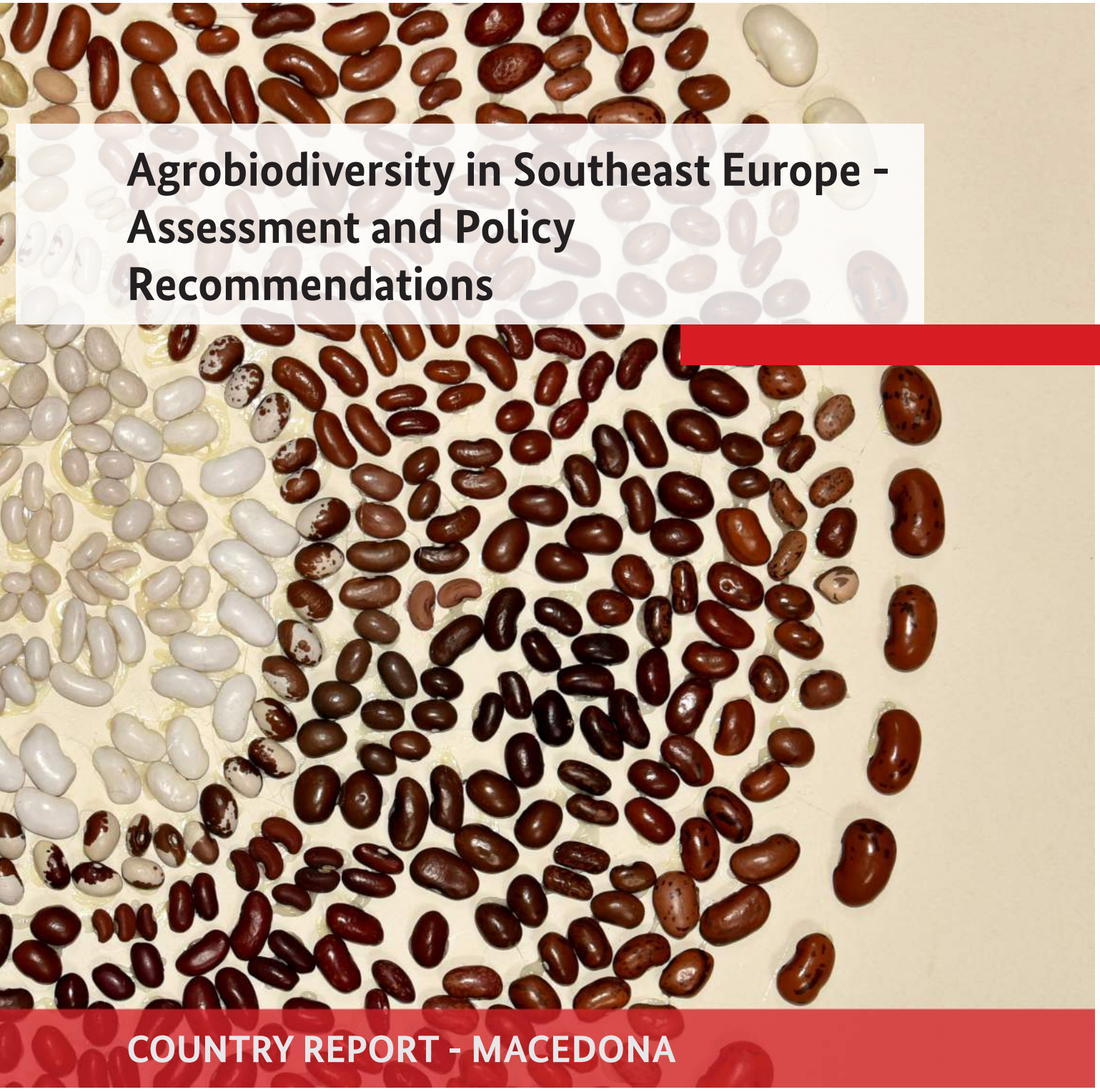

Agrobiodiversity in Southeast Europe - Assessment and Policy Recommendations

COUNTRY REPORT - MACEDONA

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South Eastern Europe
Regional Rural Development Standing Working Group

