



## 1<sup>st</sup> Project Management Unit Meeting

# Analysis of soil degradation/soil erosion state and torrential floods in Bulgaria

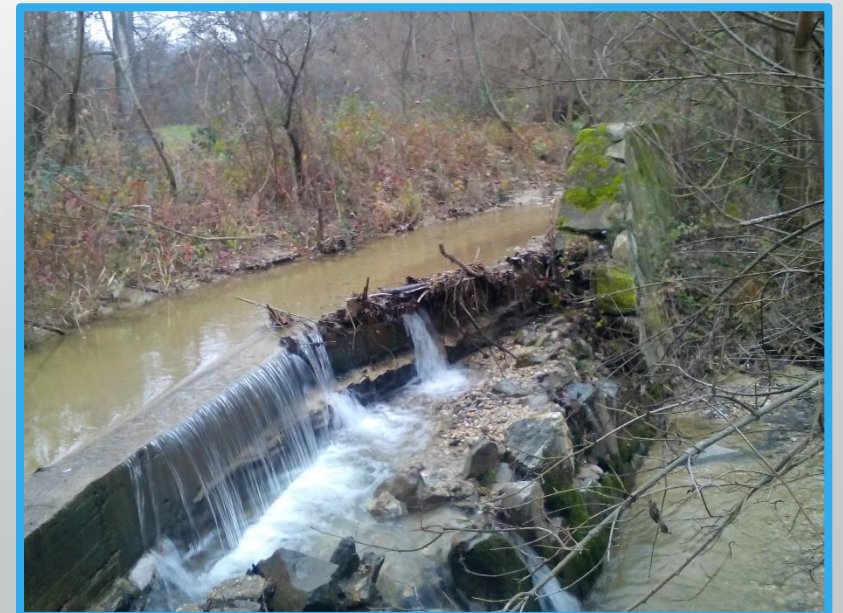
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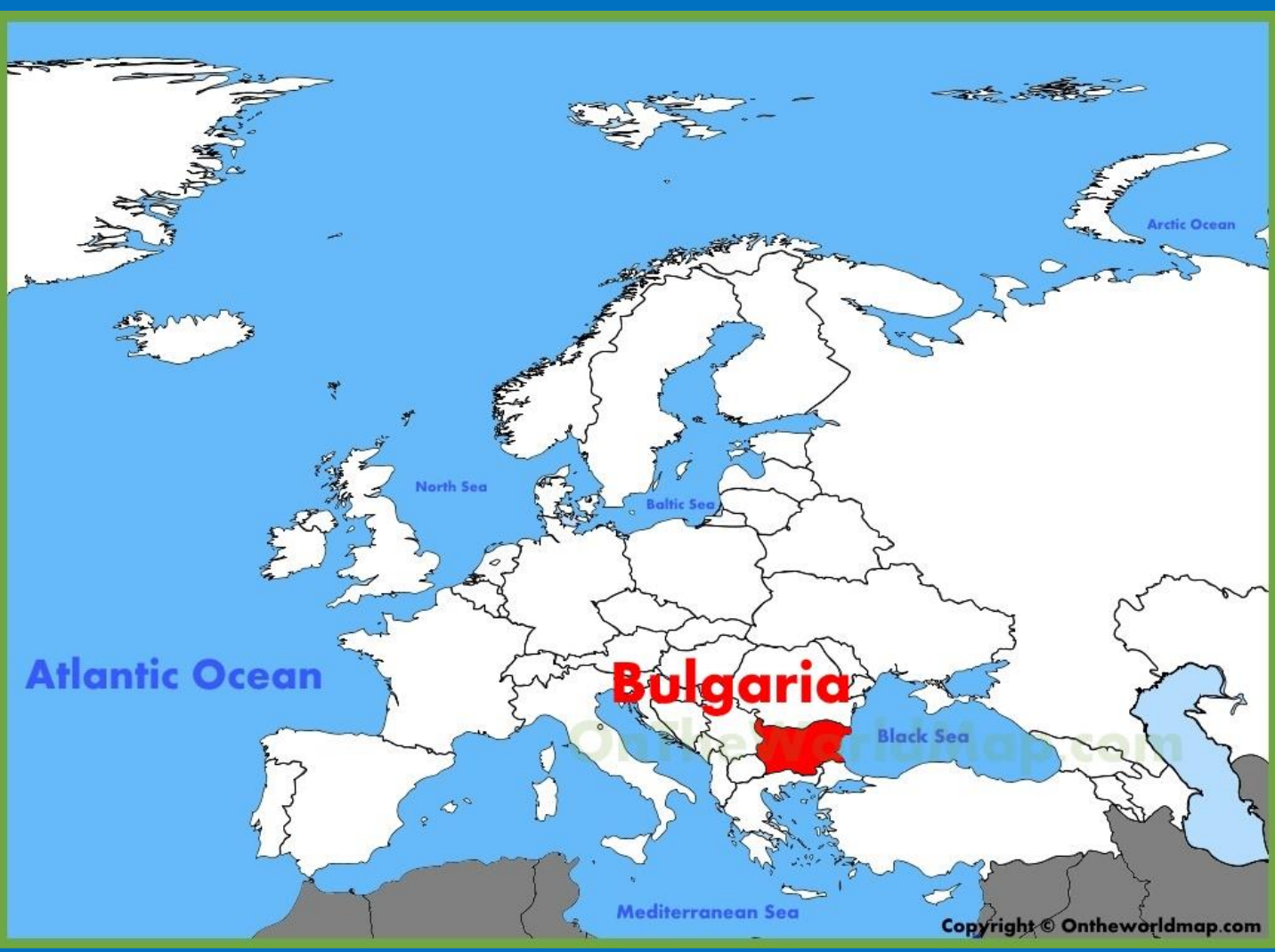








