**Republic of Moldova**

# TECHNOLOGY NEEDS ASSESSMENT FOR CLIMATE CHANGE ADAPTATION

## REPORT IV

## PROJECT IDEAS

February, 2013

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AIT Asian Institute of Technology

# PREFACE

The Republic of Moldova has signed the United Nations Framework Convention on Climate Change (UNFCCC) on June 12, 1992, ratified it on March 16, 1995 and for our country the Convention entered into force on September 7, 1995. On January 28, 2011 the Republic of Moldova has associated with the Copenhagen Agreement of the United Nations Framework on Climate Change. Under this Agreement, our country has set a new target aimed at Greenhouse Gas (GHG) emissions reduction, specifying " reduction of total national levels of GHG emissions by not less than 25% by 2020 compared to the reference year (1990). Hereby, it is determined that this target shall be achieved by implementing global economic mechanisms focused on mitigating climate change in accordance with UNFCCC principles and decisions."

The recent and underway policies of the Republic of Moldova on climate change mitigation are aimed at promoting energy efficiency and renewable energy sources in all sectors of the national economy, systematic afforestation activities and rational land management, promoting innovative approaches and environmentally friendly technologies and exploring carbon financing mechanisms.

In conformity with the general objective of the Convention, which sets as a target the maximum global average temperature growth until 2100 by no more than $2^0$C, the Republic of Moldova has decided to undertake a transition to a low GHG emissions development path. The first step in this direction was made in 2011 when development of the Low-Emission Development Strategy and Climate Change Adaptation Strategy started. Approval of these strategies is planned for 2013, which will allow access to the long-term financing mechanisms under the Convention to implement the so-called Nationally Appropriate Mitigation Actions (NAMA) and adaptation measures. Technology needs assessment in the context of climate change mitigation and adaptation is a crucial first step in achieving the objectives of these strategies. Methodological aspects of evaluation and identification of appropriate technologies in climate change mitigation and adaptation revealed during the TNA will serve as a starting point in promoting them nationwide. In the future the Republic of Moldova will address climate change issues so, that they can be included in all national and sector development policies and strategies of the country. This status will allow our country to get integrated in the global process of climate change mitigation and adaptation to this phenomenon at the national level.

# ACKNOWLEDGMENTS

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# ABBREVIATIONS

| | |
|---|---|
| ACSA | National Agency for Rural Development (Moldova) |
| MH | Ministry of Health |
| ALRC | Agency for Land Relations and Cadastre |
| MAFI | Ministry of Agriculture and Food Industry |
| ME | Ministry of Environment |
| MEc | Ministry of Economy |
| SAUM | State Agrarian University of Moldova |
| RIFC | Research Institute of Crop |
| MCDA | Multicriteria Decision Analysis |
| LPA | Logical Problem Analysis |
| RIFC | Research Institute of Field Crops |
| TNA | Technology Needs Assessment |
| TAP | Technology Action Plan |
| NGO | Non-Governmental Organisation |
| FNC | First National Communication |
| SNC | Second National Communication |
| UNFCCC | United Nations Framework Convention on Climate Change |
| SEI | Sate Ecological Inspectorate |
| NCHI | National Company for Health Insurance |
| SAUM | Sate Agrarian University of Moldova |

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# FOREWORD

I am proud to provide a foreword to this report, which is one of the outputs of the 'Technology Needs Assessment' (TNA) conducted in Moldova. The TNA process was coordinated by the Ministry of Environment through Climate Change Office (CCO), who, with the help of local experts, conducted a thorough stakeholder consultation and analysis of the technical and policy options for increasing the use of low-carbon and climate-resilient technologies in Moldova.

Following methodological and technical assistance provided by the UNEP Risø Centre, the CCO facilitated a stakeholder-led Multi Criteria Analysis for the prioritisation of both mitigation and adaptation-side technologies. This was followed by stakeholder consultations regarding the most important barriers to the uptake of these technologies, and what can be done to overcome them.

The TNA process has finalised with Technology Action Plans (TAPs) that provide a clear and realistic road map to reforming market incentives and attracting investment in specific technologies. As such, these documents allow us to facilitate the transfer of key climate technologies that also serve to drive economic growth and development. Above all, the TAPs offer practical solutions for the sustainable development of the country's agricultural sector, upon which we depend heavily for our income and livelihoods.

*Gheorghe Şalaru*

Minister of Environment of the Republic of Moldova

March 2013

# Part IV
## Project Ideas Report

# Chapter 1. Project Ideas for Agriculture Sector

## 1.1. Brief summary of the Project Ideas for Agriculture Sector

The agriculture sector technologies prioritized during Technology Needs Assessment Project represent measures for the sustainable management of Republic of Moldova's natural resources, promoting resources efficiency, enhancing resilience to climate variability and change, with a special focus on soil characteristics improvement, management, protection and sustainable practices. The deployment of these technologies will contribute to build in Moldova a more resilient agriculture system from climatic and economic viewpoints. The Project ideas have been developed within Republic of Moldova TNA and Analysis of Barriers and Enabling Framework for Climate Change Adaptation Project based on the technologies with similar title: (i) *Conservation system of soil tillage without herbicides for winter wheat;* (ii) *Vetch field as green fertilizer into five- year crop rotation.* Project ideas have the core content of technologies however, they are adapted for further development into Project proposals. They were elaborated by national experts of TNA Project in consultation with stakeholders, representatives of the Ministry of Environment (ME) and Ministry of Agriculture and Food Industry (MAFI), business, academia representatives. Proposed Project ideas are directly related to adaptation targets set for Agriculture sector of Moldova and are consistent with the existing policy framework. They will directly contribute toward implementation of Technology Action Plans adjusted to overall targets for improvement of soil conditions derived from a number of national and sectoral policies, strategies and development plans. Project ideas have the same orientation as the government programs, they also highlight the significance of non-inverse system of soil tillage, including No-till and the importance of crop rotation and system of soil fertilization in the frame of a more sustainable farming system. The system of soil tillage, even the progressive one like No-till, can't solve the problem of soil fertility restoration without an optimal combination with a proper rotation and fertilization of crops in the frame of crop rotation.

Project ideas include analysis of current issues of the sector in relation to climate variability and future climate change. They have emphasized the poor state of soil derived from its continuous overexploitation, improper crop rotation practices, intensive tillage practices, overuse or inappropriate use of fertiliser, poor organic matter management, other problems that led to alarming current status of soils. Soil erosion resulted in poor performance of cultivated crops, particularly cereals, increased disease and pest incidences, declining soil water holding capacity-soil. The Project ideas of Agriculture sector address these issues and have the objective to assist poor resourced framers of Moldova to stop soil degradation, restore soil physical quality, increase soil productivity, make the humus and soil carbon balance positive or well-balanced, improve the soil biota status, increase resistance of soil to drought. Both proposed ideas have a rich research background, based on long term filed experiments at the Research Institute of Pedology, Agrochemistry and Soil Protection "N. Dimo" and Research Institute for Filed Crops "Selectia".

Proposed Project ideas are not totally new to Moldova's agricultural practices; however, due to many barriers identified during TNA Project, currently they are not widely adopted by farmers and agri-business. Project ideas promote long-term responsibilities for soil quality and management. They are supportive to long term sustainable soil management, use of techniques oriented towards soil protection and diminishing the negative influence of droughts, rain storms and floods. Implementation of environmentally friendly technologies in agriculture to increase soil fertility and prevent pollution is considered one of the main priorities of the strategic development of agricultural sector of Moldova.

***Conservation system of soil tillage without herbicides for winter wheat.*** Soil fertility status depends directly on farming practices and they are critical for the productivity of land. Implementation of Project idea will enable operation of whole farming system, based on preventing soil degradation and pollution. It means that modern technologies of growing field crops, including cereal crops should cover a proper crop rotation, optimal system of soil tillage and fertilization allowing reducing the dependence from non-renewable sources of energy and their derivates (mineral fertilizers and pesticides). Implementation of Project ideas will enable reducing the rate of nitrogen from mineral and pesticides for weed, pest and disease control. The proposed optimal system of soil tillage in crop rotation is integrated with the system of crop rotation and soil fertilization and remains a plausible option of system approach of farm management. Conservation agriculture should lead to soil fertility improvement and to preservation in the long-term of soil quality and their productive capacity. Proposed technologies for soil conservation and soil improvement aim to be implemented at the national level starting with pilot project with following replications.

***Vetch field as green fertilizer into five- year crop rotation.*** The scope of improving overall soil fertility implies the need to focus on farm specific problems and to introduce sustainable practices into existing conventional agriculture practices. The farmers need to survive under increasingly adverse climate change phenomena. The sustainability status

of Moldova's soils is under threat therefore, the embedding of sustainable practices into existing agriculture practices need to be applied urgently, within exiting farm sizes. The implementations of these practices are influenced by many factors: rural community, policies, supporting institutions, and markets. While dissemination of sustainable practices is one of the major goals of the Project ideas, significant advances could be made by simple awareness and information campaigns, detailed and accessible by content recommendations for farmers, spread through extension networks.

## 1.2. Project Idea "Conservation system of soil tillage without herbicides for winter wheat".

### Introduction

According to its natural composition and fertility, the soils of the Republic of Moldova make part of the most valuable soils, characterized by a remarkable diversity, related to the local vertical and horizontal zone differences, covering 75% of the land area. The cernozem soil considered the "king" of the soils[1] dominates on Moldova's territory and has to be preserved for future generations. In 2012 y. , during a scientific forum held in Balty city, Republic of Moldova researches from 14 countries have accepted to include the chernozem soils from Balti steppe in the World Heritage List protected by UNESCO. Taking into account the global trends in the depreciation and losses of agricultural land as well as the development of agriculture, the issue of preserving agricultural lands became a strategic concern of national security for our country[2].

As part of its development policy framework, the Government of Moldova has prepared a number of sector strategy documents, sectoral polices and development plans promoting and supporting soil conservation and soil quality improvement actions. These policy documents incorporate targets carrying out agro-technical measures for soil protection – anti-erosion crop rotation; agro-technical anti-erosion; growing of cereals in a sustainable mode. The relevant legislation will be provided in the respective compartment bellow.

Agriculture sector of Moldova is already substantially affected by current climate variability. According to assessments undertaken during Moldova's First (FNC, 2000)[3] and Second (SNC, 2009)[4] National Communications under the United Nations Framework Convention on Climate Change (UNFCCC) it faces distinct challenges of droughts, floods, frosts, hails and heavy rains. The climate is expected to become more arid and risky for agricultural production, due to increasing temperatures and longer dry periods. The impacts of climate change will necessitate shifts in land management applying a range of sustainable technologies related to land conservation and rehabilitation. Changes in climatic conditions (rising temperatures, changing precipitation intensity and frequency) are likely to significantly affect soil-related processes and environmental services regulated by soil in Moldova.