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TABLE OF CONTENTS

LIST OF ABBREVIATIONS....03
FOREWORD AND ACKNOWLEDGMENTS....05
INTRODUCTION....06
1. SOCIO-ECONOMIC, INSTITUTIONAL AND LEGISLATIVE CONTEXT....09
1.1. Geographical and political context....09
1.2. Agricultural production....11
1.3. Institutional and administrative set up....13
1.4. Non-governmental set-up....15
1.5. Legal framework for protection of agrobiodiversity....16
1.6. Foreign donor support for current and previous activities related to agrobiodiversity....21
2. GENETIC RESOURCES IN AGRICULTURE....24
2.1. Overview of the status of genetic resources in agriculture....24
2.1.1. Plant genetic resources....24
2.1.2. Animal genetic resources....33
2.2. Conservation efforts of genetic resources....37
2.2.1. Plant genetic resources....37
2.2.2. Animal genetic resources....40
2.3. Socio – economic aspects of agrobiodiversity protection....41
2.4. Status of public awareness....42
3. CONCLUSIONS....44
4. PERSPECTIVES AND RECOMMENDATIONS....46
4.1. Recommendations for the creation and upgrade of policy and legislation....46
4.2. Recommendations for improvement of institutional capacities....47
4.3. Recommendations for improvement of agrobiodiversity conservation....47
4.4. Recommendations for improvement of scientific and public awareness....49
4.5. Recommendations for improvement of regional cooperation....50
5. CASE STUDIES....51
ANNEX 1 (Structure of agricultural production)....52
ANNEX 2 (List of institutions and governmental bodies)....54
ANNEX 3 (List of NGO's)....58
ANNEX 4 (List of national laws)....59
ANNEX 5 (List of references for genetic resources in agriculture)....62
ANNEX 6 (List of references for conservation efforts of genetic resources)....64
ANNEX 6a (List of national collections - plant genetic resources)....65
ANNEX 6b (List of national collections - animal genetic resources)....67
ANNEX 7 (Activities for raising public awareness)....68
ANNEX 8 (Photographs)....69

LIST OF ABBREVIATIONS

AFSARD	Agency for Financial Support in Agriculture and Rural Development
AnGR	Animal Genetic Resources
CAP	Common Agricultural Policy
CBM	Swedish Biodiversity Centre
DGPB	Department of Genetics and Plant Breeding
DNA	Deoxyribonucleic Acid
DSS	Directorate for Seed and Seedlings
DUS	Distinctness, Uniformity and Stability
EC	European Commission
EU	European Union
EURISCO	European Search Catalogue
FA	Faculty of Agriculture
FACE	Foundation Agro-Centre for Education
FASF	Faculty of Agriculture Sciences and Food
FAO	Food and Agriculture Organization
FBS	Faculty of Biotechnical Sciences
FVM	Faculty of Veterinary Medicine
GEF	Global Environmental Facility
GDP	Gross Domestic Product
GTZ	German Technical Cooperation
IA	Institute of Agriculture in Skopje
IAB	Institute for Animal Biotechnology
IAS	Institute of Animal Science
IPA	Instrument for Pre Accession Assistance
IPARD	Instrument for Pre Accession Assistance for Rural De-velopment
IPB	Institute for Plant Biology
ISC	Institute for Southern Crops
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
LARD	Law on Agriculture and Rural Development
LSS	Law on Seed and Seedlings
MAFWE	Ministry of Agriculture Forestry and Water Economy
MAP	Medicinal and Aromatic Plants
MoEPP	Ministry of Environment and Physical Planning
MOET	Multiple Ovulation and Embryo Transfer

