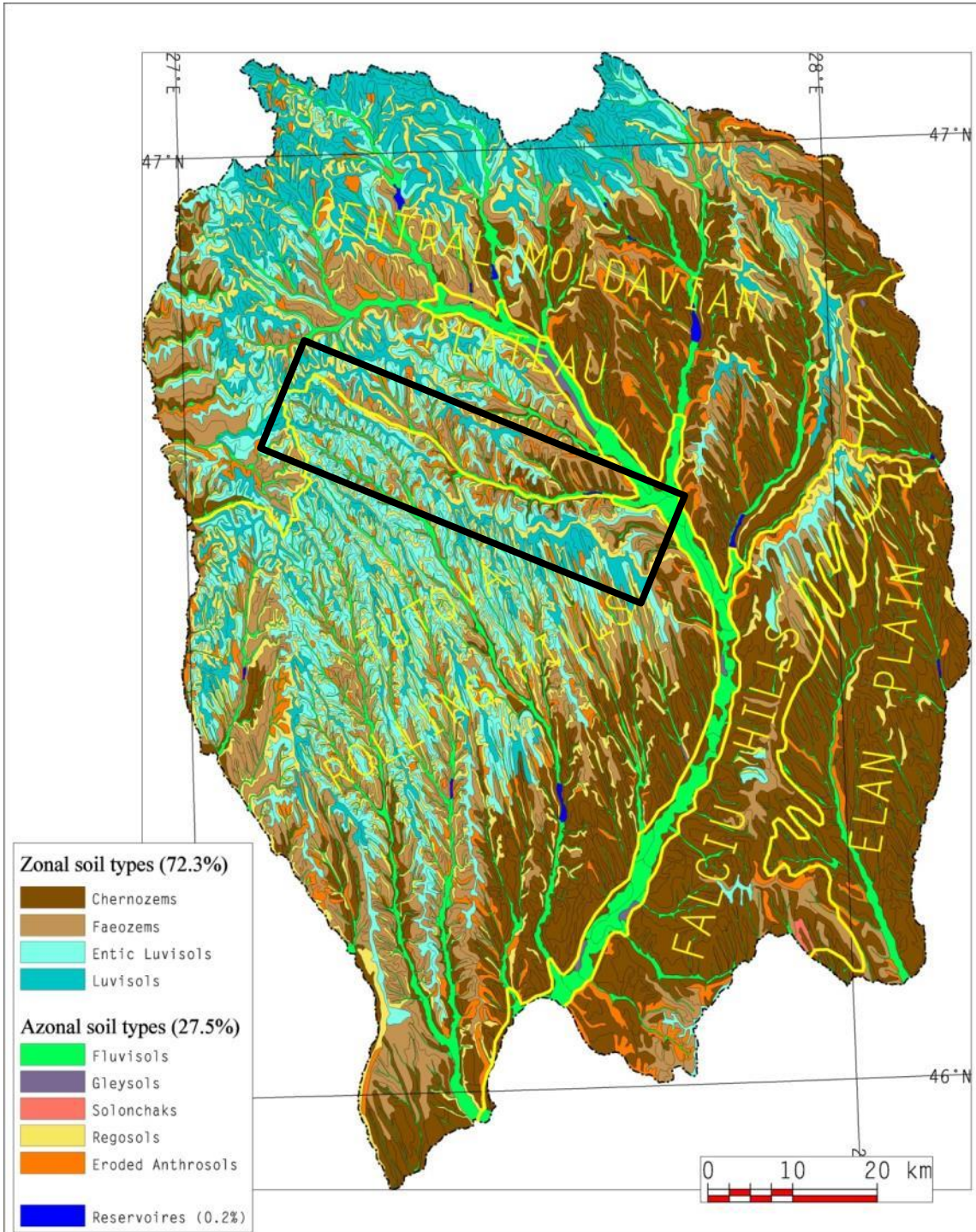
Zonal soils – 72.3 %

Steppe / forest steppe soils
* Chernozhems
* Faeozems

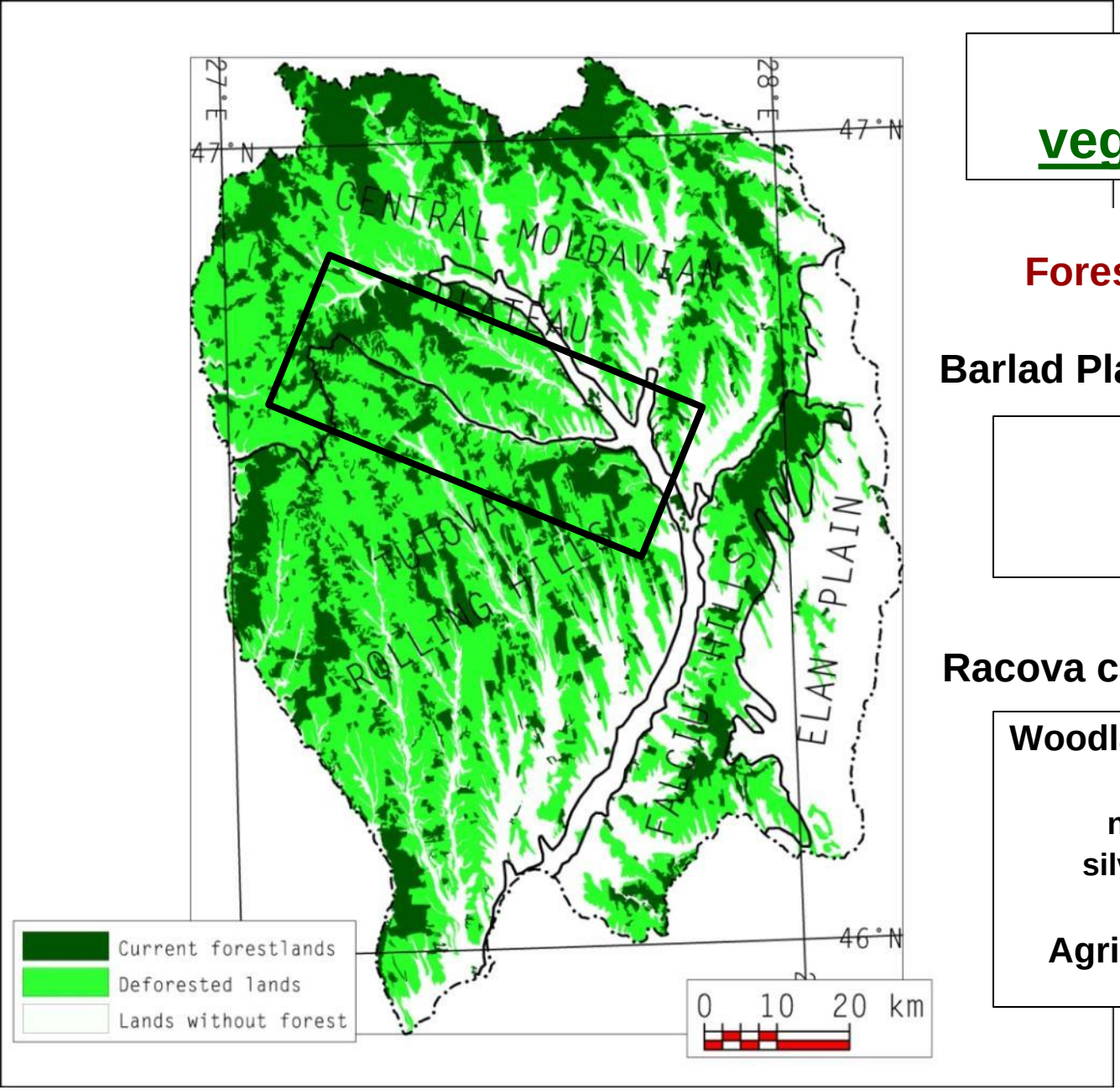
Forest soils
* Entic luvosols
* Typic luvosols

Azonal soils - 27.5 %

* Fluvisols
* Gleysols