# Introduction

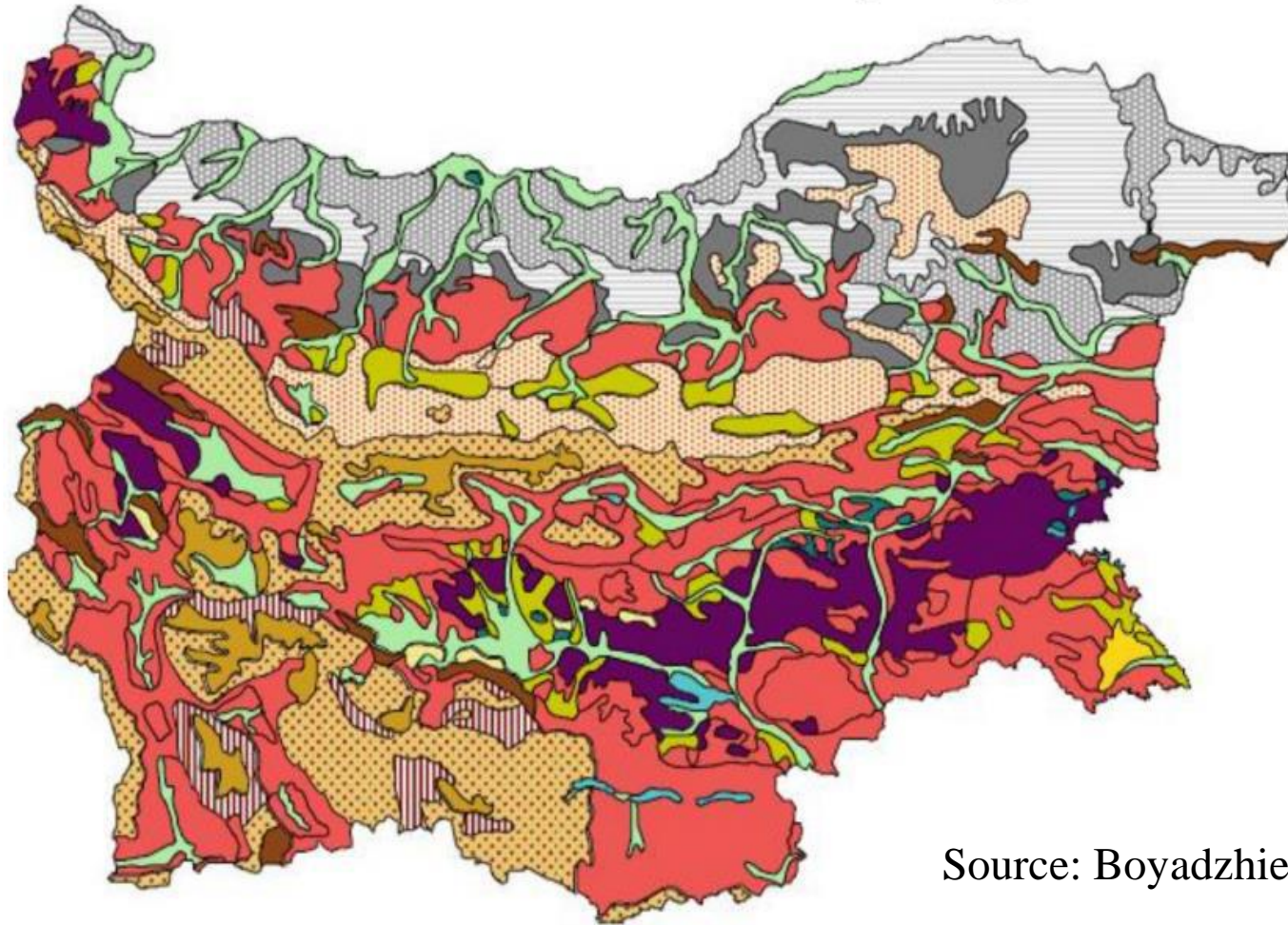


- The total area of the country is about 111, 000 sq. km;
- Very diverse climate and meteorological conditions;
- Various relief predominantly with moderate to hilly elevations;
- Rich and unique biodiversity;
- 34.46% of the territory is protected under the Birds and the Habitats Directives.
- Forestland in Bulgaria covers an area of 4,230,825 ha (38%), and croplands cover area of 4,107,476 ha or 37% of the country's territory.

# Analysis state of soil degradation/soil erosion in Bulgaria

## 1. Status of the soil data (types of soil, monitoring)

Soil Map of Bulgaria



Soil Units

VRe	SNh
PLe	PH1
LVx	LVh
LPq	Ksh
FLe	E(LPk)
CMu	CMe
CMd	CHh
ACh	water

- Bulgaria is characterized with great variability of soils;
- The most widely spread soil group in the country is Chromic Luvisol with 21.91%. The next soil groups are Chernozems with 20.23, followed by Cambisols – 15.58%, Haplic Luvisols with 10.24%, Pseudopodsolic soils (9.75%), Fluvisols (8.97%) and Vertisols (5.37%). Limited spreading has Rendzic Leptosol (2.74%) and Leptosols (1.55%). Least spread soil groups are Solonetz and Solonchaks (0.22%). The rest groups (Regosols, Arenosols, Calcisols and Anthrosols) could be found in association with the other soil groups

Source: Boyadzhiev, 1994

(Soil Units: VRe - Eutric Vertisols; SNh - Haplic Solonetz; PLe - Eutric Planosols; PH1 - Luvic Phaeozems; LVx - Chromic Luvisols; LVh - Haplic Luvisols; LPq - Lithic Leptosols; KSh - Haplic Kastanozems; FLe - Eutric Fluvisols ; LPk - Rendzic Leptosols ; CMu - Humic Cambisols; CMe - Eutric Cambisols ; CMd - Dystric Cambisols; CHh - Haplic Chernozems; ACh - Haplic Acrisols )