**Agriculture sector issues**

Despite its significance in the economic and social development of the country, the agriculture is not sustainable from economic, ecologic and social viewpoints. The "green revolution" concept for agricultural intensification is dominating, although the increased prices of nonrenewable sources of energy and their derivates (mineral fertilizers, especially nitrogen, pesticides etc.) make the economic survival of farmers more difficult. Non- sustainable use of the land over a long time spam, its over exploitation via agricultural intensification has reduced the biological diversity both under and above the soil; it has emphasized the consequences of global warming etc. Currently missing crop rotation in Moldova is compensated by excess amount of mineral fertilizers and pesticides in order to control nutrient deficiency and hard phitosanitation problems (high levels of infestation with pests, diseases and weeds). Losses of soil biodiversity increase

[1] *Docuceaev V.V.(1952).Russian chernozem. State Publisher of Agricultural Literature,Moscow,1952,Second edition,634p.(Russian language)*

[2] *National Agriculture Sector and Food Processing Industry Sustainable Development Strategy of the Republic of Moldova for 2008-2015: http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=327309.*

[3] *UNDP/Ministry of Environment and Territorial Arrangement (2000), First National Communication of the Republic of Moldova under the United Nations Framework Convention on Climate Change. Chisinau, 2000. – 87 p.*

[4] *UNEP/Ministry of Environment and Natural Resources (2009), Second National Communication of the Republic of Moldova under the United Nations Framework Convention on Climate Change. Chisinau, 2009. – 316 p.*

the dependency of farms from pesticides for weed, pest and disease control. Restoration of soil fertility and agro-biodiversity will help to re-establish and maintain ecosystem functioning. It can be done only by returning enough fresh organic matter as a source of energy for soil biota.

In spite of the widespread awareness, and rationales provided, the adoption of conservation technology has not been widespread in Moldova. During barrier analysis of the TNA Project a number of barriers have been identified that hold back the wide diffusion of sustainable agricultural practices in Moldova. Identified barriers relate to financial, technical, policy, farm size and structure, institutional and human factors which constrain many farmers from adopting conservation practices. Barriers relating to economics and technology seem to be most influential. Measures to overcome identified barriers have been proposed and structured into the Technology Action Plan. Proposed measures were discussed in terms of its necessity, responsible implementing entities, estimated timelines, costs, funding opportunities, indicators of success and risks. The most important proposed measure was to implement *Conservation system of soil tillage without herbicides for winter wheat* technology based on whole farming system.

**Advantages of sustainable practices**

Conservation system of soil tillage without herbicides is a sustainable land management practice that contributes to improving soil fertility and structure, adding high amounts of biomass to the soil, causing minimal soil disturbance, conserving soil and water, enhancing activity and diversity of soil fauna, and strengthening mechanisms of elemental cycling. *Conservation system of soil tillage without herbicides for winter wheat* technology can be extended to other cultivars, such as sugar beet and sunflower.

This technology has advantages comparing to conservation tillage with herbicides or conventional tillage.

- Moldboard plug is replaced by combinator, which contributes to the reduction of soil erosion and uncompensated mineralisation losses;
- By reducing soil erosion and mineralisation losses of soil organic matter we decrease global warming through increased carbon sequestration;
- By reducing the consumption of fuel as a result of replacing the moldboard plough with minimum tillage it is possible to adapt to the limited sources of non-renewable sources of energy, to the fluctuation of prices for non-renewable sources of energy at the international level;
- By keeping mulch on the soil surface it is possible to reduce evaporation of soil moisture and to increase the resistance;
- By using minimum tillage it is possible simultaneously to reduce or even avoid application of mineral fertilizers and pesticides for weed, pest and disease control, which requires a proper soil management system.

The above mentioned advantages allow also to adapt better to the limited sources of non-renewable sources of energy, to the fluctuation of prices for non-renewable sources of energy at the international level, to adapt to global warming by increased carbon sequestration, to increase biodiversity in the soil and on the soil surface through less dependence from mouldboard ploughing and chemicals for pest, disease and weed control.

Adoption of farming system brings changes not only in the growing of open filed crops, orienting them toward sustainability, but also is a new concept in farm management applying whole farm system or more precisely technologies of growing crops in the frame of farming system.

Taking into consideration that crop rotation is not respected in Moldova, it would be risky to make direct transition to No-till technology over whole arable land. That is why, within future Project, it is intended to use No-till technologies if identified site will allow to apply it or to use minimum till in crop rotation concurrently looking for alternatives to nitrogen mineral fertilizers and herbicides for weed control. It means we should make an ecological restructuring of the existing structure of sowing area, which can allow to respect crop rotations and to improve health of soils and crops. As regarding crop diversity, it will be applied a larger diversity of crops from different botanical groups and with different capacities to extract water and nutrients from different soil layers, crops with different biological capacities to suppress weeds, pests and diseases, with pronounced allelopatic activity. Only higher diversity of crops in crop rotations will allow to reduce the dependence from chemicals and to prevent many others negative consequences on the environment and health of people.

The above mentioned structural changes in the farming systems of Moldova are necessary in order to make transition to a more sustainable agriculture capable to conserve natural resources as the basis for future development. Success can be achieved only in case of holistic (systemic) approach to three main components of each farming system: crop rotation, systems of soil tillage and fertilization in the frame of crop rotation. By optimizing these three main components it would be possible to reduce such inputs as: nutrients from mineral fertilizers, pesticides, irrigational

water etc. The research made at RIFC" Selectia" proved, that that such changes are efficient from economic point of view. Currently existing conventional farming system in agriculture of Moldova is based mainly on controlling the consequences of mistakes made in the alternation of crops, soil tillage and fertilization, instead of preventing the causes, which contribute to many of the negative consequences on the environment and health of people. The system was studied in the long/term field experiments at the RIFC «Selectia". Research results are available for farmers through publications of books, recommendations, articles, TV, radio etc.

**The proposed holistic approach of sustainable agricultural practice brings economic and environmental benefits:**

- Increasing the sustainability of the agricultural sector, including profitability;
- Reducing the dependence from non-renewable sources of energy and their derivatives (mineral fertilizers and pesticides), which we have to import at the moment and in the future;
- Creating conditions for the development of small and medium size enterprises.
- Achieving a more sustainable use of natural resources through preventing soil degradation, soil and water pollution, preservation of biodiversity etc.
- By implementing a conservative system of soil tillage it would be possible to increase the environmental benefits through:
    - Higher carbon sequestration which allows to reduce global warming;
    - Reduction of soil erosion and better storage of soil moisture;
    - Reduction of pollution of ground water with nitrates;
    - Reduction of GHG emission as a result of lower amount of burned fuel.

The Project idea was developed within TNA Project Republic of Moldova Technology Needs Assessment and Analysis of Barriers and Enabling Framework for Climate Change Adaptation based on the technology with similar title and content, passing assessment, prioritisation, barrier analysis applying Logical Problem Analysis (LPA), Problem tree, Objective tree, economic-financial analysis, market analysis using market mapping approach, development of measures as TAP to technology diffusion. The methodological guidance of climate change Technology Needs Assessment was received from UNEP Riso Center and Asian Institute of Technology (AIT), Bangkok, also following a number of methodological sources elaborated by UNEP RIso Centre, UNDP, Asian Institute of Technology, Climate TechWiki website.

The Project idea was elaborated by national experts of TNA Project in consultation with stakeholders, representatives of the Ministry of Environment (ME) and Ministry of Agriculture and Food Industry (MAFI), business, and academia representatives. Proposed Project idea is directly related to adaptation targets set for Agriculture sector of Moldova and is consistent with the existing policy framework.

## Objectives of the Project:

- ✓ To apply a holistic approach of sustainable agricultural practice as alternative to the existing in Moldova conventional (simplistic) model of agricultural production thus, facilitating the transition from conventional to a more sustainable agriculture.
- ✓ To integrate the three main components of each farming system - crop rotation, systems of soil tillage and fertilization, towards restoration of soil fertility and a reasonable level of crop productivity without damaging the environment and health of people.
- ✓ To apply a well-balanced site-specific crop rotation, aimed at boosting whiner wheat yield and improving soil characteristics, including those climate - sensitive: soil erosion, soil moisture, storage of organic form of carbon.
- ✓ To promote whole farming system in winter wheat production as a measure to increase farms resilience to climate change aiming to the extension of the system to other major crops planted in Moldova: sunflower and sugar beet.
- ✓ To promote whole farming system as agriculture management practice helping to tackle both climate change adaptation and mitigation.

## Outputs

The outputs of the project are:

1. Developed an applied holistic approach of sustainable agriculture as alternative to existing in Moldova conventional model of agriculture on the selected area of 1500 ha (500 ha South; 500ha Center; 500 ha North). Developed farming system (functional model) will operate as small or medium sized agricultural enterprise with on-site specific crop rotation, soil tillage practices and rational use of fertilizers.
2. Developed new skills of sustainable farming of farmers involved in the Project.
3. Develop Project activities time schedule.
4. Improved soil fertility through prevention of soil erosion, better compensation of annual mineralization losses of soil organic matter and, as result, a better soil carbon sequestration, higher capacity of soil moisture accumulation;
5. Increased productivity of winter wheat crop relatively to the existing level of wheat production in Moldova;
6. Reduced budget of winter wheat production due to the diminished or completely avoided use of mineral fertilizers, in particular nitrogen and pesticides, reduced consumption of fuel, cost-effective integration of crops into crop rotation.

The aforementioned outputs are measurable based on indicators and functionality of applied systems.

1. In place whole farming system with al components set and functioning;
2. Evaluation of soil fertility status based on soil fertility indicators used to establish the level of recovery of soil organic matter as the integral index of soil fertility;
3. Agronomic and biological productions measured (yields of the main production and secondary production, the total biomass) and compared to those of conventional growing;
4. The amount of money saved due to reduced use of nitrogen and other fertilizers, pesticides; by reducing the consumption of fuel as a result of replacing the moldboard plough with minimum tillage.
5. Comparative evaluation of the ratio between input and output of energy for conventional and proposed models of sustainable farming system (energetic efficiency).

## Relationship to the country's sustainable development priorities

As part of its development policy framework, the Government of Moldova has prepared a number of sector strategy documents, sectoral polices and development plans promoting and supporting sustainable practices, including soil conservation and soil quality improvement actions, as efficient climate change adaptation measures.

The main policies incorporating country's sustainable development priorities are:

- The *Strategic priorities for the activities of the Ministry of Agriculture and Food Industry of the Republic of Moldova in the years 2011 – 2015*[5] promotes conservation agriculture leading to increase of soil fertility and preserve long-term quality and productive capacity of soils.
- The *National Agriculture Sector and Food Processing Industry Sustainable Development Strategy of the Republic of Moldova (2008-2015)*[6]. The Strategy establishes measures contributing toward diminishing agriculture's vulnerability related to risk factors and environmental protection. Erosion combating was specified as one of the main measures in soil improvement actions.
- *The Program for Soil Fertility Conservation and Enhancement 2011-2020*[7] supports the implementation of environmentally safe farming methods to increase soil fertility, use as organic fertilizer manure and green manure, application of minimum tillage and no-tillage.
- *Land Consolidation Program*[8] is a detailed law governing land consolidation process under Chapter 10 of the Land Code, to create conditions for the implementation of a space-based modern agriculture crop rotation and use of organic fertilizers.