MES	Macedonian Ecological Society
NATO	North Atlantic Treaty Organization
NCP	Nature Conservation Program
NEIS	National Environmental Information System
NGO	Non Governmental Organziation
NVL	National Variety List
OEDC	Organization for Economic Co-operation and Develop-ment
PGR	Plant Genetic Resources
PPS	Purchasing Power Standard
RSC	Regional Steering Committee
SDC	Swiss Agency for Development and Cooperation
SEEDNet	South East European Development Network on Plant Genetic Resources
SGP	Small Grants Programme
SIDA	Swedish International Development Cooperation Agency
SIPPO	Swiss Import Promotion Programme
SIT	Scientific Institute for Tobacco
UCM	SS Cyril and Methodius University in Skopje
UGD	University Goce Delchev - Shtip
UKLO	University St Kliment Ohridski - Bitola
UNESCO	United Nations Educational, Scientific and Cultural Or-ganization
UPOV	Union for the Protection of New Varieties of Plants
USAID	United States Agency for International Development
WG	Working Groups

FOREWORD
AND ACKNOWLEDGMENTS

The three-year project "Rural Development through Integrated Forest and Water Resource Management in Southeast Europe (LEIWW)" is jointly implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) and the Standing Working Group for Regional Rural Development (SWG RRD).

The project aims to improve the regional capacities for sustainable management of natural resources for the development of rural areas of Southeast European countries: Albania, Bosnia and Herzegovina, Kosovo*, Macedonia, Montenegro and Serbia.

As part of the EU (pre-) accession process, the countries of Southeast Europe (SEE) are committed to the harmonisation of their strategies, policies and legislation with the acquis communautaire of the EU and to build the conditions and capacities for their implementation.

Therefore, one of the main objectives of the LEIWW project is to create preconditions for evidence-based, EU-compliant policy formulation regarding the conservation and sustainable use of genetic resources in agriculture (agrobiodiversity). Agrobiodiversity is essential for the sustainable development of agricultural production, nature conservation and adaptation to climate change, as well as for the welfare of the people living in rural areas.

In line with this objective, evidence-based policy assessments and gap analysis related to agrobiodiversity were performed in a regional process involving leading experts and institutions of all SEE countries and entities aiming to identify priorities and to formulate recommendations for mainstreaming agrobiodiversity in agriculture and rural development policies, strategic plans, programmes and relevant legislations.

On this occasion, SWG and GIZ would like to express our appreciation to the Ministries of Agriculture and Rural Development from the SEE region for their dedication and active contribution to the process.

The appreciation particularly includes the regional coordinators Prof. Sonja Ivanovska and Prof. Sreten Andonov from the Faculty of Agricultural Sciences and Food, St. Cyril and Methodius Universityof Skopje, all participating experts and institutions, as well as the team of international experts from the Environment Agency Austria (Umweltbundesamt, GmbH).

The coordination of the process by Ms. Irena Djimrevska, GIZ and Ms. Katerina Spasovska, SWG, as well as the technical assistance of Ms. Jana Vasilevska, GIZ and Mr. Oliver Pop Arsov, SWG is highly acknowledged.

We would like to thank you all for having contributed to this major work!

On behalf of the SWG Secretariat
Mr. Boban Ilic
Secretary General

On behalf of GIZ LEIWW
Mr. Benjamin Mohr
Team Leader

INTRODUCTION

Southeast European (SEE) countries are rich in agrobiodiversity. Farming systems are built on a broad range of divergent local and autochthonous plant varieties and animal breeds of international importance. In times of ecological and economic pressure the treasure of diversity is at risk, distinction is irreversible and hinders today's and tomorrow's welfare, resilience and adaptive capacity. Strong links between agrobiodiversity, traditional knowledge, cultural diversity and local innovations are evident in the region and are part of its unique and rich character. In contrast to the developed countries, often less rich in agrobiodiversity, but equipped with strong policies for supporting preservation, sustainable use and promotion of genetic resources, Southeast European countries still struggle to establish an adequate framework for conservation and sustainable use of plant and animal genetic resources.

Moreover, the public, political and scientific awareness on the essential role of agrobiodiversity is on very different, mostly low levels, followed by (in-)different legislative, low institutional and financial support. Finally, all countries of SEE are facing two strong factors leading to inevitable loss of the still existing valuable genetic resources in agriculture: aging and migration of the rural population.

Conservation and sustainable use of genetic resources in agriculture are essential for the sustainable development of agricultural production, food security, adaptation to climate change, as well as for the socio-economic development and welfare of rural areas. Strong international governance structures, such as the Convention for Biodiversity (CBD) are in place, while the EU countries developed support mechanisms for safe-guarding agrobiodiversity. The SEE region, however, is lagging behind in defining and implementing support policies for conservation and sustainable use of its -still rich- agrobiodiversity.

