MINISTERUL AGRICULTURII, DEZVOLTĂRII REGIONALE ȘI MEDIULUI AL REPUBLICII MOLDOVA

AGENȚIA MOLDSILVA

Institutul de Cercetări și Amenajări Silvice ICAS Republica Moldova

FORESTRY SECTOR OF MOLDOVA AND CLIMATE CHANGE

Ion Talmaci, Dumitru Galupa, Liliana Șpitoc,
Forest Research and Management Institute, Moldsilva Agency,
Republic of Moldova

Balti, 29-30 November 2019

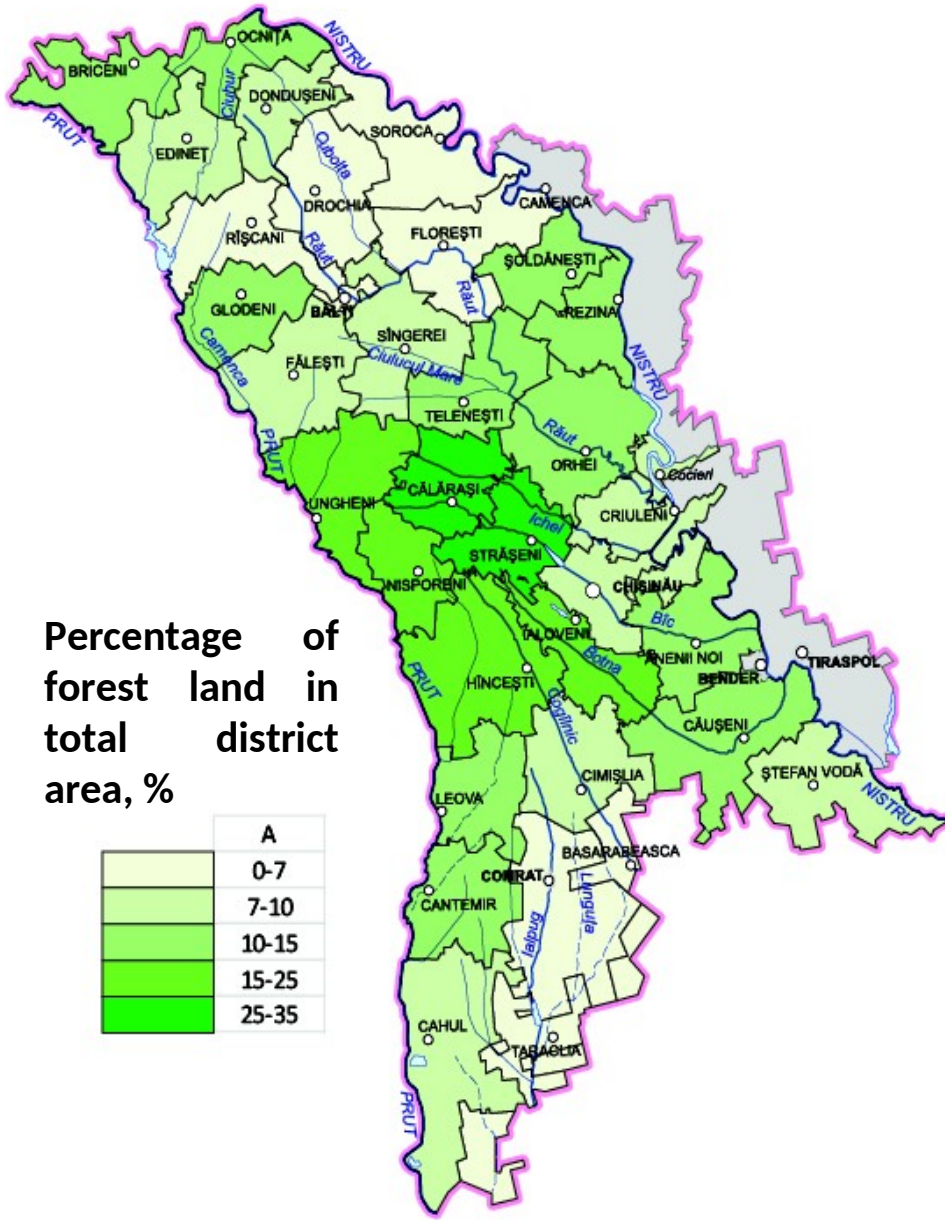
BACKGROUND INFORMATION OF FORESTRY SECTOR

Forest Fund structure by ownership categories:

Categories of holders	Total area/percentage, 1000 ha/%
Forest Fund under the state management	362,3/ 81,0
Forest Fund managed by local public authorities	82,2/ 18,4
Forest Fund in private property	3,0/ 0,6
TOTAL (13,2%)	**447,5/100**

Forest land by ownership categories:

Categories of holders	Area of forest land/percentage, 1000 ha/%
Lands under the state management	331,2/ 85,7
Lands managed by local public authorities	51,9/13,4
Private lands	3,3/ 0,9
TOTAL (11,4/11,7)	**386,4/100**



BACKGROUND INFORMATION OF FORESTRY SECTOR

Valorization of potential of forest vegetation condition by forests managed by Moldsilva

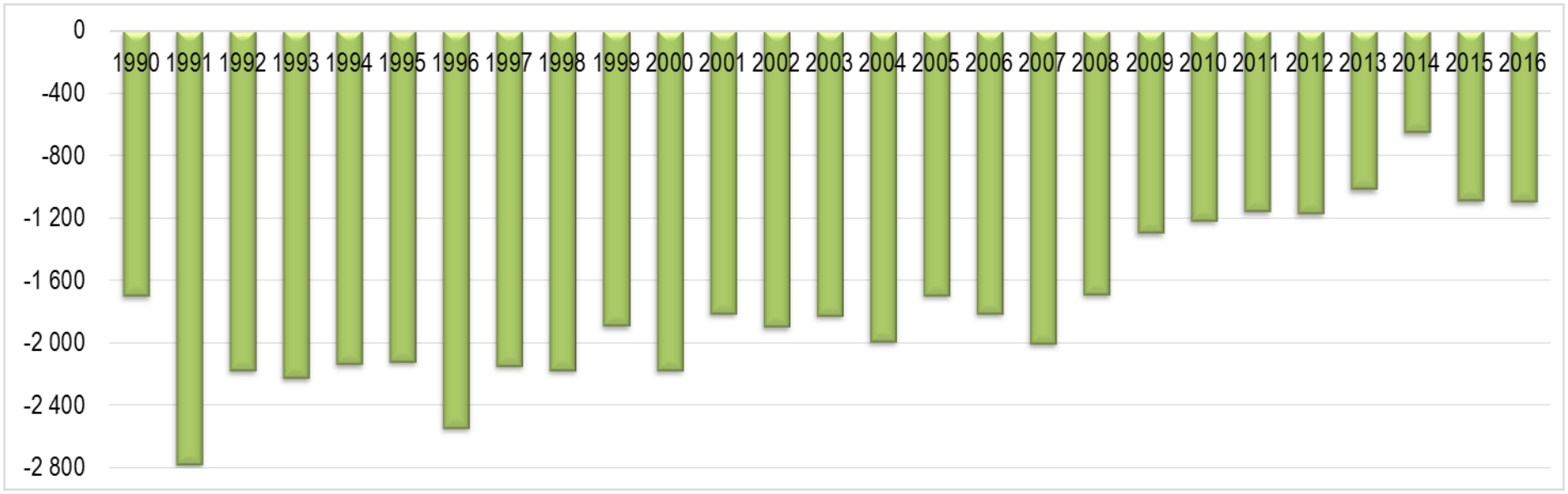
Indicators	Category of quality class/productivity		
	superior	middle	lower
Quality of forest vegetation conditions (%)	15,5	42,6	41,9
Productivity of forest types (%)	13,7	43,6	42,7
Actual productivity of species/stands (%)	9,4	33,8	56,8
Actual average production class	3,8		
Potential average production class	3,4		
Natural potential to increased productivity, %	10,5		