# Most of these soils are under degradation treats...

- Estimation of the average annual erosion is 72 million tons;
- The highest intensity of the erosion processes occurred in arable lands in Sliven region (37 484 ha), the land with perennial crops - 837 ha, pastures - 370 ha;
- There is also tendency to increase the areas with high and very high erosion risk by 2 961 ha and 3 615 ha respectively;
- The lowest level of risk of water erosion is the area of Blagoevgrad District - 3 327 ha, of which for agricultural land with permanent crops - 498 ha, pastures - 902 ha;
- Soil losses in Bulgarian forests are estimated as 1,211,471 tones;

- For the areas occupied by deciduous forests the highest intensity of the erosion processes is 15,700 ha and for the coniferous forests respectively 176 ha.
- Forest areas with the lowest degree of actual risk of water erosion occupy 11,592 ha;

Source : Rousseva et al. 2010 a, b

Percentage distribution of territories by degree of erosion risk (Source: Executive Environment Agency)

Land use	Low (< 5 t/ha/y)	Moderate (5.01 - 20 t/ha/y)	High (> 20 t/ha/y)
Arable land	65	27	8
Permanent plantation	33	38	29
Pastures	48	32	7
Other agricultural territories	49	35	11

# Monitoring



National Network on Soil Monitoring

- In Bulgaria soil monitoring starts in 1913;
- In 2004 The Ministry of Environment and Water develops and implements the state environmental policy including National system of soil monitoring;
- The soil monitoring aims actual information about the soil vulnerability to different degradation processes, such as erosion, salinization, acidification, heavy metal pollution and groundwater pollution;
- The National system of soil monitoring consists of 446 points in a network grid of 16x16km;
- The monitoring is being conducted during 5 or 10 years and includes 8 criterions;
- Soil erosion is one of those criterions;



## 2. Soil degradation (land cover and changes in land use, organic carbon content in the soil, alkalization and salinization, management of contaminated sites etc.)

Change in type of territories in %

Type of territories	Years	
	1998	2015
For transport needs	0.63	0.64
Mining of minerals	0.32	0.23
Areas occupied with waters	1.81	1.80
Urban territories	4.99	4.47
Forest territories	33.1	35.15
Agricultural lands	59.17	57.69
Used agricultural land (UAL)	50.9	45.10
Arable land (% from UAL)	60.10	69.70

- Land degradation affects 50-60% of the country's territory;
- The overall change in land cover compared to other European countries is very low and is getting even lower compared to other periods;
- After 2007 there is positive increase in arable lands;
- Bulgaria is on average position in the EU by the territory of agricultural lands;



# Organic carbon content in soils

Organic Carbon Reserve (kg/sq.m in 0-25 cm depth)



- Average content of soil organic carbon in arable land is determined from 16.3g/kg to 15.7g/kg;
- For meadows and pastures this values are 20.5g/kg to 20.1g/kg;
- In Rila Mountains organic carbon in surface layers under white pine is 8.4t/ha and under spruce is 4.7t/ha ;
- In Stara planina Mountains under beech forest this values is 3.8;
- According to Malinova et al. 2011, the total stock of organic carbon in different soil types under forest is determined and is fallow - 76.95 Mt in Luvisols, 67.60 Mt in Cambisols, 12.07 Mt in Regosols, and 10.01 Mt in Leptosols;

Organic carbon reserve 0 – 25 cm depth of Bulgarian soils. (Filcheva, 2014)



# Salinization and Alkalization

- Areas affected by salinization processes count 35,500 ha of the arable lands;
- These territories are encompassed in Burgas, Varna, Veliko Tarnovo, Pleven, Plovdiv, Sliven, Stara Zagora, and Yambol - some of the largest regions by area and by traditional agricultural production;
- The soils prone to alkalization takes 4,300,000ha of the agricultural territories;
- For about 1,500,000ha of the arable lands in lowlands and semi-mountain regions and 1,200,000ha of the mountain lands have soil pH lower than 5.0;