National and regional policy assessments and gap analysis have been conducted in a process in ownership of the SEE countries (Albania, Bosnia and Herzegovina, Kosovo*, Macedonia, Montenegro and Serbia) in order to provide recommendations for EU compliant policy development relevant for the conservation and sustainable use of agrobiodiversity.

The assessment focuses on an analysis of the current national legislative and institutional status, trends of agrobiodiversity and its protection in the SEE countries. They also focus on identification of gaps, highlighting the necessary changes, reforms and harmonization of the legal base in respect to the Common Agricultural Policy (CAP), NATURA 2000, EU Biodiversity Strategy and Biodiversity Action Plan for Agriculture, Global Plan of Action for Plant Genetic Resources, Global Plan of Action for Animal Genetic Resources and Convention for Biodiversity (CBD).

Key problems and challenges requiring policy interventions are identified, and policy recommendations that will assist the EU integration process of the candidate and potential candidate countries are formulated and disseminated.

The work has raised awareness regarding the importance of agrobiodiversity in the SEE countries, in particular regarding the incentives for conservation and adding value to agrobiodiversity in order to enhance the rural welfare thus maintaining traditions, passing on the local knowledge and ensuring food security.

The assessments, gap analysis and policy recommendations were prepared by academic experts (one for animal genetic resources and one for plant genetic resources from each of the SEE

countries/entities), in cooperation with representatives of the respective Ministries of Agriculture and Rural Development, and coordinated by a team of experts from the Faculty of Agricultural Sciences and Food at the St. Cyril and Methodius University in Skopje.

Considering that the agrobiodiversity heritage of the SEE countries is without boundaries, shared, or mutually owned, while the EU accession process represents a common framework for the whole region, the issue of agrobiodiversity affects not only the national levels of each SEE country, but also touches upon the aspects of regional coordination and cooperation. Key challenges and reform priorities at regional level are presented in the Regional Synthesis Report prepared by the Environment Agency Austria, in their position as international backstopping institution.

The assessments were performed in the period between June 2017 and April 2018, through a process of research, consultations, peer learning and networking, both on national and regional level. During this period of time, four coordinative regional working meetings of the experts and Ministries were held.

All the information presented here are as of December 2017.

**This designation is without prejudice to positions on status, and is in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence*

1. SOCIO-ECONOMIC, INSTITUTIONAL AND LEGISLATIVE CONTEXT

1.1. GEOGRAPHICAL AND POLITICAL CONTEXT

The Republic of Macedonia is a South-Western Balkan country situated in South-Eastern Europe, between latitudes 40°51'and 42°22' N and between longitudes 20°27'and 23°02' E. It is a landlocked country with a total surface area of 25,713 km², surrounded by five neighboring countries: Greece, Albania, Kosovo*, Serbia and Bulgaria.

Three main climatic zones prevail in Macedonia: temperate Mediterranean, mountainous, and moderate continental. Average annual precipitation varies from 1,700 mm in the western areas to 500 mm in the eastern areas. Its territory is predominantly mountainous with 79% of the area consisting of hills and mountains, 19.1% plains and 1.9% water surfaces.

Macedonia has a parliamentary democracy, gaining its independence from the former Yugoslavia in 1991. Local governance is divided between 80 municipalities, out of which ten are agglomerated in the capital city, Skopje. The country has 34 cities, while the total number of settlements in 2013 was 1,767. Statistically it is divided into eight non-administrative planning regions: Eastern, Northeastern, Pelagonia, Polog, Skopje, Southeastern, Southwestern and Vardar Region, out of which six are predominantly rural and two are intermediate rural (according to the OECD definition). The last census (2002) shows a population of 2,022,547 inhabitants. Official estimates from 2016 give a figure of 2,072,490 or 80.6 inhabitants per km2. Rural population shares 43%, while the majority lives in the urban areas. The share of young population (0-14 years) of the total number of inhabitants was reduced from 18.9 % to 16.6 % in the period 2006-2016, suggesting the aging status of the country.