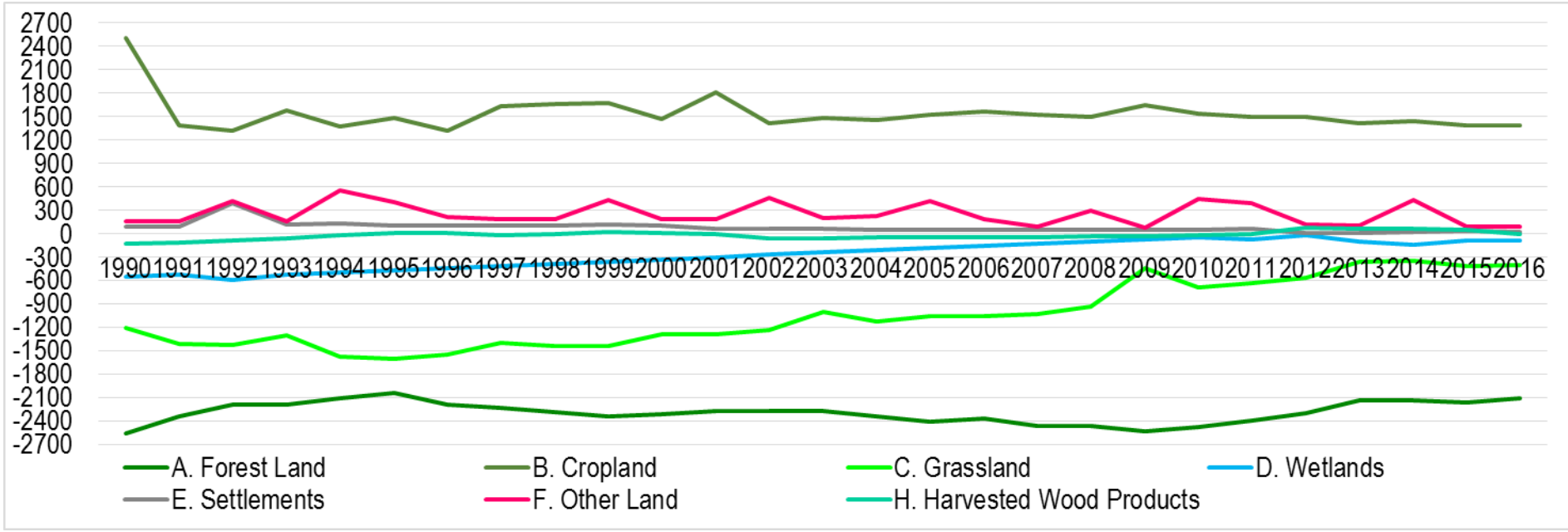
Main indicators of forest lands during 1988-2016:

Characteristics of forest fund	The year of forestry records		Differences, ±	
	1988	2016	Physical units	%
The area covered with forestsi, 1000 ha	317,6	386,4	+68,8	+21,7
Average age, years	40	45	+5	+12,5
Average production class	2,3	3,9	+1,6	+69,6
General average consistency	0,73	0,76	+0,03	+4,1
Total standing volume, 1000 m^3	39382,4	45407,8	+6025,4	+15,3
Average standing volume, m^3/ha	124	118	-6	-4,8
Average growth, m^3/ha/year	3,3	3,8	+0,5	+15,2

BACKGROUND INFORMATION OF FORESTRY SECTOR

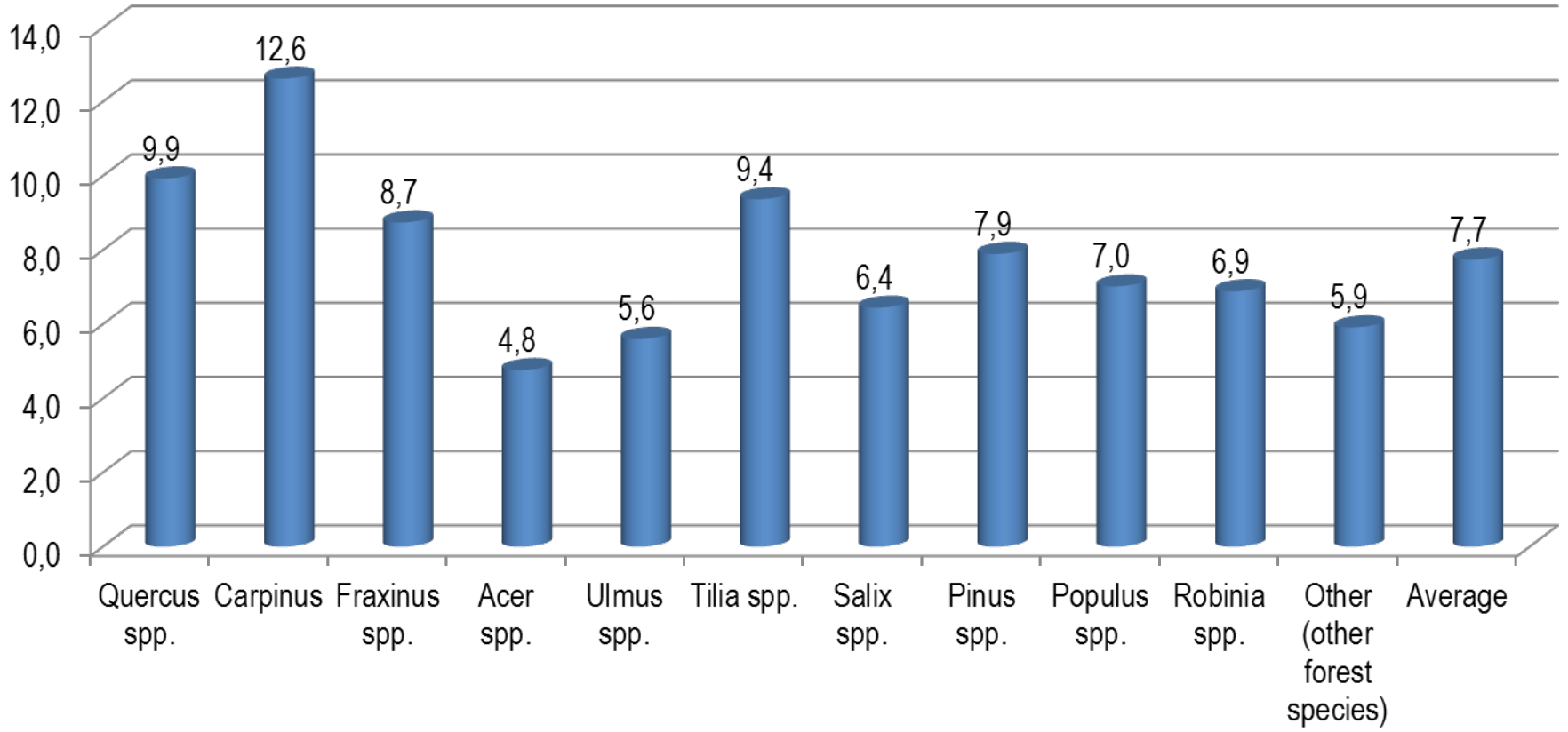
CO_2 Emissions/Removals within the Sector 4 'LULUCF' (1990-2016), kt:





BACKGROUND INFORMATION OF FORESTRY SECTOR

Average sequestration by the group of species, tCO_2/ha/year:



STRATEGIC FRAMEWORK WITH REFERENCES TO THE FORESTRY SECTOR

1. Strategy on sustainable development of forestry sector in Moldova (Parliament Decision No. 350 as of 12.07.2001);
2. Environmental protection strategy of Moldova (Governmental Decision (GD) No. 301 as of 24.04.2014);
3. **Moldova's climate change adaptation strategy (GD No. 1009 as of 10.12.2014);**
4. Moldova's biodiversity conservation strategy (GD No. 274 as of 18.05.2015);
5. Moldova's low emissions development strategy (GD No. 1470 as of 30.12.2016);
6. The strategy of institutional reform of the forestry sector in Moldova (2012-2019, draft);
7. Forest Policy Note (World Bank/Moldsilva Agency, 2014);
8. **Forestry sector's climate change adaptation strategy (draft, 2015-2018);**

VULNERABILITIES CONCERNED/FORECASTED

- Changing the territorial distribution of plant species and associations (reducing the natural area);
- Changing tree and tree growth patterns (biomass accumulation);
- Changes in timber quality;
- Reducing adaptive capacity of trees (phenomena of tree stand degradation);
- Increasing the area of drying trees;
- Reducing the success of natural and artificial forest regeneration;
- The increase in the incidence of forest pest attacks;
- Increased competition capacity of exotic species;
- The increase in the incidence of forest fires;

VULNERABILITIES CONCERNED/FORECASTED

Risk analysis for forests:

Details on the size risks/opportunities		North	Centre	South
Risk	Change of species composition	LOW	MEDIUM	HIGH
	Possible increase in tree mortality	LOW	MEDIUM	HIGH
	Changes in species competition	MEDIUM	MEDIUM	HIGH
	Negative consequences for species susceptible to the temperature change	LOW	MEDIUM	HIGH
	Change of regeneration rate	MEDIUM	HIGH	HIGH
	Changes in species sensitivity to water deficiency	MEDIUM	HIGH	HIGH
	Changes in individual tree density	MEDIUM	HIGH	HIGH
	Increasing abiotic damage caused by fires, windstorms, floods and drought	LOW	MEDIUM	MEDIUM
	Change of phytosanitary conditions	MEDIUM	HIGH	HIGH
Opor-tunity	Change in biomass production	RIHIGH	MEDIUM	LOW

VULNERABILITIES CONCERNED/FORECASTED

Impact analysis for forests:

Impact category	Impact on the forestry sector	Social/economic impact
High temperatures, heat waves	Longer growing season; Negative consequences for species sensitive to temperature changes; Increased vulnerability to forest fires.	Reducing the volume of wood production; Transition to other forms of energy; Additional costs for the population.
Changing precipitation indices	Change of phyto-sanitary status Changing species composition; and Changes in the types and incidence of pests and diseases.	Modification of the capacity of the forest habitat to maintain biological diversity, environmental protection and assurance of specific socio-economic functions.
Extreme phenomena: droughts, fires, windstorms and floods	Low biomass growth and production; Increase in the number of forest fires; Increased seed mortality rate.	Economic losses in the forestry sector.