* Solonchaks
* Regosols
* Anthropic eroded soils



Natural vegetation cover



Forest distribution in the

Barlad Plateau (Stanga & Niacsu, 2015)

1800 = 68.3%
1893 = 19.6%
Today = 20.7%

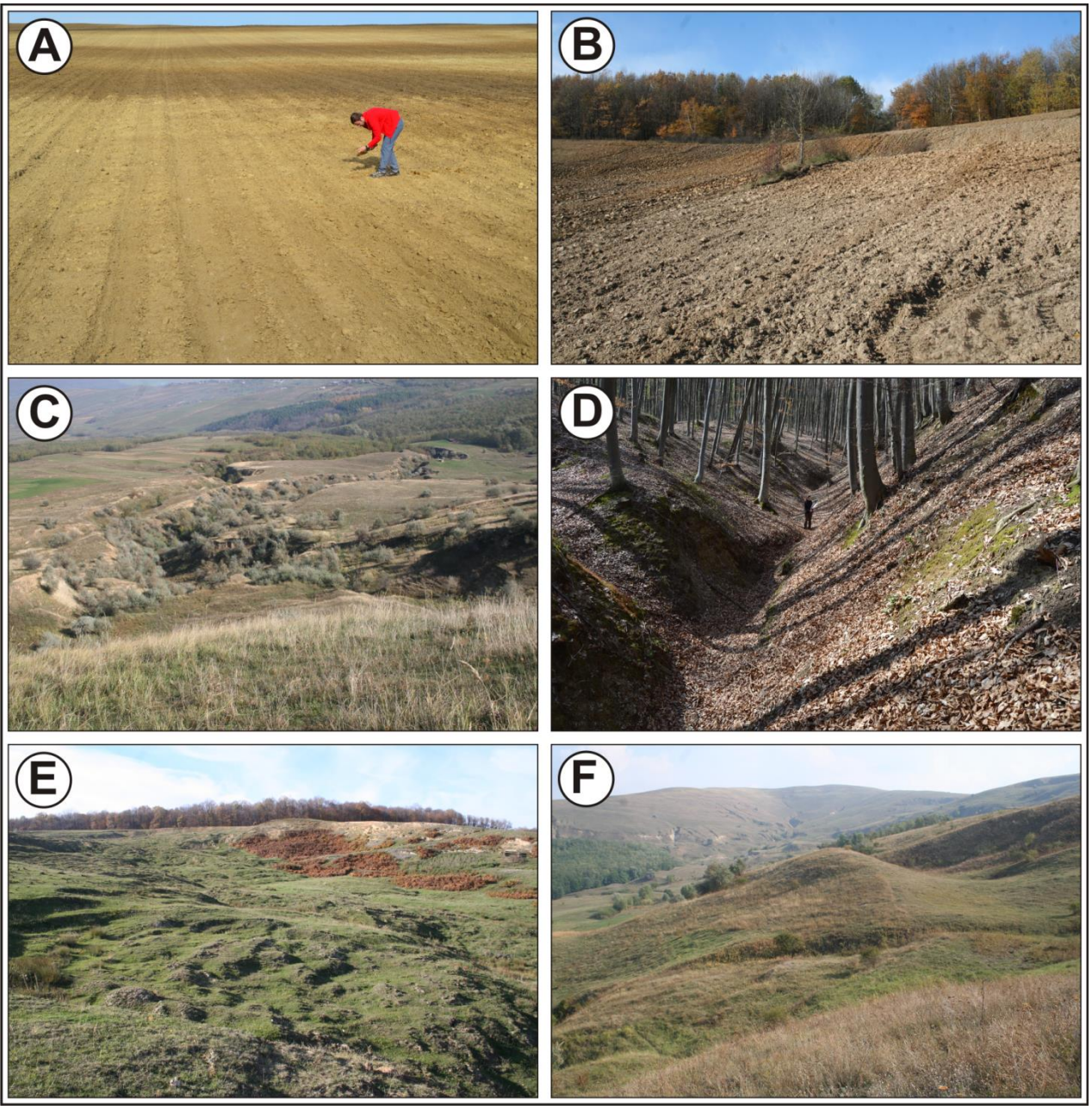
Racova catchment (nowadays)