[5] *Strategic priorities for the activities of the Ministry of Agriculture and Food Industry of the Republic of Moldova in the years 2011 – 2015. www.maia.gov.md*

[6] *National Agriculture Sector and Food Processing Industry Sustainable Development Strategy of the Republic of Moldova (2008-2015); www.maia.gov.md*

[7] Approved by Government decision Nr. 626 of 20.08.2011
*http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=339882*

- *The Law regarding environmental protection*[9]. This law aims at a system of economic activities, were it becomes inconvenient causing any environmental damage; creating eco-funds for financing of activity oriented toward improving the quality of the environment.

## Project Deliverables

**Deliverables of the Project:**

- ✓ An operational model of whole farming system with a well-balanced crop rotation, soil tillage techniques and rational use of fertilizers for winter wheat production as a measure to increase the resilience of Moldova's farms to climate variability and change. Conservation technologies are somewhat distinct from other agricultural innovations because they do not provide financial or time-saving benefits to the farmer in the short term. However, proposed farming system proved to be financial and economic effective within short term.
- ✓ A functional model of small or medium size agricultural enterprise based on sustainable practices, flexible in management with high environmental benefits, able to adjust to climate uncertainties. Some of the applied techniques are: reduced areas under row crops and increased areas under compact drilled crops, including perennial leguminous crops; integration of crop and animal husbandries in order to restore soil fertility and to reduce the dependence from inputs; site-specific crop rotation to compensate the erozional and biological (mineralization) losses of soil organic matter, other.
- ✓ Improved soil quality based on soil fertility indicators. Losses of soil biodiversity increase the dependency of farms from pesticides for weed, pest and disease control. Restoration of soil fertility and of soil health, in particular, will improve the ecological situation in agriculture. It can be done only by returning enough fresh organic matter as a source of energy for soil biota. Soil quality will be assessed by independent researchers.
- ✓ Increased ( comparing to conventional farming) winter wheat productivity;
- ✓ Sharing acquired knowledge to agricultural producers via training workshops, developed Project web.site, other types of communications;
- ✓ Progress and final reports on Project implemented activities.

Main message delivered to all interested in sustainable agriculture:

- ✓ Modern technologies in order to be sustainable have to be improved in the frame of the whole farming system

Message delivered to farmers:

- ✓ Farmers have to reduce areas under row crops and to increase areas under compact drilled crops, including perennial leguminous crops, taking in consideration the ecological particularities of the landscape for each field and locality;
- ✓ Farmers ha to integrate crop and animal husbandries in order to restore soil fertility and to reduce the dependence from inputs. Each crop rotation has to compensate the erozional and biological (mineralizational) losses of soil organic matter.

Message delivered to researches:

- ✓ Cooperation in researches it is mandatory; because only multidisciplinary approach in the researches od sustainable agriculture can find solutions for human created problems. Agroecology should serve as a scientific basis for research programmers in agriculture.

Message addressed to both farmers and scientists:

- ✓ On-farm researches are the most appropriate for real problems in real farms. It means, working together is the most efficient way in finding solutions for farmers' problems.

[8] *Land Consolidation Program* .Approved by Government Decision no. 554 of 22.05.2006. http://lex.justice.md/index.

[9] Law N 115-XVI regarding the ecological production from 09.06.2005 www.maia.gov.d

## Project Scope and Possible Implementation

The idea is developed for a Pilot Project implementing the holistic approach of farming system with perspectives of further diffusion of the applied system on the 340,200 ha, in the North, Central and South parts of the country, which 22% of total arable labd in Modova[10]

On the identified areas of 500 ha, South, 500 ha Centre and 500 ha North regions of Moldova the works will be centred on implementation of winter wheat conservation system of soil tillage (by using disking and combinators for seedbed preparation) without herbicides. Varieties of winter wheat to be used have a higher biological capacity to suppress weeds. Such varieties are better adapted also to drought conditions from the steppe zone of Moldova.

The proposed farming system has been elaborated and tested at the Research Institute of Field Crops "Selectia" and is a result of long term research experiments. These experiments proved that proposed system is both economic and financial feasible. The cost/benefit analysis performed during TNA Project also proved the economic and financial profitability of proposed technology.

The proposed Project idea has a significant financial value due to low inputs used. By respecting crop rotation, which means having a good predecessor for winter wheat it would be possible to increase the level of yields and to cut the expenditures for the utilization of herbicides, chemicals for pest and disease control, nitrogen from mineral fertilizers, lower expenditures for soil tillage.

The Project idea feasibility increases if investments funding will be provided as grant funding, the farmers benefiting on training, consultancy and technical assistance free of charge and equipment purchased under the project to remain in their own use.

Proposed Project idea has a strong research and implementation background provided at RIFC "Selectia", nevertheless, farming practices vary between places and over time, and also in relation to their suitability for the soils being managed. Therefore, continuous adjustment of applied technologies in system farming will be applied during implementation of the Project. This adjustment via continuous consultancy and technical assistance will be provided by RIFC "Selectia". Although not essential, the Project will include some investigations of different models of technologies of growing field crops (from existing to more sustainable ones). The obtained results with different models, including more sustainable technologies of growing field crops, will be used for the implementation by farmers from Moldova and from the whole region with similar soils and weather conditions. It assumes knowledge sharing within held seminars for farmers including concurrent demonstration of the experimental plots at the RIFC "Selectia". The multidisciplinary approach to alternative farming systems and technology of growing field crops requires participation of specialists from different branches of knowledge.

## Project activities

The adoption of conservative system is preferable to be operational at small-medium size farm, for this reason the activities are proposed for this scale of farm operation.

Establishment of farming system that involves many different conservation measures and sustainable soil management practices, the main component being:

1. Develop Project activities time schedule and implement them accordingly.
2. Identification of pilot farms in 3 agro-climatic regions of Moldova in order to implement the conservation system of soil tillage without herbicides for winter wheat.
3. Activities on farmers' perceptions and awareness on proposed whole farming system. Training of land owners/farmers on whole farming system and soil conservation practices, with clear emphasis on benefits derived, visits to demonstration plots at RIFC "Selectia".
4. Adjustment of proposed farming system to site specific characteristics and on-site technical assistance before proceeding to conservation practices.
5. Training of farmers in local seeds use of different varieties applied in crop rotation

[10] http://www.statistica.md/pageview.php?l=ro&idc=315&id=2279

6. On the identified areas to establish the level of existing and potential soil erodibility as one of the main indicator of efficiency of applied soil rehabilitation technologies.
7. Acquisition of conservation tillage designed equipment and machinery and their use in the tillage works during the whole Project according to applied technology.
8. Acquisition of winter wheat seeds, other seeds needed in crop rotations.
9. Provide on-site technical assistance and consultancy to farmers practicing whole farming system during the implementation of the Project.
10. Establishment of demonstrational plots at RIFC" Selectia" for on-going adjustment and technological support provided to farmers/land owners involved in the Project.
11. Site-specific application of technologies in the framework of the main three components of the system: crop rotation, soil tillage and fertilization. Alternatives for nitrogen from mineral fertilizers and herbicides for weed control will be proposed.
12. Development of Project web.site with the purpose of sharing knowledge, setting of forum for sustainable agriculture practitioners, project transparency and identification of other potential adopters of sustainable practices.
13. Sharing acquired knowledge to agricultural producers via training workshops, developed Project web.site, seminar, TV, radio broadcast.
14. On-going and completing Project reporting activities.
15. Monitoring and evaluation of project activities.

## Timelines

The duration of the project has to be adjusted to the technologies applied in the whole farming system, which means at least one full crop rotation -7 years. This time will be enough to observe changes in crop productivity and soil fertility.

## Budget/Resource requirements

Financing climate change project is a difficult task for a country like Moldova. That is why the Project idea will be developed into Project Proposal and advanced for funding to international bodies financing climate change adaptation projects.

*Operational costs* for on-site consultancy and technical assistance: 3 agronomists, 3 engineers and 6 technicians should be involved in the activity of the project (one agronomists, one engineer and two technicians for each of the three zones of Moldova) – 54,000€/per year. For 7 year duration of the Project-378,000 €. Per diem- 75,600€.

PCs (6)-1,800€ ,phone/fax (3)-350 €, mobiles(6)- 2560 €. Total:4,710€

*Transportation costs* (cars and fuel): 11,000€ price per car x 3 cars= 33,000€. Fuel-6,600€ per year, for 7 year Project-46,200€**.**

*Conservation tillage equipment and machinery*: three tractors with 130 horse power – 105,000 €; one tractor with 89 horse power – 20,000 €; three sowing machines for compact drilled crops according No-till technology – 60,000 €; three sowing machines for row crops, according No-till technology – 60,000 €; combine for harvesting crops – 70,000€; three spreaders – 45,000 €; 80 finger harrows ("Hatzenbishler" Austria )- 0.56M€.

Total conservation tillage equipment: 2.54M€

Project office rent for 7 years-31,500 €

Unforeseeable expenses – 60,000 €

For 7 year pilot Project total costs: 3,169,010€.

## Measurement/Evaluation

- ✓ During the implementation of the Project the regular evaluation to assess progress made will be performed using project management indicators.
- ✓ The evaluation of the level of sustainability for different technologies of growing field crops for the whole duration of the crop rotation will provide the scientific community, farmers and authorities with very valuable information regarding the perspectives for agricultural intensification.
- ✓ The evaluation of farmers' abilities to individually implement the whole farming system.
- ✓ The evaluation of the level of winter wheat productivity, using specific indicators of yield performance.
- ✓ Cost/benefits analysis of applied technologies in crop rotations and conservation techniques of tillage. Comparative analysis with similar indicators of conventional agriculture. Calculation of savings due to inputs cutting costs in conservative agriculture..
- ✓ Final Project evaluation and accountability to assess its efficiency and effectiveness.

## Monitoring:

- ✓ Keep track on changes of progress made in implementing activities in relation to objectives set. Make necessary adjustments.
- ✓ Continuous monitoring of herbicides and fertilizers use. Comparative assessment with their use in conventional practices of agriculture.
- ✓ Continuous monitoring of soil erosion and fertility indicators and their comparative assessment with similar indicators of conventional agriculture will be applied.
- ✓ Monitoring of site-specific proper implementation of crop rotation.
- ✓ Monitoring of winter wheat disease control actions.
- ✓ Monitoring of fertilizers use for winter wheat crop production.