The GDP per capita in 2015 was estimated at 4,377 euro with a growth rate of 2.4% in 2016, compared to 2015. The agricultural sector constituted 10% of GDP in 2016. The share of the food processing industry including beverages and tobacco in GDP ranges between 3-4%. Thus, the agro-food sector is still one of the most important contributors to the national economy accounting for up to 14% in the GDP. According to Eurostat data, Macedonian Purchasing Power Standard (PPS) GDP per capita stood at 36% of the EU average in 2014.

Since December 2005 Macedonia has been a candidate for joining the European Union and has applied for NATO membership.

Macedonia has undergone considerable economic reforms since its independence. Despite these reforms, the unemployment rate was 36.0% in 2006, decreasing to 23.7% in 2016 when the poverty rate was estimated to be 21.5%. The high unemployment rate of young people (15-24) is an additional problem leading to the young labor force migrating from rural areas to urban centers and abroad. Out of the total number of the employed population (723,550) in 2016, the highest number of employees was engaged in the processing industry (137,615) and agriculture, forestry and fishing (120,303) sectors. Moreover, the food and beverages participate with 10% in the products export, which proves that the agriculture and food industry are strategic sectors for socio-economic security and welfare, providing income for a large part of the population.

Map of the Republic of Macedonia

Agriculture (together with the forestry and fisheries) is the third largest sector contributing to the economy in Macedonia. However, the agricultural and food sector with the relevant institutions should make strides to significantly approach the level defined in the Common Agricultural Policy (CAP) of EU. The three main areas (policy, institutions and legislative) implementing the reforms will have to decrease the negative effects over the agricultural and rural population during the process of approaching to European standards. For that purpose several goals, measures and instruments for their implementation were envisaged in the National Strategy for Agriculture and Rural Development (2007-2013).

According to the Annual Report for Agriculture and Rural Development for 2015 (Ministry of Agriculture, Forestry and Water Economy), a budget of approximately 616 million euro was allocated to agriculture and rural development in the period 2010-2015. The largest proportion of the budget goes to direct payments, while the rest was directed towards investments and modernization of the agriculture and food production. In addition, rural development policy contains elements for preservation of the natural, cultural and developmental values of the rural areas. Some of the priority areas were preserving agrobiodiversity, with an allocated budget of 404,650 euro in 2015 for preserving rural areas and their traditional characteristics, and 357,723 euro for preserving the genetic diversity of autochthonous crops and livestock breeds.

The IPARD Program (2007-2013) started to be implemented after the aid was granted in 2009 with

measures for investments in agricultural companies, in processing and marketing of agricultural and fishing products for their restructuring and upgrade to the EU standards and for diversification and development of rural economic activities. The program is implemented by the Agency for Financial Support in Agriculture and Rural Development (AFSARD), established as an independent body of the state administration located in Skopje. From 2009 until August 2015 there were 3,087 applications, out of which 40% were approved and only 620 have obtained the financial support. In 2015, 439 applicants signed contract with AFSARD, with a total amount of 3,945,978 euro, out of which 277 were paid totaling 1,821,247 euro, while 30 contracts with a combined sum of 184,896 euro were breached.

IPARD II Program (2014-2020), adopted in 2015 and followed by public calls in 2016 and 2017, includes measures for investments in material assets in agricultural companies, in processing and marketing of agricultural and fishing products, and in rural public infrastructure, measure for farms' diversification and business development and measure for technical assistance. Several EU financed projects for the introduction of new IPARD measures and for the establishment of National Rural Network are currently in the implementation phase that will contribute towards more efficient utilization of the financial support.