Woodland = 26.6%

native forest = 17.8%
silvic plantations = 5.2%

Agricultural lands = 68 %
arable = 35.4

Consequence: Land degradation



Land degradation –
major cause of environmental degradation !

Highly susceptibility to
- **soil erosion,**
- **gullying and**
- **landslides,**
- **sedimentation**

which
- **damages the local landscape**
- **depleting soil resources,**
- **decreasing agricultural productivity**

Results on:

Soil erosion

Soil loss by water erosion
(rill and inter-rill)

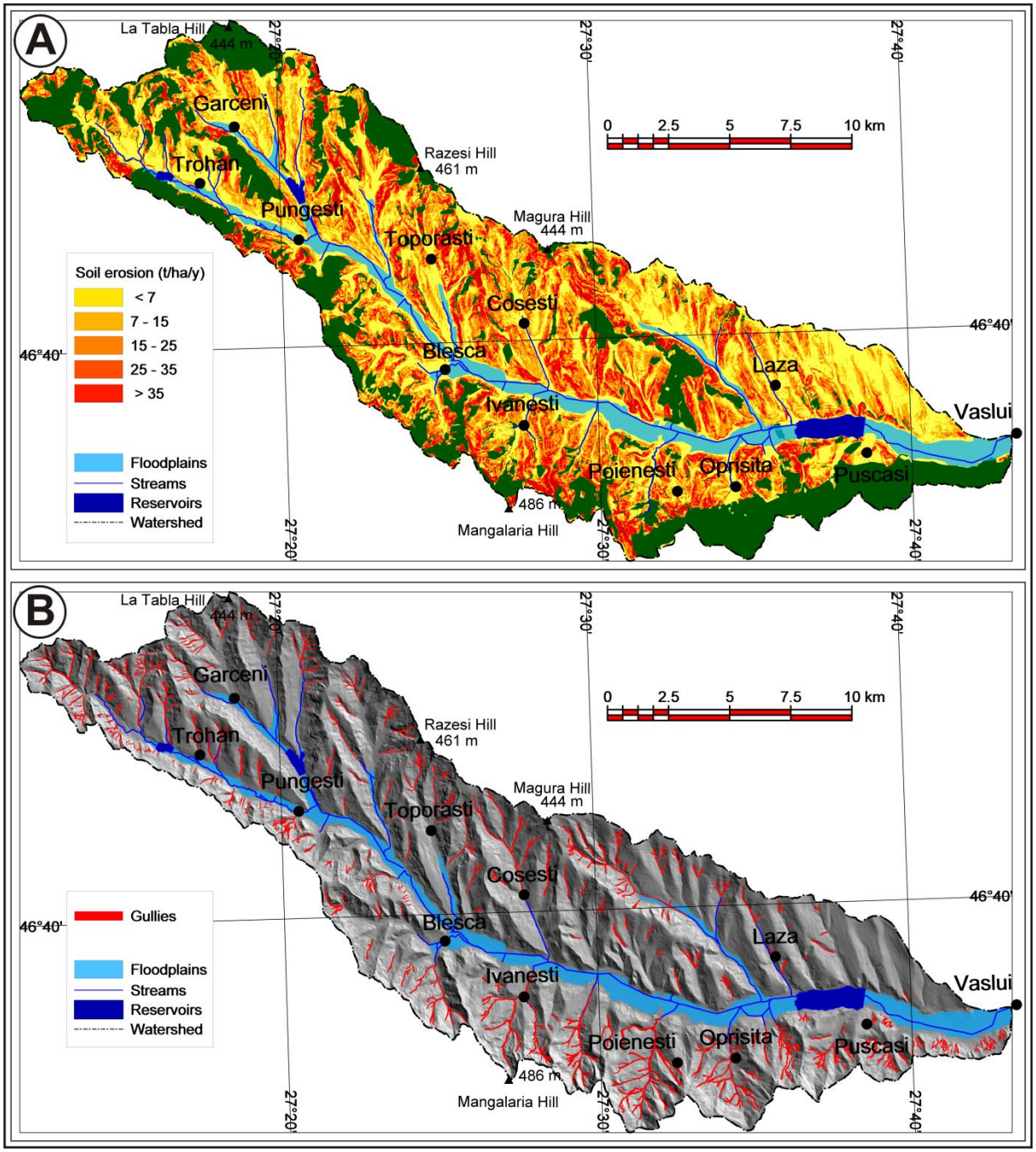
7-25 t ha^{-1} y^{-1} - 46%
SD - 455 10^{3} t y^{-1}
SSY - 15.6 t ha^{-1} y^{-1}
specific sediment yield