## Possible Complications/Challenges

- ✓ Project idea is a sustainable agriculture practice, which requires high start investments that are difficult to find in Moldova. That is why, the most appropriate source of funding are international bodies financing climate change adaption projects, which might be difficult to access.
- ✓ Currently conservation agriculture practices have top-down approach and lack of appropriate incentives for their adoption by land users with limited local involvement.
- ✓ Land users have low awareness on soil erosion issues, that is why might be reluctant or marginally involved in agriculture sustainable practices.
- ✓ Government insufficient efforts on consolidation of fragmented land.
- ✓ Lack of tight linkages between soil conservation issues and developed agricultural policy. Lack of legislative comprehensive framework that promotes sustainable agriculture practices and prevent soil degradation.

## Responsibilities and Coordination

Ministry of Environment (Implementation Unit of the Project, IUP) will be the responsible institution for Project coordination, management and implementation. Implemented activities will involve also other stakeholders, sectorial institutions, land owners, researchers. Activities 1-12

Ministry of Agriculture and Food Industry: Activities 6, 8, 9, 11,12

- ✓ Provide consultancies on best seeds to be procured, help negotiate best prices.
- ✓ Provide on-site technical assistance and consultancy to farmers practicing whole farming system during the implementation of the Project.
- ✓ Help identifying site-specific crop rotations, advice on fertilizers use and management.
- ✓ Provide information and share knowledge, setting of forum for sustainable agriculture practitioners.

Land owners /farmers: Activities 1, 2,3,4,5

- ✓ Farmers will be the main actors of implemented activities and also beneficiaries of the Project.

Laboratory testing Institution: Activities 6,10.

- ✓ Perform soil testing analysis

RIFC "Selectia", ACSA, SAUM: Activities 5, 10, 11

- ✓ Provide training for farmers on use of varieties of seeds for crop rotations.
- ✓ Establishment of demonstrational plots at RIFC" Selectia" for on-going adjustment and technological support provided to farmers/land owners involved in the Project.
- ✓ Provide consultancy on site specific application of technology

The State Hydro Meteo Service will provide weather forecast.

## 1.3. Project Idea "Vetch field as green fertilizer into five- year crop rotation" .

### Introduction

The classical tillage system cannot be replaced by soil conservation works on circa 30% of arable lands[11] because of specifics of crops (fodder beets, vegetables etc.) growing, as well as for other reasons. This system mandatorily implies moldboard ploughing at 20-35 cm depth, which turns over the topsoil layer (furrow), and ensures preparation of a fine seedbed. The classical tillage system, although resulted in a gradual increase of agricultural output, caused the phenomena of soil characteristics degradation. Excessive cultivation of lands favoured dehumification, damaged the soils structure, increased the danger of erosion. Heavy and frequent traffic increased compaction and, consequently, triggered other negative phenomena.

Predominantly, Moldova has fine textured loamy-clay or clay-loam soils (up to 80% of the total area). The arable layer of these soils, as a rule, is deconstructed and lacks resistance to compaction. Because until 1990 soils were mainly ploughed to a depth of 35cm, while now the soil is tilled not deeper than 10-20 cm, a very compact post-arable layer has formed under the recently arable layer.

The main cause of soils characteristics degradation in the classic tillage is dehumification.[12] Climate aridization along with classic cultivation leads to dehumification of agricultural soils, soil structure damage and strong secondary compaction of the arable layer. Currently the arable layer of agricultural soils lost its natural ability to compaction resistance. Dehumification, dissolution and secondary arable soil compaction is a global problem[13], but particularly acute in Moldova where 80 percent of soils are characterized by fine texture[14]. These soils have a high production capacity only if their structure is agronomical favorable and contributes positively to regulate air-fluid and nutrient regimes, ensuring optimal conditions for plant growth and development. In a compacted layer of soil moisture reserves are almost by two times less accessible than in the same loose layer with agronomical favorable structure. Therefore, soils with a high content of humus, agronomical favorable structure and loose arable layer are more adapted to climate change. To adapt to increasing desertification due to dehumification, dissolution and secondary compaction of the arable layer of soil generated by climate change.

Under circumstances when manure is underused as fertilizer (10-20 kg / ha / year according to statistics) and scarcity of fertilizers (20-30 kg / ha / year active ingredient), in order to reduce the process of dehumification, damaging the structure, strong compaction of the arable layer and increase resistance to compaction and soil erosion, it is recommended to include in a 5 fields crop rotation based on classical tillage, a field occupied by an annual leguminous crop - autumn and spring vetch (2 vetch yields incorporated into the soil as green fertilizer once in 5 years on each

[11] *Nicolaev Nionila, Boincean B. Agrotehnica. Bălți: Presa universitară bălțeană, 2006. 298 p.*
[12] *Boincean B.* Lucrarea solului - tendințe şi perspective. În: Academos, nr. 3(22), 2011, p. 61-66.

[13] *Guj P., Rusu T., Bogdan I. Asolamentele, rotația culturilor şi organizarea teritoriului. Cluj-Napoca: Risoprint, 2004. 219 p. ISBN 973-656-566-1*

[14] *Cerbari V., Scorpan V., Țăranu M., Bacean I. Remedierea stării de calitate şi capacității de producție a cernoziomurilor obişnuite din sudul Moldovei sub influența unor măsuri fitotehnice. În: Mediul Ambiant. Nr. 1 (61), Februarie, 2012. p. 38- 43. ISSN 1810-9551*

field). The crop rotation structure may be as follows: vetch field → winter wheat→ corn → winter wheat or barley → sunflower. It is necessary to note that vetch, as green fertilizer, can be used in all basic soil cultivation options.

The advantages of this technology are the following:

- ✓ the population is used to tillage practices;
- ✓ total incorporation of crop residues, weeds and their seeds;
- ✓ safety in operation due to simple construction of the plough;
- ✓ the effect of soil loosening and intense fertility mobilization;
- ✓ the crops are fully provided with nitrogen during 4 years due to return in soil of about 500-600kg/ha nitrogen with crop residues and vetch roots;
- ✓ Considerably restores physical quality and improves biological condition of the soil.

Sidereal annual legume crops, as a mandatory component part of a crop rotation scheme where one field is occupied by vetch (two yields per year incorporated into the soil as green fertilizer), enrich the top layer of the soil with high quality crop residues which are very rich in nitrogen (the yield of dry air mass reaches 7-8 tons / ha, containing about 4-5% nitrogen), cause intensification of biological processes of humification (and the main crop residues with low content of nitrogen), and formation of new active organic matter, which leads to the accumulation of nutrients, formation of valuable agronomic structure, reducing topsoil layer compaction[15]. Organic carbon reserves, biological activity, above ground and underground biodiversity and soil structure are increased and improved. The need for fertilizers and soil restoration interventions decreases. More intense biological activity results in formation of well-connected macro biopores, mainly vertical, which increase water infiltration and resistance to intense mechanical compression.

Two crops of vetch in an agricultural year accumulate about 20 -24t/ha of organic matter dry in soil (residues of the air mass and roots) containing about 3.0% nitrogen. This amount of nitrogen-rich organic matter in soil ensures synthesis of about 6 t/ha of humus or 3, 5 t/ha of carbon. It provides for a good balance of humus, carbon, nitrogen and CO2 emissions in soil. In terms of adaptation benefits, the arable layer becomes looser, with higher resistance to compaction and erosion. The arable layer of loose soil, enriched with new organic matter is characterized by high water capacity and is more resistant to pedological drought than a soil with a compact arable layer.

The Project idea was developed within TNA Project Republic of Moldova Technology Needs Assessment and Analysis of Barriers and Enabling Framework for Climate Change Adaptation based on the technology with similar title and content, passing assessment, prioritisation, barrier analysis applying Logical Problem Analysis (LPA), Problem tree, Objective tree, economic-financial analysis, market analysis using market mapping approach, development of measures as TAP to technology diffusion. The methodological guidance of climate change Technology Needs Assessment was received from UNEP Riso Center and Asian Institute of Technology (AIT), Bangkok, also following a number of methodological sources elaborated by *UNEP RIso Centre, UNDP,* Asian Institute of Technology, Climate TechWiki website.

The Project idea was elaborated by national experts of TNA Project in consultation with stakeholders, representatives of the Ministry of Environment (ME) and Ministry of Agriculture and Food Industry (MAFI), business, and academia representatives. Proposed Project idea is directly related to adaptation targets set for Agriculture sector of Moldova and is consistent with the existing policy framework.

## Objectives of the Project

The main objectives of the Project is to assist poor resourced framers of Moldova to stop soil degradation, restore soil physical quality, increase soil productivity, make the humus and soil carbon balance positive or well-balanced, improve the soil biota status, increase resistance of soil to drought.

- ✓ Promote soil erosion control through applying vetch field as green fertiliser into five-year crop rotation, which will ensure more competitive agricultural products both by quantity and quality, lower costs and higher profit, due to the improved soil characteristics and functions, and environmental protection factors.

[15] *Cerbari V., Ciolacu, Tatiana. Metode fitotehnice de remediere a însuşirilor degradate ale cernoziomurilor. În: Academicianul I.A.Krupenikov – 100 ani. În: Culegere de articole ştiinţifice. Red.resp.: Tamara Leah. Ch.: S.n. (Tipogr. „Elan Poligraf" SRL), 2012, p. 62-68. ISBN 978-9975-66-231-4.*

- ✓ To apply sustainable farming practice adapted to specific type of soil and requirements to main cops planted in Moldova on the area of 200, 000 ha in conditions of conventional tillage system (by ploughing).
- ✓ Restoration of degraded characteristics of the arable and underlying layer of soil at 0-35cm depth on lands to be used for phased implementation of the 5 field crop rotation scheme with one field sown twice a year with winter vetch and spring vetch as "green fertilizer", annually on the area of 40 000 ha;
- ✓ Developing a system for monitoring the soils evolution process (data banks) under the influence of the organic mass of stems and roots of 2 vetch yields incorporated into the soil as green fertilizer.

## Outputs.

Project outputs are:

1. Stopped soil degradation, restored soil physical quality, increased soil productivity, positive or well-balanced content of humus and soil carbon balance, and improved the soil biota status, increased resistance of soil to drought.
2. Established soil erosion control through applying vetch field as green fertiliser into five-year crop rotation, improve soil characteristics and functions and environmental protection factors.
3. Applied sustainable farming practice adapted to the type of soil and requirements to main cops planted in Moldova on the area of 200, 000 ha in conditions of conventional tillage system (by ploughing).
4. Restoration of degraded characteristics of the arable and underlying layer of soil at 0-35cm depth on lands using for phased implementation of the 5 field crop rotation scheme with one field sown twice a year with winter vetch and spring vetch as "green fertilizer", annually on the area of 40 000 ha;
5. Developed monitoring system of the soils evolution process (data banks) under the influence of organic mass of 2 vetch yields incorporated into the soil as green fertilizer.
6. Developed recommendations to improve the conventional soil tillage systems taking into account local conditions of soil, climate, and endowment with machinery, equipment and materials, to widely disseminate the proposed technology.