Government policies in the National Strategy for Agriculture and Rural Development 2014-2020 are much more directed towards rural development and protection and utilization of agrobiodiversity, according to the EU Biodiversity strategy 2050. The main goal of the policies is to increase the share of biodiversity in agricultural production through increased direct payments. Priority will be given to varieties and breeds that have the potential to be improved by breeding and achieve sustainable economic result. Activities for inventorization and characterization will be supported for vegetables, fruit crops and vineyards, with establishment of a Register for autochthonous varieties. Autochthonous varieties, such as pepper Kurtovska kapija, tomato Jabuchar, Buchinski onion and Tetovski bean, cultivated on larger areas but insufficient to satisfy the market demand will be supported through the establishment of breeding and seed production fields. Farmers will be motivated to cultivate such varieties with additional financial support of up to 30%. Regarding AnGR, the strategy foreseen continuation of the financial support for local breeds (sheep Pramenka type breeds, cattle breed Busha and, sheep dog Sharplanian). In 2015, the list of local breeds was extended in order to provide a legal base for registration of local goats and water buffalo into the national register for local AnGR. Registration of farmers for local chicken breeds into a recognized farmers' organization is foreseen as well. From 2017, the Strategy predicts the use of IPA II funds for development of farmers' organizations dealing with improvement of genetic potential in farm animals within a recognized breeding organization.

The implementation of this Strategy will be realized through a five-year national program and annual programs for financial support. The highest amount of financial support will be provided through the state budget and additional support will be directed through IPARD II. A smaller part will be contributed from foreign donations and local government budget. The total budget for the support of the sector and rural development and the utilization of IPARD funds are expected to increase from 139 in 2013 to 175 million euros in 2020. Financing through IPARD will be implemented from 2017 as part of the Agro ecological Program. Currently, a new five-year national budget plan for direct payments is under preparation.

1.2. AGRICULTURAL PRODUCTION

Half of the total surface area of the Republic of Macedonia is agricultural (1.26 million ha), out of which 516,000 ha are classified as cultivated land and 750,000 ha as permanent pastures.

The largest proportion of cultivated land consists of arable land and gardens (417,000 ha), but only 281,000 ha are sown and the rest are fallows. Almost half of the arable land in 2016 was cultivated with cereals (168,000 ha) and the rest was used for vegetables, industrial and fodder crops production. Approximately 1,000 ha were used for production in greenhouses. The most important cereal crop is wheat with 306,433 tons harvested from more than half of the area sown with cereals. The remaining area is sown with barley (~40,000 ha), maize (~30,000 ha) and rice, rye and oats are cultivated on areas smaller than 5,000 ha. Vegetable crops are cultivated on 52,000 ha, out of which major crops are potatoes, tomatoes, pepper, cabbage, melons and watermelons and onion. Much smaller production shares have beans, garlic and lentils. Production of industrial crops with tobacco as a major crop is continuously decreasing reaching 8% of the sown area in 2016. The cultivation of fodder crops (39,000 ha) is increasing with fodder maize and alfalfa as the main crops, followed by clover, fodder pea, vetch and fodder beet.

Orchards are planted on 16,000 ha with a total fruit production of 177,630 tons contributing to around 80% of the total production value of perennials. Apples take up almost one-third of the orchards and with their production of 101,088 tons are the dominant fruit crop. Plums (33,684 tons) and peaches (12,108 tons) significantly contribute towards production. Cherries, sour cherries, pears, quinces, apricots and walnuts production is less than 10,000 tons. Vineyards are cultivated on 24,000 ha with a production of 333,319 tons and together with the wine production contribute approximately 20% to the agriculture share in GDP. Following tobacco, it is the second most important agricultural export product.