61% of gross erosion

Gully erosionerosion

Area - 2.7%

SD - 231 10^{3} t y^{-1}
SSY – 7.1 t ha^{-1} y^{-1}
31% of gross erosion

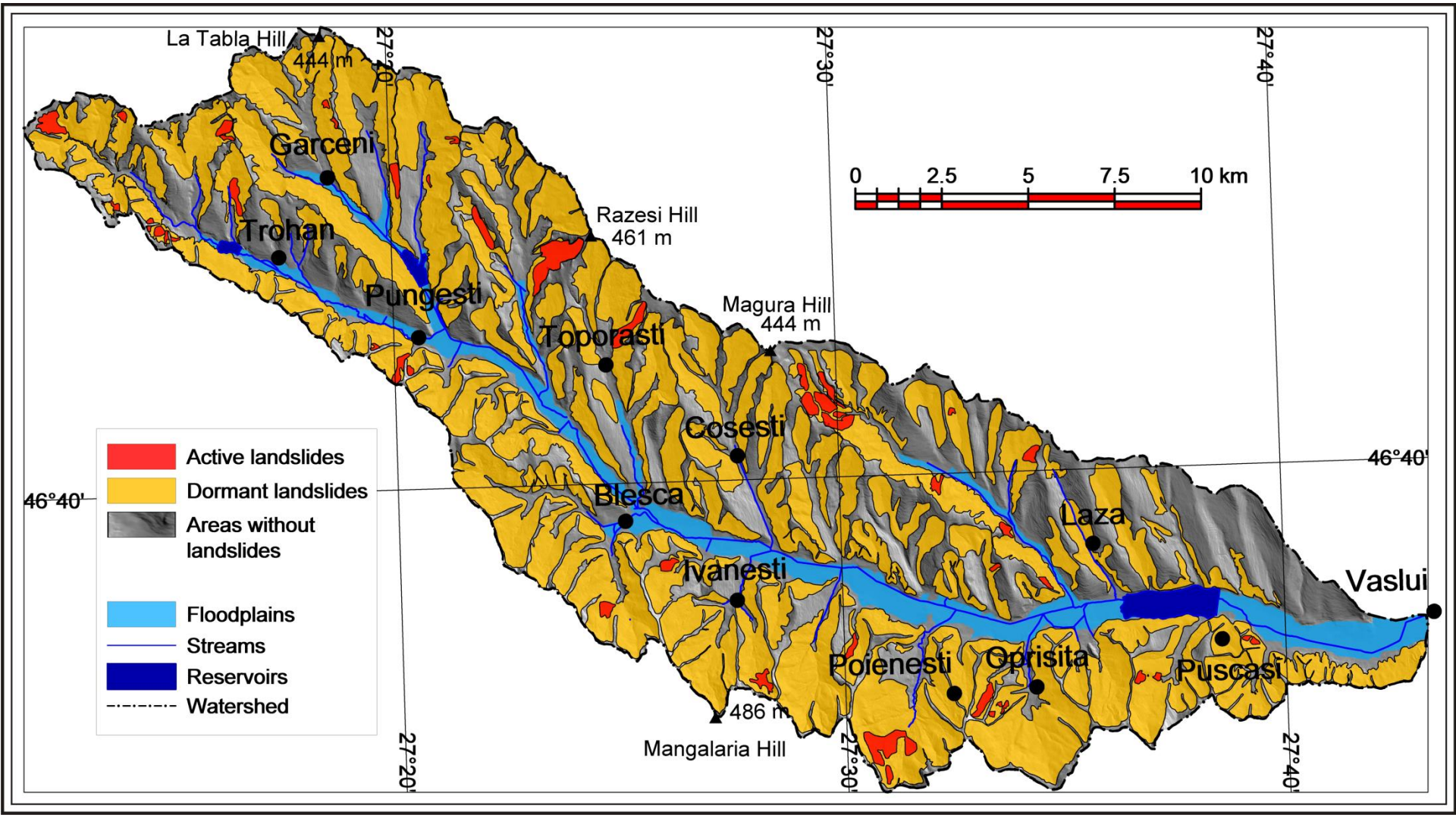


Results on:

Landslides

56.2%

3% active landslides



Results on:

soil conservation measures

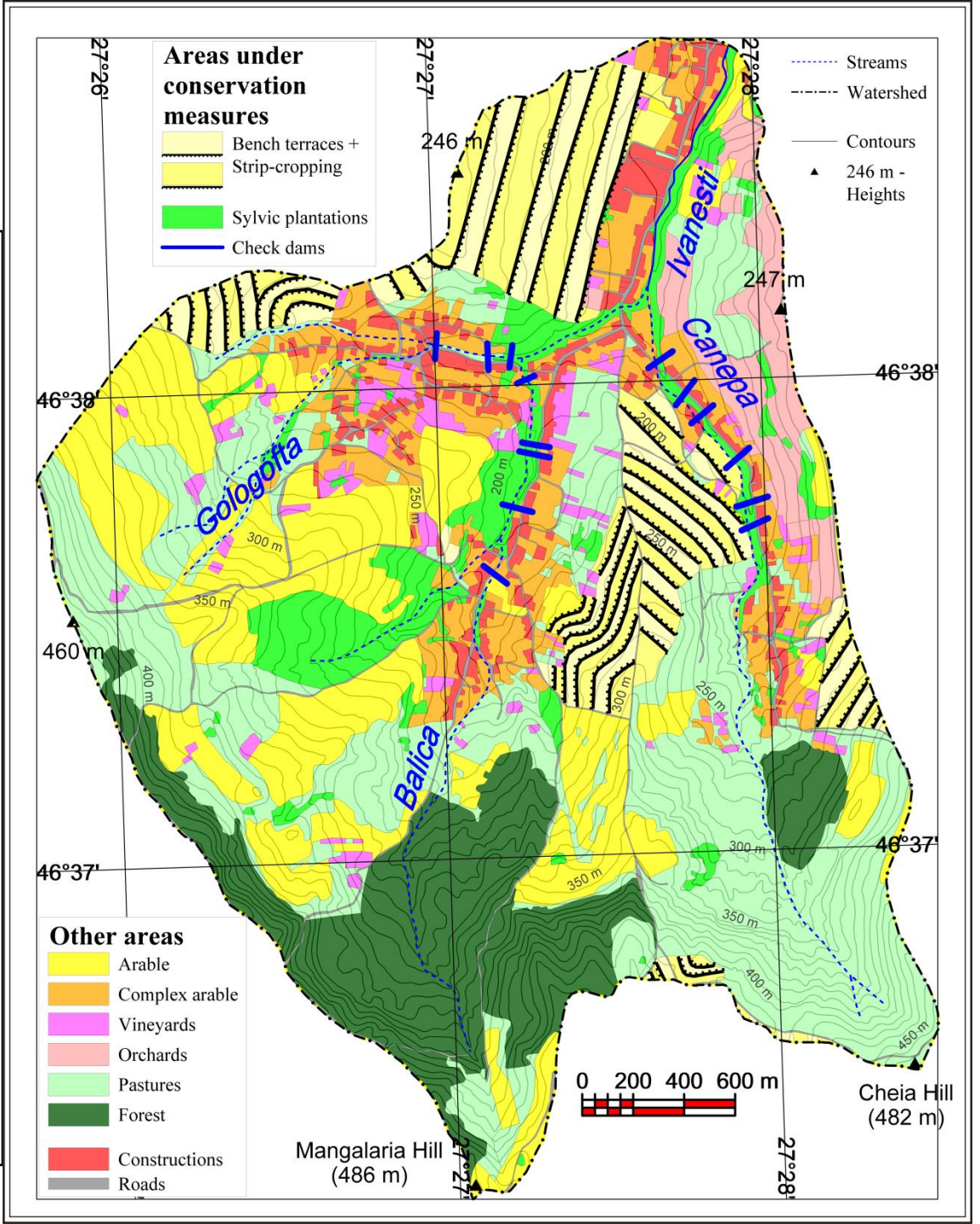
Between 1970-1989 much soil conservation work was accomplished, especially by IEELIF Vaslui

- design and construction of **dams and reservoirs**: Puscasi (1973, 257 ha NRL), Trohan (1982, 21 ha at NRL), Pungesti-Garceni (1976, 61 ha at NRL).

- design and construction of **check-dams** to control gully erosion in the tributaries

- design and implementing **soil conservation practises** on slopes in large farms (strip-cropping, buffer strip cropping and especially bench terraces).

- design and building **drainage systems**.
- filling small gullies, **land reshaping** using topsoil and **improving pastures**.
- large-scale **afforestation** on 1,704 ha on landslides and gullies



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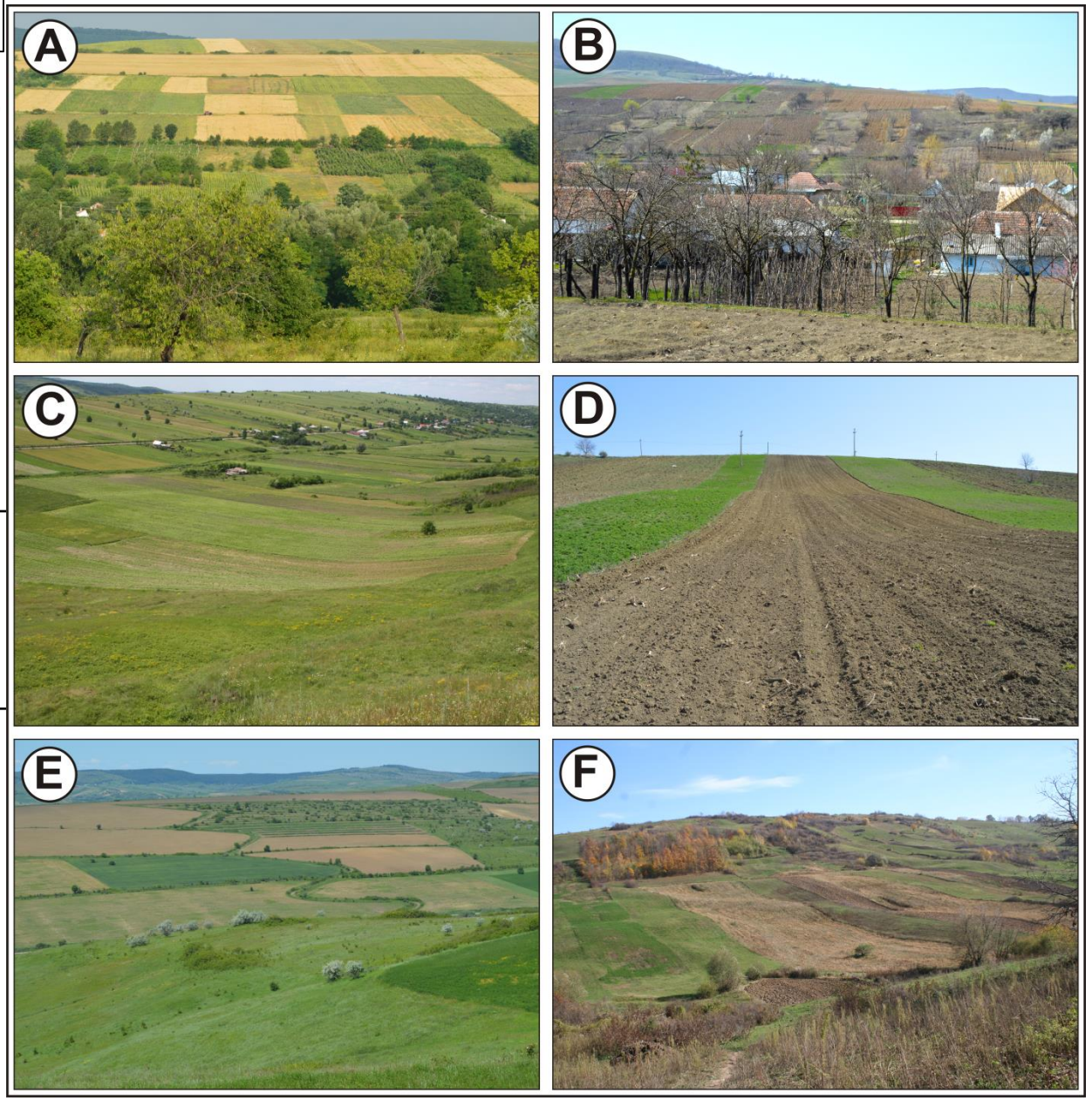