The aforementioned outputs are measurable based on soil indicators, data collected, sustainable practices applied:

1. Assessment of the degree of degradation of soils exploited until now under the conventional tillage system involving ploughing ("base-line", beginning of the project state).
2. Evaluation of soil fertility status using soil fertility indicators to establish the level of recovery of soil organic matter as integral index of soil fertility;
3. Evaluation of soil physical, chemical and biological properties and identification of soil quality changes under sustainable practice of green fertilizer application in different zones of Moldova.
4. Sustainable practices of vetch filed into five-year crop rotation incorporated into soil management of various types and relief location on the area of 40, 000 ha annually in 2 cycles of application of the proposed technology. Establish the relationship between soil characteristics and intensity of cropping.
5. Restored characteristics of soils on the total area of 200, 000 ha using soil testing indicators and their comparing with the "base-line" state of soil quality.
6. Developed databank on soils evolution process under the influence of organic mass of 2 vetch yields incorporated into the soil as green fertilizer.
7. Developed and disseminated recommendations to improve the conventional soil tillage systems taking into account local conditions of soil, climate, and endowment with machinery, equipment and materials.

## Relationship to the country's sustainable development priorities

The Project meets the objectives of the National Sustainable Development Strategy for the agricultural sector of the Republic of Moldova (2008-2015)[16], approved by Government Decision no. 282 of 11.03.2008 and contributes to addressing the problems listed in the Soil Fertility Conservation and Enhancement Program for 2011-2020, approved by the Government Decision no. 626 of 20.08.2011[17].

## Project Deliverables

1. Implemented technology of crop rotation with vetch plants as green fertilizer, planted on one field once per 5 year. The system will ensure agricultural production competitive by quantity and quality, generating higher profits due to improved soil characteristics and functions on the area of 40 000 ha annually, for a total area of 200 000 ha of arable land during project lifetime.
2. Replacement of chemical fertilizers with nitrogen green fertilizers rich in biological nitrogen (60% of symbiotic origin), which will increase the agricultural output of high quality. Positive balance of humus, carbon and nitrogen in soil;
3. Comparative analysis of soil fertility indicators.
4. Increased profitability of agricultural production process by 30% due to improved soil characteristics an applying of on-site specific crop rotation with vetch as green fertilizer, planted on one field once per 5 year (2 yields in an agricultural year), 2 cycles of technology during 10 years.
5. Accumulation in soil, on the account of organic waste and roots of the 2 yields of vetch, of about 6 t / ha of humus (3.5 t / ha of carbon) and 600 kg / ha of nitrogen;
6. Restored soil characteristics of degraded arable layer of 0-35cm; improved indicators t of organic matter, structure, porosity; water permeability will increase and soil erosion hazard will decrease; decompaction and loosening of arable layer, increased field capacity for water and reduced danger of pedological drought. These changes will result into stabilised economic, ecologic and social rural life of Moldova's villages.
7. Developed databank on soils evolution process under the influence of organic mass of 2 vetch yields incorporated into the soil as green fertilizer.
8. Developed and disseminated recommendations to improve the conventional soil tillage systems taking into account local conditions of soil, climate, and endowment with machinery, equipment and materials

## Project Scope and Possible Implementation

The project can be implemented by any farm which uses ploughing in basic cultivation of soil, has crop cultivation machines, able to allocate land for a field sown with vetch (2 yields incorporated into the soil as green fertilizer) in a five-year crop rotation. Minimum size of farms is 200 ha however, a 5000 ha arable land better suits the implementation of technology.

Due to the circumstances, that in Moldova soils were overexploited, their current conditions is advanced degradation. For soil recovery the application of one field of vetch as green fertilizer once per five year is not sufficient to restore soil's good properties therefore, the proposed technology will be applied in 2 cycles: 5 year time per each cycle for a total area of 200, 000 ha,(40, 000 ha annually) then repeatedly applied during next 5 years. In terms of climatic conditions, relief and soil type, this system can be implemented in all climate zones of the country with site specific management. Considering that soil erosion and degradation is a common issues of all arable land in country , the successful implementation of Project idea will lead to adoption of this technology on other arable degraded land.

The Project idea is feasible, as it is based on common, previously applied in Moldova's agriculture production techniques. The management of implemented activities require continuous consultancy, which will be provided by Project consultants during Project lifetime.

[16] *National Sustainable Development Strategy for the agricultural sector of the Republic of Moldova (2008-2015), Government Decision no. 282 of 11.03.2008. www.maia.gov.md*

[17] *Soil Fertility Conservation and Enhancement Program for 2011-2020, approved by the Government Decision no. 626 of 20.08.2011. www.maia.gov.md*

The Project idea feasibility increases if investments funding will be provided as grant funding, the farmers benefiting on training, consultancy and technical assistance free of charge and equipment purchased under the project to remain in their own use.

## Project activities

During the Project lifetime the following main activities will be implemented:

1. Develop Project activities time schedule and implement them accordingly.
2. Provide the basic training for farmers adopting proposed sustainable practice and review the need for training annually.
3. Acquisition of dedicated equipment and machinery.
4. Acquisition of vetch seeds for sowing the fields incorporated into site-specific crop rotations.
5. Implement technology of five-filed crop rotation with vetch plants as green fertilizer, planted on one field once per 5 year on the area of 40,000 ha annually. Sawing of basic crops of site-specific crop rotation, sawing of vetch plants, management of activities.
6. Continuous support and consultancy for agricultural producers' farmers to allow incorporation of a vetch field into site specific crop rotation. Sowing of winter and spring vetch plants, incorporation into the soil of vetch green mass.
7. Collect soil samples and perform soil testing analysis periodically to determine the effect of applied technological practices on soil quality. Perform comparative analysis of soil indicators during Project lifetime.
8. Comparative analysis of crop yields during implementation of the Project.
9. Organize national and regional networking groups for farmers interested in promoting climate technologies.
10. Assure an efficient coordination between the main actors of green fertilizers chain.
11. Develop a databank on soils evolution process under the influence of organic mass of 2 vetch yields incorporated into the soil as green fertilizer.
12. Public awareness on soil erosion issues and dissemination of information about implementing of environmentally friendly practices.
13. Dissemination of project achievements.
14. Monitoring and evaluation of project activities.

**Timelines** (What are the timelines e.g. one quarter, one year, multiple years?)

The project has a timeline of 10 years, 5 year time per first cycle for a total area of 200, 000 ha; 40, 000 ha recovered annually. The cycle will be repeatedly applied during next 5 years for full recovering of eroded soils.

## Budget/Resource requirements

Considering the total timeline of the Project being 10 years, the costs distributed per year are provide in the table 1.3.1

**Table 1.3.1. General analysis of costs for an area of 40 thousand ha**

| Category of indicators | Year I | Year II | Year III | Year IV | Year V | Year VI | Year VII | Year VIII | Year IX | Year X |
|---|---|---|---|---|---|---|---|---|---|---|
| Capital investments***, thousand € | 4000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Material costs*, thousand € | 4576 | 4576 | 4576 | 4576 | 4576 | 4576 | 4576 | 4576 | 4576 | 4576 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Labour retribution fund **, thousand € | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| Total, thousand € | 8636 | 4636 | 4636 | 4636 | 4636 | 4636 | 4636 | 4636 | 4636 | 4636 |

*This category was determined only cost diesel fuel consumption and wear and tear of machinery, including repair and maintenance. Usually, it is considered worth 10% of the total investment amount.

the respective calculations.

**Compulsory medical insurance and pay for mandatory health insurance were considered.

*** Refers to capital investment cost of choppers to incorporate vetch mass into the soil. Operating period of aggregates- up to 10 years.

Thus, the total cost of 10-year implementation of the technology is 50, 362,000 €. However, the cost-benefit analysis of the Project (table 1.3.2) shows net benefits starting with year 2 of the Project. Annual farm net benefit exceeds considerably the implementation costs of the technology and expenses could be covered by operation benefits. The technology is developed based on grain yield growth over 5 years in the rotation sowing vetch rotation in the first year. Income from operating activities is a fleet size due to changes in grain commodity price influence depending on natural conditions, the market, the production obtained. Thus, for the Project implementation it is necessary to consider first year expenses, including capital investments, material costs( seeds costs, fuel costs, fixed assets wear), labor retribution costs, with a total of 8, 636,000 €.

**Table 1.3.2. Operational costs and benefits of *Vetch field as green fertilizer into 5 year crop rotation* technology for first cycle (5 years)**

| Category | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| Benefits from operation th, € | 0 | 16200 | 12960 | 8640 | 5400 |
| Operational costs th € | 4636 | 4636 | 4636 | 4636 | 4636 |
| Net benefits, th € | -4636 | 11564 | 8324 | 4004 | 764 |

Additionally to technological costs, Project activities costs are to be added (farmers training, consultancy, recommendations publishing, public awareness campaign, laboratory work, establishing of farmers' network, other costs) at estimated amount of 500,000 €. Thus, the total estimated costs of the Project are 9, 136,000 €. Detailed budget with costs per activity will be elaborated during Project proposal development.

## Measurement/Evaluation

- ✓ During the implementation of the Project the regular evaluation to assess progress made will be performed using project management indicators.
- ✓ The evaluation of farmers' abilities to individually implement the whole farming system.
- ✓ Evaluation of soil quality indicators during Project lifetime.
- ✓ Cost/benefits analysis of applied technologies in crop rotations. Comparative analysis with similar indicators of conventional agriculture without applying vetch filed.
- ✓ Comparative analysis of crop yields during implementation of the Project.
- ✓ Final Project evaluation and accountability to assess its efficiency and effectiveness.

## Possible Complications/Challenges

Possible complications :

- ✓ Insufficient legal and regulatory framework;
- ✓ Lack of involvement of stakeholders in decision making;

- ✓ Lack of investment for procuring the equipment and organization of local production of vetch seeds;
- ✓ Low interest of land owners in maintaining long-term quality status and production capacity of soils;
- ✓ Lack of economic incentives to encourage farmers to use green fertilizers in order to maintain long-term quality status of soil;
- ✓ The mentality of rural population that crop cannot be incorporated into the soil as organic fertilizer;
- ✓ Lack of awareness by farmers of organic fertilizers' role in maintaining the quality status and production capacity of soils;
- ✓ Government insufficient efforts on consolidation of fragmented land;
- ✓ Low discipline in terms of accurate and timely fulfilment of all technological operations necessary for the proposed tillage system.

## Responsibilities and Coordination

Ministry of Environment (ME) (Implementation Unit of the Project, IUP) will be the responsible institution for Project coordination, management and implementation. Implemented activities will involve also other stakeholders, sectorial institutions, land owners, researchers : Activities 1-12.

**Ministry of Agriculture and Food Industry** (MAFI),local public administration: Activities - 8, 11,12

- ✓ Organize and coordinates the large scale implementation of the technology, contributes to the restoration of the indigenous seed pool of autumn and spring vetch.
- ✓ Develop informational marketing, organizes training of agricultural professionals.
- ✓ Organise consolidation activities of agricultural lands into agricultural exploitations larger than 400 ha managed by one operator.
- ✓ Organize national and regional networking groups for farmers interested in promoting climate technologies

**Land owners/ farmers**: Activities 2,5,6,9.

Farmers will be the main actors of implemented activities and also beneficiaries of the Project.