FORESTRY SECTOR'S CLIMATE CHANGE ADAPTATION

Scheduled measures:

- Afforestation (Forest Fund, shelterbelts, degraded lands), reaching the afforestation degree of 15% (about 130 thousand ha);
- Ecological reconstruction of unsuitable trees (about 30-40% of the existing forests);
- Planting of forest energy crops of fast growing species, managed at short production cycles (3-10 years) on communal and private lands;
- Adapting forest regeneration practices to the needs imposed by climate change;
- Adaptation of wood use to climate change (harvesting possibilities, processed wood products etc.);
- Selection of genotypes of forest trees / shrubs adapted to the new climatic conditions;
- Extension of areas of forest protection shelterbelts up to 4% from the area of croplands (additional 50 thousand ha, at least);

FORESTRY SECTOR'S CLIMATE CHANGE ADAPTATION

Scheduled measures:

- Developing a methodology for calculating carbon balance of forest land in accordance with international practices for monitoring carbon stocks;
- Normative regulation of the practices of carbon stock conservation in forests and their incorporation in forest management;
- **Development and promotion of normative guidance „Forests and climate change";**
- New regulations in the conservations of forest genetic resources;
- **Reconsider the concept of protective shelterbelts,** including by adapting of composition of existing shelterbelts to **new climate conditions**;
- Training of forest staff and personnel involved in forest management on the necessity and the opportunity to implement adaptation and mitigation measures;

FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

Agro-forestry practices:

- An integral part of sustainable land management - it ensures the needs of current generations, does not compromise the needs of future generations and is beneficial not only to agricultural producers, but also to the environment;
- The installation of agroforestry systems minimizes the possibility of intensive exploitation of natural resources, which diminishes their capacity for regeneration, but guarantees the permanent renewal of used resources, such as soils, water, forest vegetation;
- Depending on purpose, tree placement (isolated, in groups, on the edge of land / plots), taking into account the local soil and climatic conditions, the following agroforestry systems are highlighted:
  - Improvement of degraded lands through afforestation;
  - multipurpose trees and shrubs within agricultural crops;
  - **Protection shelterbelts**;
  - cover crops in place of fallow;
  - uncultivated land (streams) improved in itinerant crops;
  - garduri de protecţie.

FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

Forest shelterbelts for cropland protection:

- Formations with forest vegetation, located at a certain distance from each other or towards an object in order to protect it against the effects of harmful factors and / or for the climatic, economic and aesthetic-sanitary improvement of the lands;
- Depending on a series of indicators that underlie the conditions for establishing the networks of forest shelterbelts (type, structure, composition, etc.) their influence contributes to the croplands related by the following benefits::
  - **Improving the microclimate** through modifying albedo, decreasing the daily and annual range of air temperature, cutting wind speed, retaining snow, cutting unproductive evaporation and increasing humidity);
  - The diurnal amplitude of the air temperature may be reduced by 1-4oC and the annual range by 1-2oC; wind speed is reduced by 31-55 per cent in the shelter belt itself and by 10-15% across the protected areas; unproductive evaporation is reduced by as 30%; and the humidity of the air at ground level is increased by 3-5%;
  - Improving the growing conditions for agricultural crops to a distance of 20-30 times the height of the shelterbelt downwind and 5-12 times its height upwind.);
  - Improving soil and water conservation by cutting runoff, increasing infiltration, increasing accumulation of organic matter, and arresting erosion by wind;
  - Creating favorable conditions for local fauna development;
  - Increasing of zonal biodiversity;
  - **Improving carbon stocks;**
  - Re-modeling the landscape.

FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

The Moldova Agriculture Competitiveness Project (MACP):

- Total area of forest shelterbelts is of 30.7 thousand ha or about 1.7% of cropland (under state management – 5,7 thousand ha; 24.9 thousand ha under local authorities and only 0,1 thousand ha – in private hands);
- Taking into consideration actual recommendations and country's characteristics (relief, soils, climate, afforestation degree etc.), the quota of shelterbelts should be at least 4% of cropland area, which means an increase of about 50 thousand ha;
- The original purpose of planting was to arrest soil erosion and, partly, to obtain valuable food products) and this determined their composition:

- walnut 38 per cent;
- acacia 36 per cent;
- oak 9 per cent;
- other species (elm, ash, sophora, cherry, poplar etc.) 17%.



FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

The Moldova Agriculture Competitiveness Project (MACP):

- Increasing the competitiveness of the agricultural sector and local agricultural products by integrating the practices of organic farming and those of sustainable land management;
- Rehalitation of forest protection shelterbelt network on the total area of 2,2 thousand ha in the southern part of Moldova;

FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

Agroforestry in the MACP project area:

Administrative district	Area of district, thousand ha	Farmland, thousand ha	Forest plantations, thousand ha				Proportion of shelterbelts within agricultural land, %
			Total	including			
				Forest land	of which		
					Forest vegetation	Shelterbelts	
Basarabeasca	31.8	23.0	3.1	2.5	0.6	0.6	2.6
Cahul	154.5	84.6	18.1	15.7	2.4	2.1	2.5
Cimislia	102.6	71.1	12.9	11.5	1.4	1.3	1.9
UTA Gagauzia	184.8	147.0	17.7	14.7	3.0	2.7	1.8
Leova	76.5	57.2	11.8	9.6	2.2	0.9	1.5
Anenii Noi	88.8	65.9	12.2	11.0	1.4	0.7	1.1
Hancesti	147.2	92.7	39.0	36.7	2.3	0.9	1.0
Ialoveni	78.4	52.4	14.8	13.6	1.2	0.6	1.1
Cantemir	86.8	64.4	12.7	11.5	1.2	0.9	1.4
Causeni	131.1	102.1	16.1	14.6	1.4	1.1	1.1
Stefan-Voda	99.8	78.5	9.6	8.5	1.1	0.9	1.1
Taraclia	67.4	54.7	5.7	4.3	1.4	1.1	2.0

FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

Areas rehabilitated in MACP by different technical solutions:

No	Technical solutions	Area, ha	Percentage
I	Reconstruction works, total	253	11.3
1.1	Replanting	253	11.3
II	Stimulation of natural regeneration, total	20	0.9
2.1	Coppicing	4	0.2
2.2	Completion/tree planting	15	0.7
III	Forestry treatments, total	252	11.2
3.1	Extraction of pre-existing trees	210	9.4
3.2	Tree planting	64	2.9
3.3	Coppicing	156	6.9
IV	Tending activities, total	1197	53.4
4.1	Tending coppice in young plantations	760	33.9
4.2	Thinning	239	10.7
4.3	Removing dead and diseased wood	198	8.8
V	Pruning	315	14.0
VI	Crown and canopy thinning	66	2.9
VII	Tending undergrowth	12	0.6
VIII	Creation and maintenance of fire breaks	127	5.7
TOTAL		2242	100

Budget for rehabilitation – circa 23,3 million MDL (1,2 mil. EURO); the most expensive– lreconstruction works – 26.2 thousand MDL/ha), and the cheapest – stimulation of natural regeneration in Robinia plantations – 0.3 thousand

FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

Cropland area protected by shelterbelts rehabilitated under MACP:

Average cropland area protected by forest shelterbelts

Group of basic species	The protected area depending on the number of rows, ha / 1 ha shelterbelts			
	1	2	3-9	=>10
Walnut	12	15	35	25
Other deciduous species	12	20	35	25

Species present in the rehabilitated shelterbelts

Main species (Romanian)	Area, ha	%
Walnut (Nuc/NU)	560	25
Acacia (Salcam/SC)	1016	46
Ash (Frasin/FR)	146	7
Elm (Ulm de camp/ULC)	118	5
Plane (Paltin/PA)	79	4
Oak (Cvercinee/ST)	74	3
Honey locust (Gladita/GL)	52	2
Sophora (Sofora/SF)	38	2
Cherry (Cires/CI)	24	1
Poplar (Plop/PL)	22	1
Others (Alte specii/AS)	70	3
TOTAL	2 200	100

FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

Area of croplan protected by rehabilitated shelterbelts:

Main species	Number of rows								Total	
	1		2		3-9		=>10			
	Area, ha	Protected area, ha	Area, ha	Protected area, ha	Area, ha	Protected area, ha	Area, ha	Protected area, ha	Area, ha	Protected area, ha
SC	0	0	6	112	874	30 578	137	3423	1016	34 112
NU	139	1 667	360	5 394	62	2 153	0	0	560	9 215
FR	0	0	7	147	121	4 242	17	432	146	4 821
ULC	1	8	13	255	85	2 976	19	485	118	3 724
PA	0.6	7	6.	123	73	2 542	0	0	79	2 672
ST	0.2	3	4	79	70	2 457	0	0	74	2 539
GL	3	35	8	159	41	1 446	0	0	52	1 639
SF	0	0	0	0	38	1 338	0	0	38	1 338
CI	7	80	17	340	0.6	20	0	0	24	440
PL	12	144	9	175	0.9	30	0	0	22	349
AS	3	34	5	108	62	2 168	0.0	0.0	70	2 311
TOTAL	165	1 978	435	6 892	1 427	49 950	174	4 340	2 200	63 159
%	*8*	*3*	*20*	*11*	*659*	*79*	*8*	*7*	*100*	*100*

FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

Carbon stock in plots rehabilitated within MACP:

Project stage	Carbon in tree and bush biomass, tC	Carbon stock in litter, tC	Carbon stock in soil, tC	Total carbon stock in MACP, tC
Initial, 2014	39 774	7 458	166 844	214 769
After rehabilitation, 2016	59 962	21 066	144 787	225 815
Post-implementation, 2019	72 883	12 594	147 524	233 001
Difference, %	+83	+69	-12	+9

Biomass – 28 SP in 8 strata (species/works); soil – 15 SP in 2 strata (<>2% humus);

Element	Actual net carbon stock, *ex post,* tC	Net carbon stock, *ex ante,* tC	Net carbon stock change, tC	Total net GHG drawdown from the atmosphere, tCO_2eq	Net GHG drawdown by sinks, $tCO_2eq/ha/yr$
TOTAL	233 001	214 076	+18 925	69 392	7.89

FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

Cost: benefit analysis of the use of shelterbelts in agricultural practice:

Indicator	Measurement unit	Agricultural crops				
		Maize grain	Winter wheat	Soy	Sunflower	Average
Yield	t/ha	5.5	3.1	2.3	2.2	3.3
Cost of agricultural production	lei/t	2278.0	2493.0	5609.0	5050.0	3857.5
Value of agricultural production	1000 MDL/ha	12.6	7.8	13.1	11.0	11.1
Value of agricultural production for a 43ha field	1000 MDL	539.7	336.6	564.4	473.4	478.5
Increase of production from shelterbelt influence (17.5%)	1000 MDL	94.5	58.9	98.8	82.8	83.7
Income from the wood	1000 MDL	46.6	46.6	46.6	46.6	46.6
Income from non-wood products and other	1000 MDL	20.3	20.3	20.3	20.3	20.3
Total complementary income	**1000 MDL**	**161.3**	**125.8**	**165.6**	**149.7**	**150.6**
Cost of shelterbelt creation (7/3 rows; 4,14 ha/2 fields)	1000 MDL	72.2	72.2	72.2	72.2	72.2
Cost of tending and maintenance works for shelterbelts	1000 MDL	5.8	5.8	5.8	5.8	5.8
Loss of farmland to shelterbelts (6% from total agricultural production)	1000 MDL	32.4	20.2	33.9	28.4	28.7
Total costs	**1000 MDL**	**110.4**	**98.2**	**111.9**	**106.4**	**106.7**
Balance of cost and income	***1000 MDL***	***+50.9***	***+27.5***	***+53.7***	***+43.3***	***+43.9***
Percentage from the total production	*%*	*+9.4*	*+8.2*	*+9.5*	*+9.1*	*+9.1*

FORESTRY PROJECTS FOR CLIMATE CHANGE ADAPTATION

Benefits from the rehabilitation of shelterbelts under MACP:

- **Clearly positive impact on the productivity of cropland** – increasing the production of agricultural crops on average by over 9%.
- **Legal harvesting of fuel wood –** about 12,5 thousand cubic meters of wood has been havested and handled to local communities fee of charge;
- **Creation of temporary and permanent jobs** in rural zones (replanting and tending activities for shelterbelts), providing the guard, harvesting of wood from various forestry treatments etc.);
- **The capacity of shelterbelts to absorb carbon significantly increased -** The shelter belts have achieved net carbon capture of 7.9 tCO2eq /ha/year, or a cumulative gain of 69 392 tCO2eq;
- **Environmental benefits** become apparent within 3-6 years of the establishment or rehabilitation of shelter belts, and culminate within 10-12 years ;
- **Testing and modeling of the technical solutions in the process of shelterbelts rehabilitation** – contributions for achieving efficiency and best results; further will be used in the rehabilitation of the entire network of shelterbelts across the country, with adjustments and embodiments;
- **Rehabilitated shelterbelts ensures the protection of neighboring croplands** (protection from winds, soil erosion and surface runoff; contributions to increase fertility, soil moisture and soil enrichment in humus and other nutrients, increasing biodiversity; creating favorable conditions for wildlife development, etc.) – 63 thousand ha;
- **Forest shelterbelts is an agroforestry practice with a high factor of maintaining and increasing the productivity of croplands.**