# Soil organic matter decline



- Despite the legislative restrictions (up to 5 000 euro), a widespread practice in Bulgaria is the burning of plant and animal residues (incl. their decomposition products) and shrubs that leads not only to soil fertility loss, but also to loss of biodiversity;
- Soil organic matter loss in arable and non-arable land ranges between 10-40%;



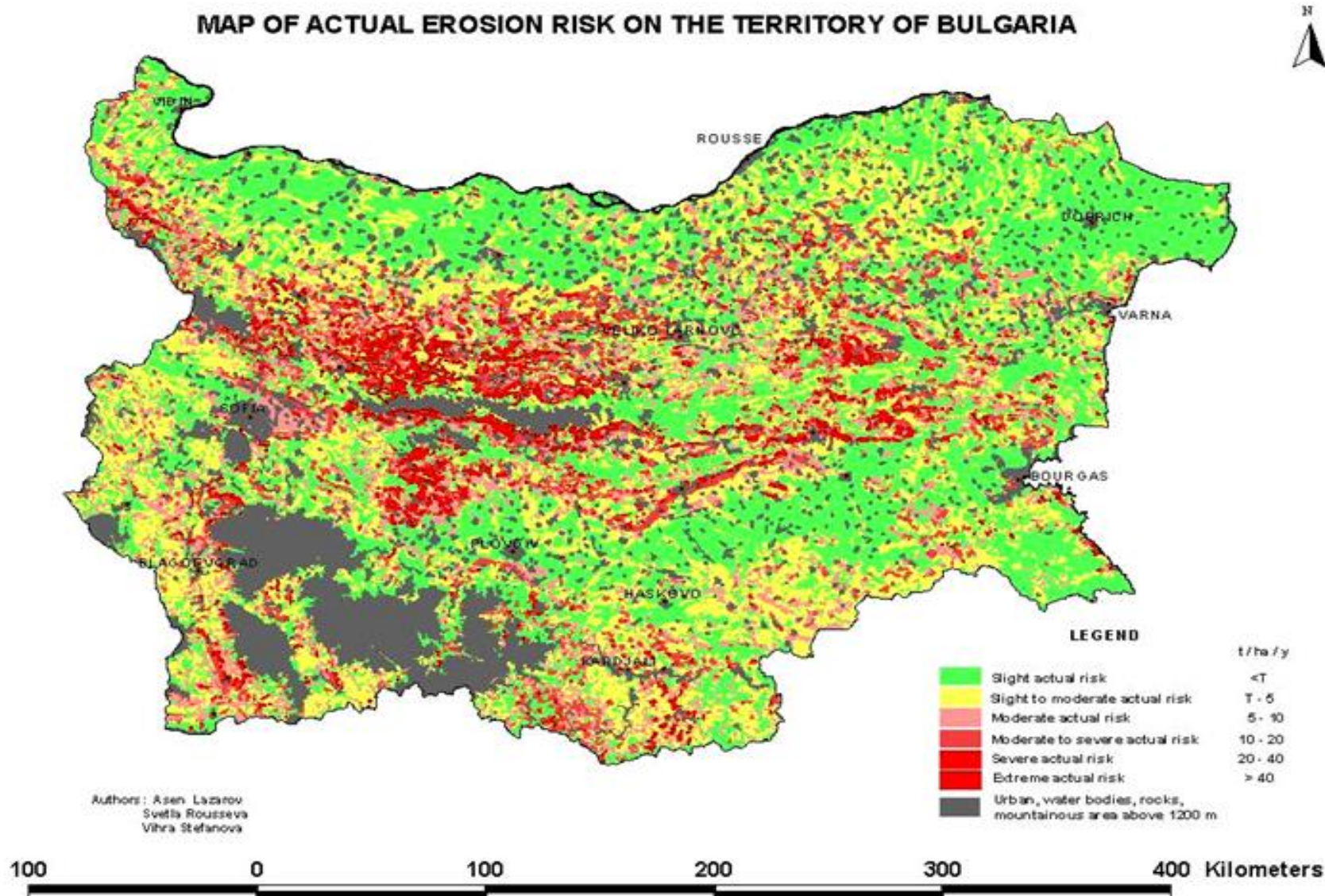


# 3. Soil Erosion Mapping/modelling

- Universal Soil Loss Equation (USLE)- mainly in agricultural lands;
- The method of Gavrilovic (1972);
- The methodology of the PHARE - MERA Project - Bulgaria - Land Degradation Mapping;
- Complex methodology for determination of torrents, erosion risk in the forest fund, necessary anti-erosion facilities (Marinov et al., 2007)
- Studies of the erosion processes on field/drainage plots;



# Erosion intensity/soil losses



- More than 62% of the country's territory is characterized with moderately strong, strong and very strong soil vulnerability to erosion;
- About 65% of the arable land area is affected by water erosion and about 24% - by wind erosion lands.
- Potentially endangered from erosion due to irrigation is about 23% of arable land;
- 7.2% from the entire forestlands are in different degree of erosion;
- The estimated "actual" average annual soil loss rates vary from 0.14 t/ha on forest lands to 2.7 t/ha on pastureland and from 4.8 t/ha on cropland to 12.7 t/ha on vineyards, and orchards, resulting in the net average annual soil loss volume, estimated of 32 million tons (290 m<sup>3</sup>/km<sup>2</sup>), as over 2/3 of which originates from cropland

(Rousseva et al. 2008)



# Sediment transport

- The average annual module of the sediment for the rivers is 125 t/km<sup>2</sup>
- It was established that the average annual total sediment transport for one small watershed (suspended and bed-load) using Poliakov-Kostadinov's method (Kostadinov 1993) is 340 m<sup>3</sup>/km<sup>2</sup>

# Erosion control activities

- During the period 1905-1944 eroded lands, spread on the area of 170,000 ha have been afforested and 160,000 m<sup>3</sup> stone barrages (check dams) and thresholds (< 2.0 m above torrent bed) have been constructed;