**Laboratory testing Institution**: Activities 6,10.

Provide soil testing analysis.

**Companies /owners of specific machinery**: Activities 3

Support in providing equipment.

**RIFC,"Selectia", ACSA, SAUM**: Activities 5,11

- ✓ Provide business consultancy for agricultural producers.
- ✓ Create awareness and provide training for agricultural professionals at the local and national level.

The **State Hydro Meteo Service** will provide weather forecast.

# Chapter 2. Project Ideas for Human Health Sector

## 2.1. Brief summary of the Project Ideas for Human Health Sector

The impact of weather on human health, particularly summer heat waves, has become an issue of increased significance for Republic of Moldova's population. Despite emphasis being placed on the health problem caused by heat waves in Moldova, little effective measures have been adopted and not being fully utilized. Therefore, the implementation of ***Provisional posts of medical emergency care and prompt rehabilitation during critical periods of waves*** health care measure is seen as innovative, adaptation action to avoid heat stress and dehydration during periods of hot weather, particularly in urban areas. In the *Introduction* part of Proposed Project idea are summarized key issues and challenges related to heat impact on population health, which are convincing arguments for implementing protective measures against adverse impact of climate change.

The Project idea has been developed within Republic of Moldova TNA and Analysis of Barriers and Enabling Framework for Climate Change Adaptation Project based on health are measure with similar title. The original health care measure of TNA had a wider coverage including district level towns, while proposed Project idea covers two big municipalities: Chisinau and Beltsy. The Working group of Human Health sector has considered starting implementation in two locations as a pilot version of Project, as these two cities urgently need the implementation of this health care measure due to exacerbating temperatures during summer time. Also despite its simplicity, the proposed Project Idea requires much cross-sectorial management, that is time and efforts consuming action therefore, it was considered better to concentrate on the urgent need of two cities, get experience on implementing this health care measure, then to expand over the all country. The idea was elaborated by national experts of TNA Project in consultation with stakeholders, representatives of the Ministry of Environment (ME) and Ministry of Health (MH), business, academia representatives. Proposed Project idea is directly related to adaptation targets set for Human Health sector of Moldova and is consistent with the existing policy framework and will directly contribute toward implementation of Technology Action Plan.

During the TNA Project were identified constraints and barriers to public health adaptation, arising from uncertainties of future climate and socioeconomic conditions, as well as financial, technological, institutional, social and individual cognitive limits. Among the barriers facing the diffusion of health care measure, a leading cant occupies the financial resources of the health care sector. Another significant barrier is the lack of regulations at the state and local level of complex emergency assistance (primary health care and social assistance) in cases of emergencies, including heat period. These and other barriers have been considered during development of Project idea.

The enabling environment of proposed health care measure relies on the Government contribution trough development of appropriate policies and regulations. Also it was analyzed from many viewpoints within TNA Project: country specific circumstances, characteristics of temperature and drought effects, health care measure capacity, physical space, personnel availability and skills, regulatory requirements for implementation of measure, policies to support adaptation to rising temperatures, sectors available infrastructure, other factors.

It was assumed, that proposed health care measure will be provided by a budgetary funded health care agency/organization, international funding organization, or based on donations, charity organizations, voluntary approach of NGOs. Therefore, the services provided would be free of charge. For this reason, it is seen as free of charge activity and the economic- financial analysis performed during TNA project was done for non-profit version.

Provisional points of medical emergency care will be served by the institutions subordinated territorial Health Centers. Costs for health care are assured by the National Company for Health Insurance (NCHI), operating on the basis of the law on compulsory health care insurance, Nr. 1585 from 27. 02. 1998.

Implementation of Project idea will contribute to saving lives and adapting of population to extreme temperatures generated by climate change. Being a short term and inexpensive, this measures will be very efficient during critical periods of heat waves. This measure is essential in the process of adapting to climate change.

## 2.1.1. Project Idea "Provisional posts of medical emergency care and prompt rehabilitation during critical periods of heat".

### Introduction

Climate change is anticipated to influence population health through a wide range of pathways, largely through exacerbating health risks that exist in the current day. The IPCC Fourth Assessment Report (AR4) clearly indicates that the updated 100-year linear trend (1906–2005) of global surface temperature is 0.74 K[18]. This trend will continue and increase the risk of climate change related mortality and morbidity, including heat waves. The IPCC projects that heat-waves will increase in number, intensity and duration over most land areas in the 21st century[19]. The changes are expected to be particularly relevant to cities, especially in central, eastern and southern Europe.

The impact of weather on human health has become an issue of increased significance for Republic of Moldova too. According to the assessments performed during development of Climate Change Adaptation Strategy20 for health care system of Moldova, six of the identified climate risks are considered to be high priority:

- Increase in heat wave-related deaths;
- Increase in air pollution-related diseases;
- Increased risk of allergic disorders;
- Increased risk of drought and water scarcity
- Increase in the burden of waterborne and foodborne diseases.

Among the identified climate risks, heat waves already have a severe impact on human health in the climatic region of Moldova.

In the future climate the heat waves are very likely to increase in both frequency and intensity. Heat stress is a pathophysiological state that directly affects the human physiology: thermoregulation during heat stress requires a healthy cardiovascular system. Several medical factors can increase the risk of heat-wave mortality, including dehydration, drugs, ageing, and having a chronic disease that affects cardiac output and skin blood flow, as well as being confined to bed[21]. Deaths from heat waves have become an emerging issue for the majority of European countries, including Republic of Moldova. In the last decades practically all European countries are suffering from loss of lives and bear enormous economic losses as a result of climate change extreme phenomena. In the Republic of Moldova heat waves have become more frequent in the recent decades[22]. More or less expressed (by intensity and duration), they take place at least every two years from five. Heat stress, which develops as a result of prolonged exposure of the body to high temperatures in the environment, may entail sudden death, because there are a significant number of people who require urgent medical care and rehabilitation in public places during the heat waves.

As climate change progresses heat exposure stands to cause additional heat-related illness and death, especially for the most vulnerable groups such as older people, young children, people with chronic disease and those living in towns and cities. In the recent decades deaths and morbid conditions caused by heat waves become more frequent and pronounced in Moldova.

The analysis of specific mortality in Moldova by specific causes of death reveals the fact that the most frequent causes of death are cardiovascular diseases, which accounts for more than half of all deaths (2010 - 56.2% of the total deaths). For women it was by 1.1 times higher than in men (719.4 women in 100,000 population compared to 654.4 men). The analysis of the structure of causes of mortality in active working age in the past five years shows that cardiovascular diseases are ranked first (on average 24.7%, 25% in men and 23.9% in women). Injuries and intoxications rank second (on average 21.7%, 24.5% in men and 13.9% in women). From these data it appears that the causes generated by

[18] *http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm*
[19] *IPCC (2007). Summary for policymakers. In: ML Parry et al., eds. Climate change 2007: impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, Cambridge University Press:7–22.*
[20] www.clima.md
[21] http://www.eea.europa.eu/publications/eea_report_2008_4

[22] Corobov, R., N. Opopol, S. Sheridan, M. Allen (2010): *Record heat waves in Moldova in 2007: Identification, description, and health consequences.* American Meteorological Society National Conference: 1st Environment and Health Symposium. Poster Presentation, Atlanta, GA.

external factors, including extreme temperature events due to climate change, have an important place among the causes of deaths in active working age, such as cardiovascular diseases, trauma, respiratory diseases and infections.
The analysis of specific incidence shows that the incidence of respiratory diseases (1084.3 to 10,000 populations) is the most frequent. Regarding specific prevalence, respiratory diseases rank first (1308.5 to 10,000 populations). Circulatory diseases (1249.2 to 10,000 population) rank second, followed by digestive system diseases (931.1 to 10,000 population). These facts can lead to the conclusion that morbid conditions, including those which may be conditioned by extreme events generated by climate change, are leading in the population morbidity structure.

Certain inexpensive, timely and sufficient measures prove to be effective to reduce heat stress and its consequences. Also, these measures are essential in the process of adapting to climate change. The *Provisional posts of medical emergency care and prompt rehabilitation during critical periods of waves* is a preventive health care measure and a solution to reduce peoples' vulnerability during heat waves. Despite emphasis being placed on the health problem caused by heat waves in Moldova , particularly during summer time, little effective measures have been adopted and not being fully utilized. Therefore, the implementation of *Provisional posts of medical emergency care and prompt rehabilitation during critical periods of waves* health care measure is seen as innovative, adaptation action to avoid heat stress and dehydration during periods of hot weather, particularly in urban areas.

It is as a short term measure, which is part of the national health policy. This measure is accomplished with inexpensive, but efficient methods employed during critical periods of heat waves. The experience of many European countries shows that the organization and operation of provisional health posts in public places during critical periods allow preventing many complications generated by heat stress. In the Republic of Moldova is proposed that temporary health posts to be supplemented by prompt rehabilitation procedures, which ensure the more efficient adaptation of the body to high temperatures. Provisional points of medical emergency care will be served by the institutions subordinated territorial Health Centers. Costs for health care are assured by the National Company for Health Insurance (NCHI), operating on the basis of the law on compulsory health care insurance, Nr. 1585 from 27. 02. 1998.

It is assumed, that this measure will be provided by a budgetary funded health care agency/organization or based on international funding, donations, charity organizations, voluntary approach of NGOs. Therefore, the services provided are seen as free of charge activity and economic- financial analysis is done for non-profit version.

The installation of provisional posts will be in Chisinau and Beltsy city during the duration of the project. However, the project idea aims to expend to other district level towns. Provisional posts will be placed in the open and agglomerated places during summer time like agricultural market, open broad streets, etc. They will be equipped with medical equipment, medicines, consumption materials, furniture, and other necessary equipment. Temporary health posts should to be supplemented by prompt rehabilitation procedures which ensure more efficient adaptation of the body to high temperatures. Period of operation of these stations will be 4 months (May, June, July, and August).

The implementation of propose Project idea brings significant benefits: Support to all citizens including vulnerable groups of population in critical periods of natural disasters is a very effective measure in terms of the national economy as it allows maintaining the human potential of the country. In terms of environmental development it is an indisputable priority, as it creates a better environment for human population during critical periods of heat waves. Social benefits are obvious due to health care measures, respectively, significant spending cuts for the rehabilitation of people affected.

The analysis of policy and legislative framework of the Republic of Moldova during the TNA Project has emphasized a number of policy documents and legislative acts under which the proposed health care measure falls. Most relevant are: National Development Strategy for 2008-2011, approved through the Law On approval of the National Development Strategy for 2008-2011, nr. 295 as of 21.12.2007[23]; *National Health Policy* (approved by the Government by the Government Decree No. 886 as of 06.08.2007)[24]; *National Strategy for the prevention of non-communicable diseases (Government decision Nr. 82 of 12. 04. 2012)*[25]. At the same time there is a need of more specific regulations in support to implementation of climate change resilience and adaptation health care measures.