Results on:

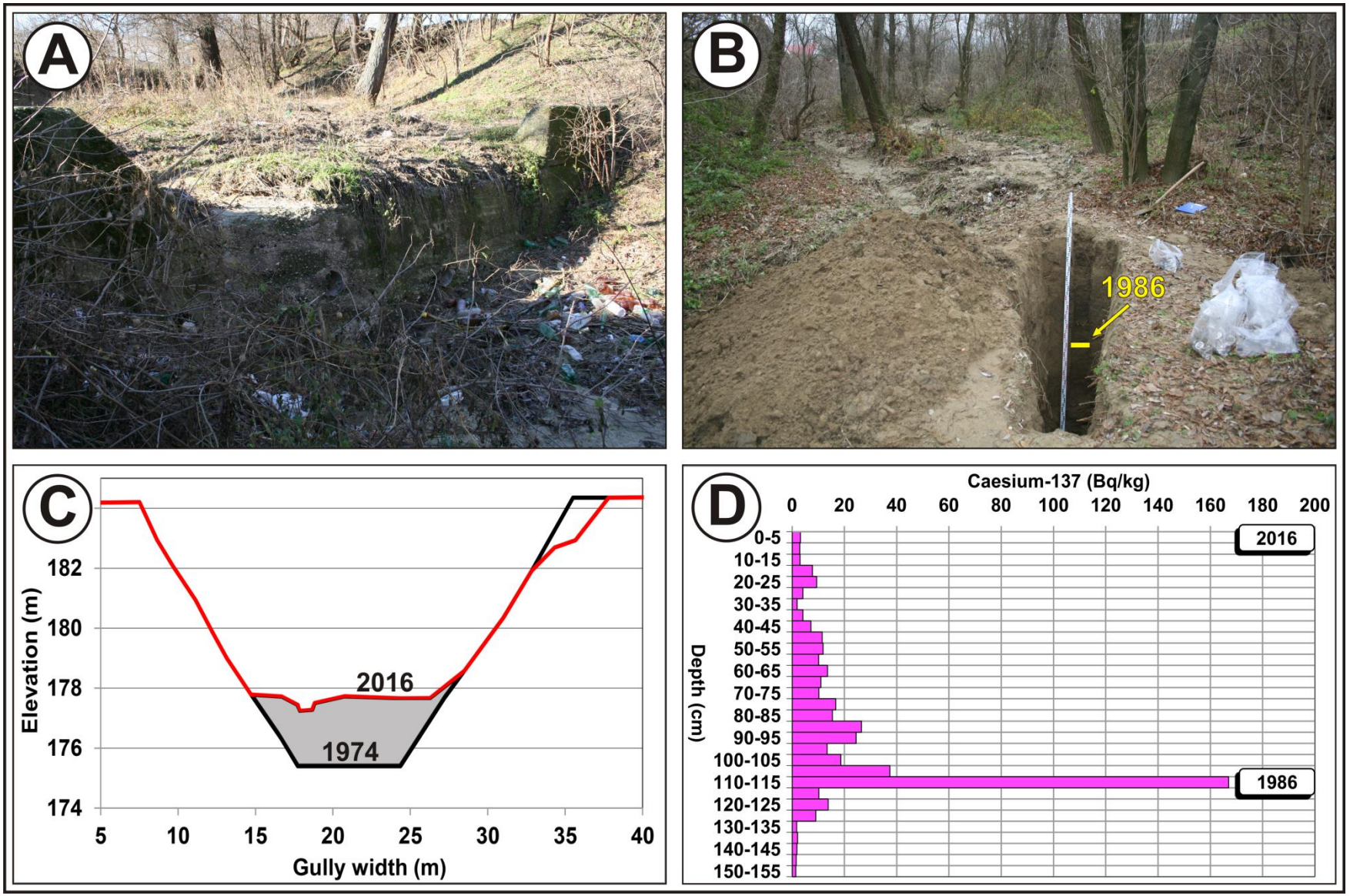
soil conservation measures

Influence of conservation measures on sedimentation rates:

Balica gully

5.2 cm y^{-1} (1974-2016)

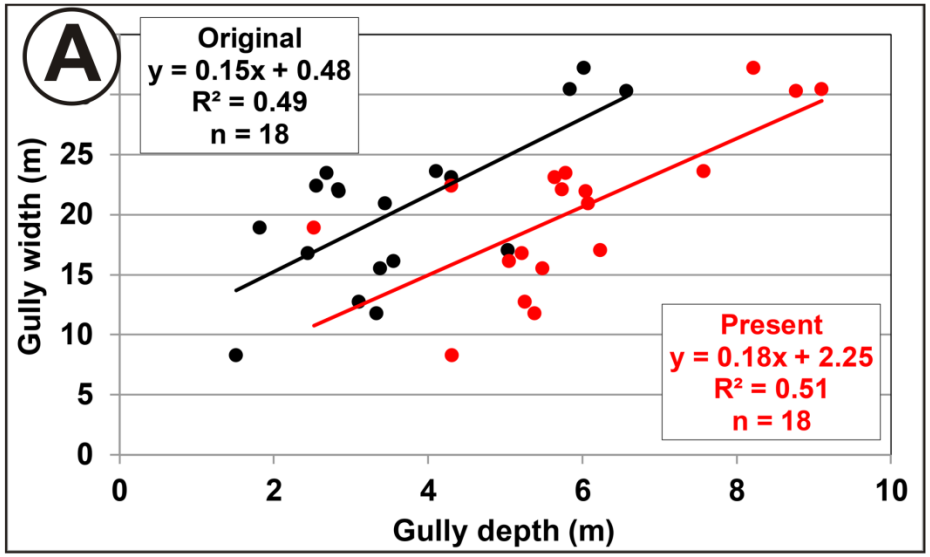
3.8 cm y^{-1} (1986 - 2016)

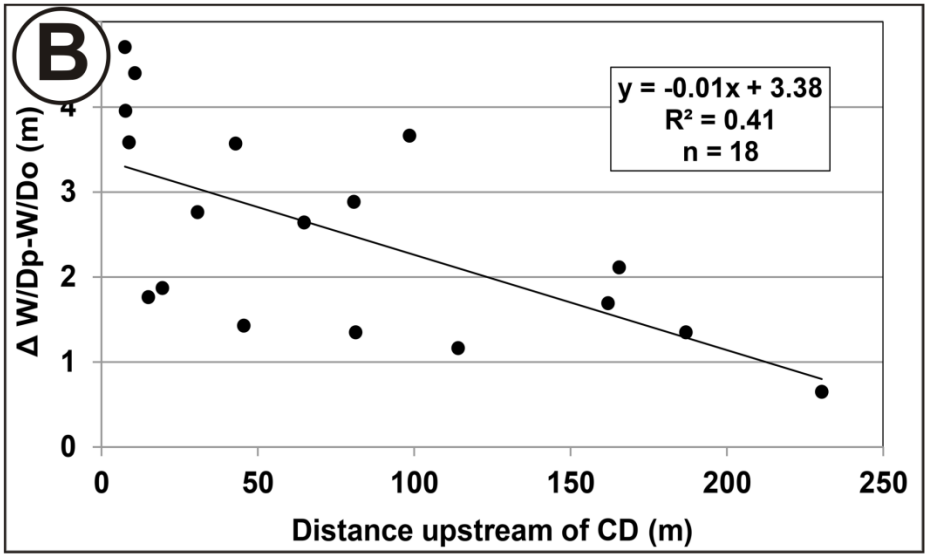


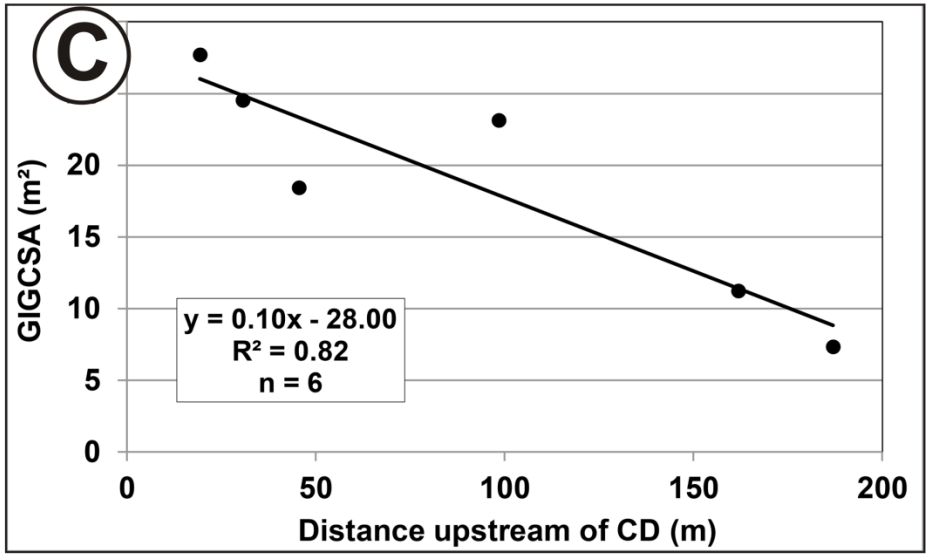
Results on:

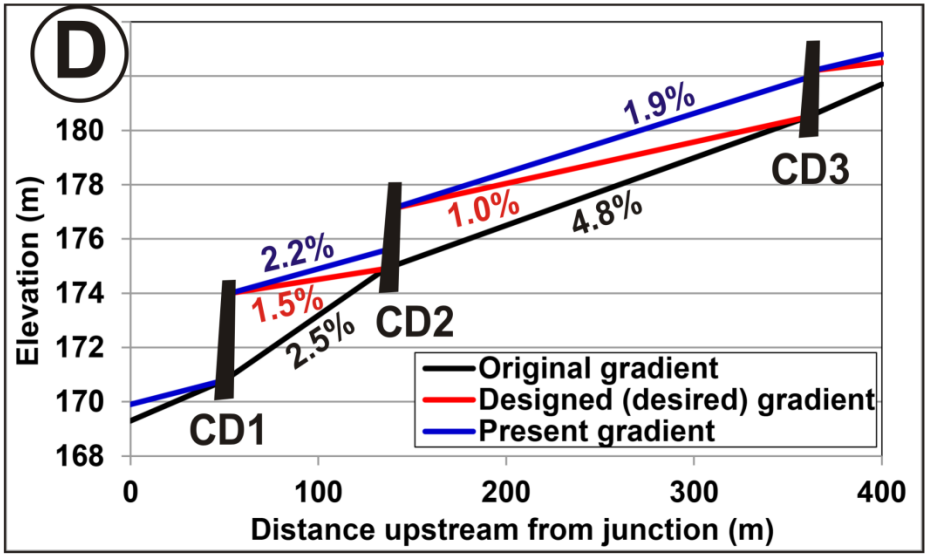
soil conservation measures

Influence of conservation measures on sedimentation rates:







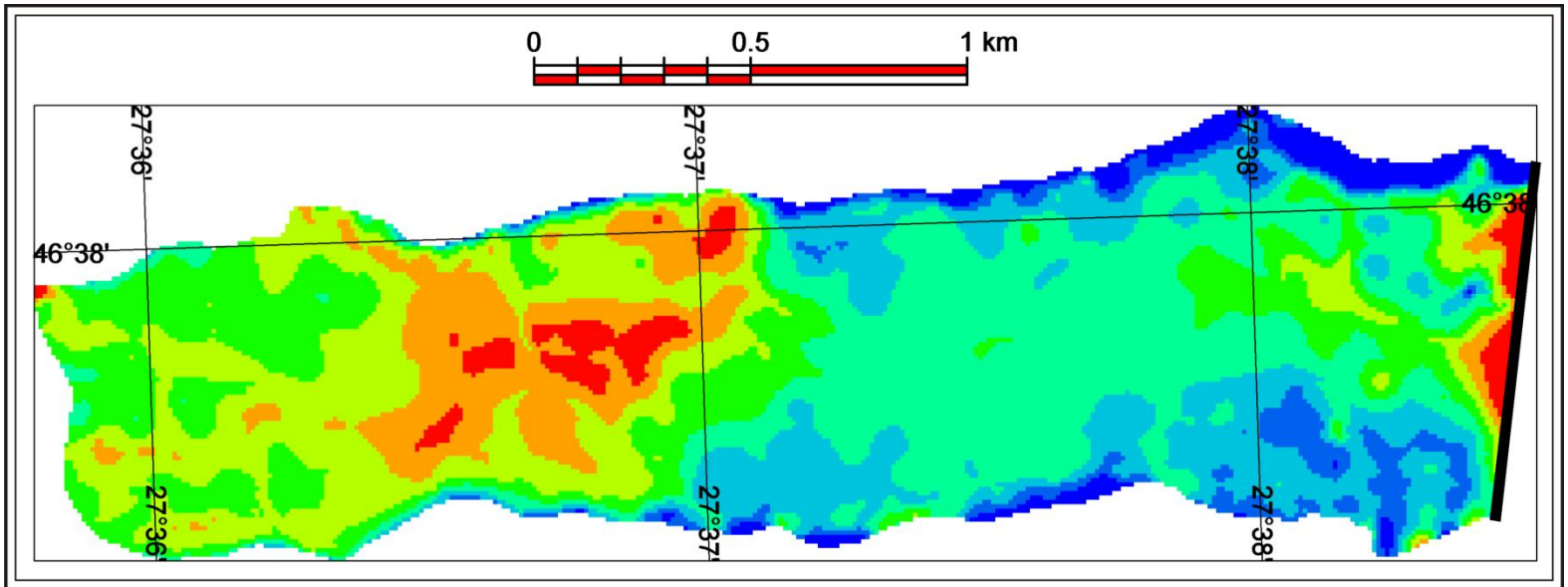


GIGCSA - growth of the infilled gully cross section area **W/D** - width/depth ratio

Results on:

Reservoir sedimentation

Influence of conservation measures on sedimentation rates:
Puscasi Reservoir (1973-2017)



Area: **257** ha > **174** ha (-32.3%)
Mean water level: **3.63 m** > **3.29 m**
Water storage capacity: **9.33 10^6** m^3 to **5.73 10^6** m^3 (-38.6%)

Mean sediment thickness (STH): **206** cm (1.5-3.90 m)
Mean sedimentation rate: **4.7** cm y^{-1} (11.5 cm y^{-1} > 1986-1998)
Volume of sediment: **5.3 10^6** m^3

Sediment delivery ratio (SDR): **0.28**

Thank you !