PROJECTS: FORESTRY SECTOR AND CLIMATE CHANGE

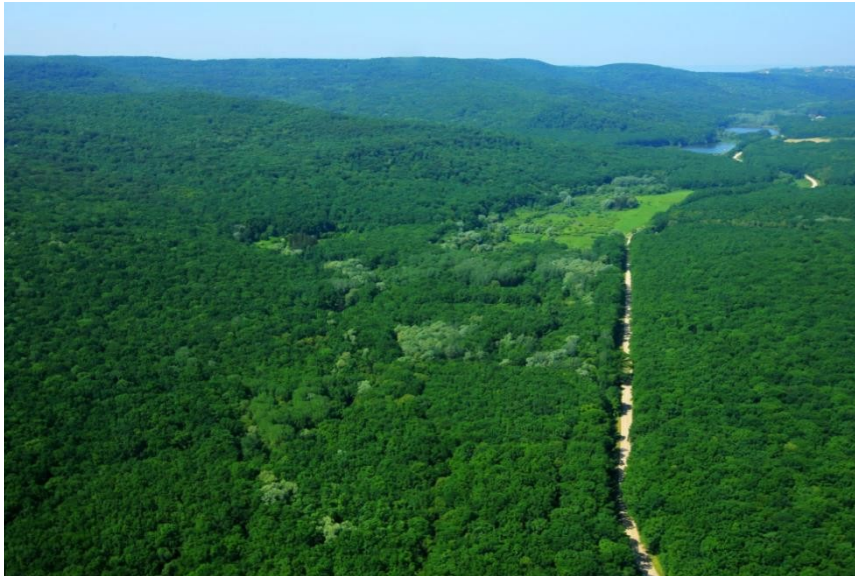
Ongoing/projecting measures:

Project name	Implementation entity	Implementation period	Main objectives
Moldova Soil Conservation Project	World Bank/Moldsilva Agency/Forest Research and Management Institute(FRMI)	Since October 2002, Project cost 19 mln. US dollars, crediting period 60 years	▪ Creation of new, communal and state forests on 20.3 thousand ha by afforesting eroded and unproductive lands; ▪ Stabilization of landslides and improvement of hydrological regime; ▪ Increased access to wood resources and non-wood forest products;; ▪ Creating a basis for sustainable development at local and regional level; ▪ **Total emission reduction of GHG – 3.6 mln tones of CO_2.** ▪ **Obtaining additional revenues from the sale of 1.9 mln. tones of ERs of CO_2.**
Moldova Community Forestry Development Project	World Bank/Moldsilva Agency/FRMI	Since November 2006, 28,2 mln. US dollars, crediting period 30 years	▪ Creation of new communal forests on 8,5 thousand ha by afforesting eroded and unproductive lands; ▪ Stabilization of landslides and improvement of hydrological regime; ▪ Increased access to wood resources and non-wood forest products;; ▪ Creating a basis for sustainable development at local and regional level; ▪ Introduction of new participatory forest and grassland management practices. ▪ **Total emission reduction of GHG – 1.2 mln tones of CO_2.** ▪ **Obtaining additional revenues from the sale of 0.55 mln tones of Ers of CO_2.**

PROJECTS: FORESTRY SECTOR AND CLIMATE CHANGE

Ongoing/projecting and measures:

Project name	Implementation entity	Implementation period	Main objectives
Forestry NAMA (National Appropriate Mitigation Action)	UNDP Moldova, Moldsilva Agency, FRMI	2020-2035, investments - 127 mln. US dollars	▪ Main objective of NAMA is to contribute to the process of stopping soil degradation, increasing carbon sequestration by approx. 140 thousand tCO_2 annually through: • Afforestation of 45.000 ha of degraded lands; • Planting of 15.000 ha of riverside forest belts; • Planting of 1.500 ha of farmland protection belts.



THANK YOU FOR YOUR ATTENTION!