The Project idea was developed within TNA Project Republic of Moldova Technology Needs Assessment and Analysis of Barriers and Enabling Framework for Climate Change Adaptation based on the technology with similar title and content,

[23] *National Development Strategy for 2008-2011, nr. 295 as of 21.12.2007 http://www.ms.gov.md/ministry/MS/strategii/*
[24] *National Health Policy (approved by the Government by the Government Decree No. 886 as of 06.08.2007) http://www.ms.gov.md/ministry/MS/policiess/*
[25] *National Strategy for the prevention of non-communicable diseases (Government decision Nr. 82 of 12. 04. 2012) http://www.ms.gov.md/ministry/MS/strategii/*

passing assessment, prioritisation, barrier analysis applying Logical Problem Analysis (LPA), Problem tree, Objective tree, economic-financial analysis, market analysis using market mapping approach, development of measures as TAP to technology diffusion. The methodological guidance of climate change Technology Needs Assessment was received from UNEP Riso Center and Asian Institute of Technology (AIT), Bangkok, also following a number of methodological sources elaborated by UNEP RIso Centre, UNDP, Asian Institute of Technology, Climate TechWiki website.

The Project idea was elaborated by national experts of TNA Project in consultation with stakeholders, representatives of the Ministry of Environment (ME) and Ministry of Health, business, and academia representatives. Proposed Project idea is directly related to adaptation targets set for Human Health sector of Moldova and is consistent with the existing policy framework.

## Objectives

The objectives of the Project are:

- ✓ To promote health equity and security, healthy environment in a changing climate of congested urban areas of the Republic of Moldova via increasing emergency medical care for most people in need and provide prompt simple and effective rehabilitation services.
- ✓ To strengthen the capacity of health system for monitoring and minimizing the public health impacts of climate change.
- ✓ To establish provisional posts of medical emergency care and prompt rehabilitation during critical periods of heat as a preventive measure to prepare for, and cope with climate change, specifically with heat waves.
- ✓ To train medical assistants in nursing services and prompt rehabilitation during critical periods of heat.
- ✓ To decrease health accidents caused by heat stress by assuring the access to emergency medical and social care for most people in need and provide prompt, simple and effective rehabilitation services in the acute heat wave periods.
- ✓ Through collaboration between health care system, hydrometeo services and urban community administration to promote coherent cross-sectorial approach in addressing climate change issues.
- ✓ Promote local engagement of NGOs, volunteers to support the capacity of urban communities to become resilient to climate-related impacts.
- ✓ To share with interested stakeholders, in charge authorities best practices, data, information and tools on heat waves impact on human health in climatic conditions of Moldova.
- ✓ To raise information and awareness campaign among citizens during heat waves.

## Outputs

Project outputs:

1. A more prepared to climate change phenomena, in particular heat waves health care system of the Republic of Moldova.
2. A practical experience of establishing provisional posts of medical emergency and prompt rehabilitation during critical periods of heat waves in the cities of Moldova.
3. Trained medical staff able to provide emergency health care services during critical periods of heats.
4. Decreased health accidents caused by heat stress by assuring the efficient work of provisional posts of medical emergency and prompt rehabilitation.
5. A better coordination among in charge institutions, local municipalities and social services in addressing cross-cutting issues of climate change impact, particularly that related to human health.
6. A larger engagement of NGOs, volunteers in supporting urban communities' capacity to become resilient to climate- related impacts.
7. Collected data and information on heat waves impact on human health in climatic conditions of Moldova.
8. Increased awareness among citizens of Moldova about heat waves impacts on human health.

The aforementioned outputs are measurable based on indicators, data collected, number of health care actions undertaken, other:

1. Ministry of Health of Republic of Moldova able to develop actions on a short and long term basis to prevent as well as to prepare for climate change phenomena in order to reduce the scale of negative impacts on human health.
2. Established and functioning in Chisinau and Beltsy cities of provisional posts of medical emergency and prompt rehabilitation. Improved specific clinical care and health treatment to overheated patients.
3. Trained staff to provide qualified and in time health care services for people in need, particularly to representatives from vulnerability groups of population.
4. Monitoring and reporting of heat related health accidents along with total number of people who called in for urgent medical help, the number of persons who have been granted medical assistance, the number of people who have derived advantage from rehabilitation measures.
5. Heat management actions incorporated into primary prevention activities, disaster risk reduction (DDR) emergency action plan, event warning and crisis management actions.
6. NGOs and volunteers, Red Cross involved in identification, localisation and supporting of vulnerable groups of people, collaboration with social services.
7. Data collected and organised into a statistical database of heat related health accidents and diseases.
8. Elaborated recommendations on heat wave impact on human health and how to protect for large public during heat stress. Use of divers means of communications (TV advertisements , radio, internet, mobile phones nets) to raise awareness about climate changes impact on human health, including heat waves, including population behaviour.

## Relationship to the country's sustainable development priorities

The increasing concern over health risks arising from climate change is stimulating greater focus on identifying and implementing preventive interventions. Republic of Moldova Government set a number of preventive measures (their successful implementation could be considered as targets to achieve) to cope with unfavorable climate events, which are specified in the *National Health Policy* (approved by the Government by the Government Decree No. 886 as of 06.08.2007)[26], and provide for creating a healthy and safe environment, controlling infectious and non-contagious diseases, promoting health and disease prevention, etc.

The proposed measure is one of the state measures to assure the sustainable development which follow up the priorities foreseen by the National Strategy of the health care system development in the period 2008-2017 (Government decision No. 1608 of 24. 12. 2007[27]; National Strategy for the prevention of non-communicable diseases (Government decision Nr. 82 of 12. 04. 2012)[28], Law No. 10 on the state public health supervision (adopted on 02.03.2010)[29], National Strategy concerning Republic of Moldova climate changing adaptation (draft submitted for Government review, 2013), the National Strategy of Republic of Moldova development with reduced emissions (draft submitted for Government review, 2013).

Specific measures in public health sector are specified in the *Law on State Surveillance of Public Health* (2009). In addition to general measures aimed to ensure continuous sanitary-epidemiological welfare of population, the law includes a special chapter, namely, Chapter IX (Articles 54-62).

[26] *National Health Policy* approved by the Government by the Government Decree No. 886 as of 06.08.2007. *http://www.ms.gov.md/ministry/MS/policiess/*

[27] National Strategy of the health care system development in the period 2008-2017 (Government decision No. 1608 of 24. 12. 2007 *http://www.ms.gov.md/ministry/MS/strategii/*

[28] National Strategy for the prevention of non-communicable diseases (Government decision Nr. 82 of 12. 04. 2012) *http://www.ms.gov.md/ministry/MS/strategii/*

[29] Law No. 10 on the state public health supervision (adopted on 02.03.2010) http://www.ms.gov.md/public/legal/laws/

Support to vulnerable groups of the population is one of the main priorities in social assistance, included in the National Development Strategy for 2008-2011, approved through the Law On approval of the National Development Strategy for 2008-2011, nr. 295 as of 21.12.2007.

Other healthcare measures/targets are formulated in the *International Health Regulation*, focusing on preparedness and response to emergencies which are organic part of the UN International Strategy for Disaster Reduction, decision of the Commission on Human Security and the WHO Health Action in Crises.

## Project Deliverables

- ✓ Enforced legal and regulatory framework support in order to assure proper functioning of the posts of temporary emergency care and rehabilitation. Approved decision by local public administration authorities on what Territorial Health Centers will assure the activities of provisional posts of medical emergency care and prompt rehabilitation during critical period of heat.
- ✓ Installed provisional posts of of medical emergency care and prompt rehabilitation during critical periods of waves in Chisinau city (8) and in Beltsy city (4).
- ✓ Equipped posts with cooling systems, emergency care pharmaceutical treatment, medical equipment, beds, big quantities of water, other.
- ✓ Hospitals to be prepared to provide clinical treatment to high risk patients during heat waves.
- ✓ Trained medical care staff in providing emergency health care services and address specific health risks during heat waves.
- ✓ Surveillance and reporting on heat related health accidents and mortalities.
- ✓ Developed database of heat related health accidents and diseases in climatic region of Republic of Moldova.
- ✓ Elaborated, published and distributed recommendations on individuals behaviour during risks of hot weather and heat-waves.
- ✓ Awareness and information campaigns companies regarding the urgent measures during critical periods of heat waves

## Project Scope and Possible Implementation

The implementation of provisional posts of primary health care in the critical periods of heat waves will become possible after the preparation, approval and implementation by government regulation on both the operation of these structures and the way of informing the population about the possibilities of urgent medical care in public places during the critical heat wave.

Public Health Centers will develop and submit to governmental approval regulations on functioning of primary health care time in critical periods of heat wave.

The project is a long lasting, multi-annual measure and working only in periods of maximum necessity in case of installation of the heat waves. The installation of provisional posts 8 in Chisinau city, 4 in Beltsy city. Provisional posts will be established in the open and agglomerated places during summer time like agricultural market, open broad streets, etc. Period of operation of these stations will be 4 months (May, June, July, and August). The provisional posts of medical emergency care and prompt rehabilitation during critical periods of heat will work within the territorial health centers, which will be responsible for their development and endowment with qualified assistances, medicines and other materials and, in some cases, with specialized transport. Urban Health Department will monitor the activities of Health Centers and provisional posts of medical emergency care and prompt rehabilitation during critical periods of heat will assure an efficient coordination between urban authorities, services and relevant medical institutions.

According the Law on the state public health supervision, No. 10 on 10. 02. 2010, the decision on carrying out of the activities of provisional posts of medical emergency care and prompt rehabilitation during critical periods of heat will be taken by the Governmental Exceptional Commission activating under the governmental umbrella.

The benefit of this technology is the provision of immediate medical aid and saving lives.
Heat-health effects can appear in all age groups, as a result of a wide range of factors; however, some people are more at risk of heat-related illness and death than others. Prolonged exposure to high temperatures is an obvious risk for

vulnerable population groups, such as infants, disabled and aged people, in particular for the homelessness people, people in need and persons who due to acute needs are required to be for a long time at high temperatures of atmospheric air, in many cases also under the sunlight.

## Project activities

The potential range and magnitude of associated health risks are central to the rationale for actions to increase resilience and the adaptation to climate change.