- About 450, 000 m<sup>3</sup> barrages and thresholds, 380,000 m<sup>3</sup> small stone thresholds and 350, 000 m<sup>2</sup> wattles have been constructed during the period 1945-1989. This period is also remarkable for comprehensive afforestation of 1.9 million ha of which 760,000 ha (about 40%) are anti-erosion forestation, and development of 20, 000 ha shelterbelts;
- More than 80 large complex erosion control projects have been designed and applied in the dam watersheds. The measures limited significantly the siltation of the dams;
- During the period 1989-2004 about 16,000 ha eroded lands has been afforested, 10,000 m<sup>3</sup> barrages and thresholds, 12,000 m<sup>3</sup> small stone thresholds and 7,000 m<sup>2</sup> wattles has been constructed (NFB 2005). A significant reduction of the afforestation rates and in the building of technical facilities was occurred after 1990. In 2014 the afforested territories for erosion and torrent protection cover 542 ha and in 2016 the applied activities cover 580 ha and 108 sq. m of constructed “clayonnage” (wattles) systems



# Policy governance

- The national policy for environmental protection is established from the Ministry of Environment and Water;
- The Ministry of Agriculture and Forests supports an informational system for the soil resources in agricultural lands that also includes the risks of contamination, erosion, salinization, alkalization and swamping;
- A set of measures for adaptation of the forest sector to climate change has been developed in line with the EU Adaptation strategy (EU Adaptation strategy 2013).
- The planning and realization of forest protection against erosion, torrential floods and landslides, incl. the design of anti-erosion activities (such as afforestation and construction of facilities) are regulated in the Regulation for protection of the forest territories against erosion and floods and construction of erosion control facilities (Regulation 4/2013).

Thank you for your attention!