During the Project the following activities will be implemented:

1. Develop Project activities time schedule and implement activities accordingly.
2. The urban health department to enforce the legal and regulatory framework support in order to assure proper functioning of the posts of temporary emergency care and rehabilitation. To make a decision what Territorial Health Centers will assure the activities of provisional posts of medical emergency care and prompt rehabilitation during critical period of heat.
3. The State Hydro Meteo Service to forecast the extreme phenomena of climate change, to assure opportune information concerning the beginning of critical periods of heat, their duration and their call of. Together with National Public Health Center to communicate information concerning gravity and duration of extreme phenomena of climate change and the degree of urgency of the climate change phenomena to central and local public administration authorities and relevant services.
4. Acquisition of tents, medical equipment, medicines, consumption materials, furniture, other necessary equipment for provisional post for emergency care successful operation.
5. Identify locations and establish eight (8) in Chisinau city and four (4) in Beltsy city provisional posts of medical emergency and prompt rehabilitation.
6. Ensure a proper function of temporary emergency care and rehabilitation posts in public places under the tents or in pavilions in Chisinau and Beltsy municipalities.
7. Territorial cervices of maintaining public order to assure the proper public order throughout the period of functioning were provisional posts of medical emergency care and prompt rehabilitation are dislocated.
8. Improved specific clinical care and health treatment to overheated patients during heat waves.
9. Training of medical care staff in providing emergency health care services and address specific health risks during heat waves.
10. Monitoring and reporting of heat related health accidents along with total number of people who called in for urgent medical help, the number of persons who have been granted medical assistance, the number of people who have derived advantage from rehabilitation measures.
11. To incorporate heat management actions into primary prevention activities, disaster risk reduction (DDR) emergency action plan, event warning and crisis management actions.
12. NGOs and volunteers, Red Cross to identify, localise and support vulnerable groups of people.
13. To develop a database of heat related health accidents and diseases in climatic region of Republic of Moldova. Increased awareness during the periods of heat waves via collection in the cities the information about the number of the population who suffer from extreme phenomena of climate change, inclusively the needing in medical emergency care, and places where the events are happening.
14. To carry on informing companies regarding the urgent measures during critical periods of heat waves and other extreme phenomena and regarding adjustment measures for the vulnerable groups of population.
15. To promote investigations and collection of scientific data and experience concerning the hazard and the unfavorable impact of extreme climate change phenomenon of local urban population.
16. To elaborated and publish recommendations giving behavioural advice to general public, particularly to vulnerable groups of people during risks of hot weather and heat-waves.

17. To use divers means of communications (TV advertisements, radio, internet, mobile phones nets) to raise awareness campaigns and communicating the risks of hot weather and heat-waves.
18. Monitoring and evaluation of project activities.

## Timelines

The project has a timeline of 5 years.

## Budget/Resource requirements

It was assumed, that this measure will be provided by a budgetary funded health care agency/organization, international funding or based on donations, charity organizations, voluntary approach of NGOs. Therefore, the services provided will be free of charge.

Costs for health care, including urgent services, are assured by the National Company for Health Insurance (NCHI), operating on the basis of the law on compulsory health care insurance, Nr. 1585 from 27.02.1998. The NCHI is financing local Health Centers which are responsible for both the volume and the quality of medical services.

Financial means needed to set up mobile health stations during the heat:

Investments costs: 31,200 € (tents, pharmaceutical drugs, furniture, air conditioning, medical equipment, mobile phones, electricity costs).

Operational costs: 8,000€ (staff training, staff salary, development of database)

Other contingencies, 3650€

Development of database~ 1,000€

Development and editing of recommendations- 3,000€

Awareness campaign ~ 10,000 €

Total estimated costs: 54, 150 €

Per year costs for maintain provisional post for emergency care 12, 000 € x 4year= 48, 000 €

Total Project costs: 102, 150€

## Measurement/Evaluation

Evaluation of achievements will be made on the base of the following indicators:

- ✓ During the implementation of the Project the regular evaluation to assess progress made will be performed using project management indicators.
- ✓ the number of functioning provisional posts of medical emergency care and prompt rehabilitation during critical periods of heat in Chisinau and Beltsy cities;
- ✓ the every year issue of the decision of local public administration authorities concerning the number and locations of the provisional posts of medical emergency care and prompt rehabilitation during critical periods of heat;
- ✓ monitoring and reporting of heat related health accidents along with total number of people who called in for urgent medical help, the number of persons who have been granted medical assistance, the number of people who have derived advantage from rehabilitation measures.
- ✓ collection in the cities the information about vulnerable population and the number of the population who suffer from extreme phenomena of climate change, inclusively the needing in medical emergency care, and places where the events are happening;
- ✓ to make a survey of agencies, partners involved in the project on the effectiveness of activities undertaken in the Project;

- ✓ statistical data on mortality and morbidity in the period when the provisional posts operated;
- ✓ monitor the consequences of heat waves impact in Chisinau and Beltsy cities.
- ✓ continuing insurance of the provisional posts of medical emergency care and prompt rehabilitation during critical periods of heat with the materials in accordance with the requirements.
- ✓ the number of prevented deaths can be estimated as the difference between the observed deaths and the numbers expected during the heat-wave (based on previous quantification of the temperature–mortality relationship).
- ✓ monitoring and reporting of heat related health accidents along with total number of people who called in for urgent medical help, the number of persons who have been granted medical assistance, the number of people who have derived advantage from rehabilitation measures.

## Possible Complications/Challenges

Possible complications can occur in cases of insufficient public activities management, in particular of:

- ✓ insufficient legal and regulatory framework;
- ✓ inefficient enforcement;
- ✓ policy intermittency uncertainty;
- ✓ lack of information or insufficient information about the number of the population suffering from extreme phenomena of climate change and places the events are happening;
- ✓ lack of health service maintenance specialists;
- ✓ red tape (bureaucracy) etc.

## Responsibilities and Coordination

**Ministry of Environment/Project Management Unit** - responsible institution for Project coordination, management and implementation. During the implementation of the Project it will coordinate the activities between urban authorities, services and relevant medical institutions. Activities: 1-18

**Ministry of Health** – Activities: 2,6,8,9

Territorial Health Care Centers:

- ✓ To promote the provisional posts of medical emergency care and prompt rehabilitation during critical period of heat;
- ✓ To ensure the provisional posts of medical emergency care and prompt rehabilitation with skilled personnel;
- ✓ To ensure the proper functioning of the provisional posts of medical emergency care and prompt rehabilitation during critical period of heat waves.

Public Health Centers

- ✓ To monitor the public health status in relation with meteorological parameters;
- ✓ To carry on informing companies regarding the urgent measures during critical periods of heat waves and other extreme phenomena and regarding adjustment measures for the vulnerable groups of population.

**Local public administration authorities**- Activities: 2,5,7,11

- ✓ To make decisions regarding the number of the provisional posts of medical emergency care and prompt rehabilitation during critical period of heat;
- ✓ To make a decision about the duration of operation of the provisional posts of medical emergency care and prompt rehabilitation during critical period of heat;
- ✓ To make a decision what Territorial Health Centers will assure the activities of provisional posts of medical emergency care and prompt rehabilitation during critical period of heat;

**The State Hydro Meteo Service** – Activities: 3,14,17

- ✓ To monitor meteorological parameters in both municipalities: Chisinau and Beltsy;
- ✓ To forecast the extreme temperature phenomena of climate change, particularly heat waves. To inform the Republic of Moldova Government about the beginning of critical periods of heat, their duration and their call off.
- ✓ To estimate gravity and duration of heat waves ;
- ✓ Together with National Public Health Center to communicate information concerning gravity of extreme temperatures, including heat waves and the degree of urgency of the climate change phenomena to central and local public administration authorities and relevant services;
- ✓ In case if necessary, to elaborate and present to central and local public administration authorities and relevant services proposals regarding declaration of emergency of extreme phenomena/cancellation of climate change.

**The national company for health insurance**- Activities: 6, 12

- ✓ Will assure financial coverage of primary urgent medical care and rehabilitation rendered to population by the provisional posts of medical emergency care and prompt rehabilitation during critical period of heat during heat waves.

**Territorial cervices of maintaining public order**- Activities:7

- ✓ To assure the proper public order throughout the period of their functioning were provisional posts of medical emergency care and prompt rehabilitation are dislocated.

**Non-governmental organizations** – Activities:12,14,16,17

- ✓ To assure wide communication of information relating to the degree of urgency of the extreme climate change phenomena;
- ✓ To carry on companies of informing the general public about the measures for the adaptation of the population;
- ✓ To contribute on mobilizing the community effort in implementing measures adapting to extreme climate change phenomena.

**Department of Emergency Services** to interfere with prompt actions according to Governmental Action Plan in case if emergency situation declared. Activity 11.

Project activities, supported by the regulatory framework will impose the responsible institutions and local public administration to plan and implement proposed heath care measure meticulously and in time.

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# Annexes I-II

## Annex I. List of stakeholders involved and their contacts

1) Ministry of Environment: (Maria Nagornii, Chief of Department for Analysis, Monitoring and Evaluation of politics, tel 373-22-204520).
2) Ministry of Agriculture and Food Industry (Iurie Senic, Chief of Department Ecological Agriculture, Renewable resources and irrigation, tel 373-22-233427)
3) Institute of Ecology and Geography of the Academy of Sciences of Moldova (Maria Sandu, Deputy Director, tel 373-22-211-134)
4) Ministry of Health (Ion Salaru, Deputy Director, National Center for Public Health. Tel 373-22-574-666)
5) State Hydrometeorological Service (Elina Plesca, Deputy Director, tel 373-22-773-511)
6) State University of Medicine and Pharmaceuticals of Moldova "Nicolae Testimiteanu" (Grigore Friptuleac, Chief of the Department Preventive Medicine tel 373-22-205-464
7) NGO "Ecospectr" (Alexandru Teleuta, Director, tel 373-22-523-898)

## Annex II. List of experts (national consultants) contracted under the adaptation component of TNA Project.

| National consultant | Title, position, institution | Background & Area of expertise |
|---|---|---|
| Druta Ala | Leader of Adaptation Team in the TNA Project, Dr. of biology, Chief of Plant Biology Department, State Agrarian University of Moldova | Vulnerability and adaptation to climate change; plant ecophysiology, crop production. |
| Boincean Boris | Prof., Dr. habilitate in agriculture, Research Institute for Filed Crops "Selectia", Coordinating researcher | Agronomy, selection and seed production; organic agriculture, soil management - integrated soil nutrient management |
| Cerbari Valerian | Prof., Dr. habilitate in agriculture, Institute of Pedology, Agrochemistry and Soil Protection 'N. Dimo', Head of the Pedology Laboratory | Pedology, agrochemistry and soil management, conservation tillage; sustainable farming systems - agro-forestry |
| Vronskih Mihail | Acad., Prof., Dr. habiitate in agriculture, Research Institute for Filed Crops "Selectia", Coordinating researcher | Agronomy, selection and seed production, sustainable crop management - crop diversification and new varieties; drought - resistant crop varieties |
| Opopol Nicolae | Acad., Prof., Dr. habilitate in medicine, Head of the Hygiene and Epidemiology Chair of 'N. Testemitianu' University of Medicine and Pharmacy | Medicine; human health adaptation to climate change: thermal stress – reduce heat island effect, air conditioning; vector borne – vaccination programs, sustainable surveillance; water borne - improved water treatment; genetic screening of pathogens, etc. |
| Baltag Grigore | Chief of Economics, Statistics and Analysis Department, Associate Professor, UASM | Financial analysis of agriculture enterprises<br>Economic European integration,<br>Agriculture policy of European Union. |