Livestock production shares one-third of the agricultural contribution to GDP. Farms have an average of 6 heads - equivalent to 500 kg of live weight which is one of the key factors for low productivity and profitability of family farms. Cattle production use forage crops, meadows and pastures, as well as lot of by-products from the sugar, oilseed, starch and beer and other industries. The total number of cattle in the past 16 years has been variable, with a decreasing trend (254,768 in 2016), but at the same time farm sizes have shown a trend towards increasing in size. The structure of dairy farms is unfavorable where small farms are predominated with limited opportunities for one's own production of animal feed. The total production of cow milk over the last ten years has been increasing, while the total beef production has been decreasing. As a country with a semi-arid climate and numerous mountain pastures and meadows, beef production can be based on grazing systems. Sheep production has the potential for development due to specific climate conditions, hilly and mountainous landscapes and tradition. The main sheep products are dairy products and lambs. Sheep milk is sold on the national market, and it is raw material for production of various cheeses and other dairy products. Although the level of sheep production is fairly low, sheep production is economically significant due to lamb meat export. In the last decade the total number of sheep was constantly declining to 723,295 in 2016. The average sheep milk per milked sheep is constantly growing, while total lamb/goat meat production is moderate. The goat population of about 88,064 (2015) is kept on about 5,000 goat farms. Over the last years, goat milk production has been declining. Pig production is represented by 202,758 (2016) heads, although the population size is constantly fluctuating due to market conditions and feed price. Pork production has been growing, as a result of better technology used, increased AI of hogs, use of genetically superior heads and proper selection techniques applied. Poultry, with a population size of 1,865,769 (2016), is oriented towards two basic products – eggs and broilers. Egg production is intensive and more developed, while the attempts to develop broiler production have been failing for a longer period. Individual farms have increased their activities in this sector. The State Statistical Office (2016) reported 18,784 heads of horses and donkeys in 2015, the majority of which are used as a power source in agriculture and forestry, and the rest are used for sport and recreation purposes (riding).

1.3. INSTITUTIONAL AND ADMINISTRATIVE SET-UP

Governmental institutions

The **Ministry of Environment and Physical Planning** (MoEPP) is responsible for the overall protection of biodiversity in the Republic of Macedonia. Regarding the obligation from the ratification of CBD and other agreements it is responsible for protection, conservation and sustainable use of the natural heritage. All activities regarding biodiversity protection are conducted through the Unit of Biodiversity established in 2001 under the Department of Nature. Agrobiodiversity has been integrated into the institution's plans, actions and documents in a very negligible way. The National Information System integrating four sectors, including biodiversity, is provided by the MoEPP.

The **Ministry of Agriculture Forestry and Water Economy** (MAFWE) is responsible for agrobiodiversity protection and sustainable use. This institution has a complex structure with 19 sectors and 62 divisions, out of which seven sectors are associated directly with agriculture: two for agricultural land, one for rural development, one for agricultural policy and one for quality and marketing of agricultural products. Issues of agricultural production are included within the Sector of Grapevine, Wine and Fruit Production and in the Sector of Agriculture (field crops, vegetables, livestock and organic production). Six other institutions are under governance of MAFWE, out of which three are relevant for agrobiodiversity: Phytosanitary Directorate, Directorate for Seed and Seedlings (DSS), and the State Inspectorate for Agriculture. The Agency for Food and Veterinary is established as an independent institution. Agrobiodiversity protection is integrated in the Rural Development Program, but the activities have to be implemented and financed through DSS (in the case of PGR) and directly through the Sector of Agriculture – Livestock (in the case of AnGR). A PGR Gene bank Division was established in 2008 at DSS with four employees. Two years ago it had only two employees. Yet, almost all of the work of this Division is directed towards the obligations of DSS concerning commercial varieties. PGR conservation and sustainable use has, in general, been marginalized and misconceived. AnGRs protection is managed through a seven-year program in accordance to the Law on Livestock Production.

Research institutions

Various activities regarding agrobiodiversity have been undertaken by several research institutions in the country for more than a few decades. Their work is not well-coordinated and transparent, being dependent on transient support by foreign donors and the willingness of the researchers to contribute to agrobiodiversity conservation. Therefore, activities are not systematically organized or implemented on a national level and many actions are duplicated.

A few decades ago, the governmental supported construction of cold chambers for seed storage in three research institutions that had been appointed as gene banks: Institute of Agriculture in Skopje (IA), Institute for Southern Crops in Strumica (ISC) and Scientific Institute for Tobacco (SIT) in Prilep. Bearing in mind that the institutes had active breeding programs and organized seed production at that time, these chambers were used for storing breeding material that included minor percentages of local populations maintained for breeding purposes only. The chambers were not regularly maintained, they were energetically inefficient compared to refrigerators and are currently not used at all. Ever since then, MAFWE has been allocating minor, irregular support to these three institutions intended for "gene bank" maintenance, although the funds are insufficient and desultory.

The leading research institution in the area of agriculture and food is the **Faculty of Agricultural Sciences and Food (FASF)** in Skopje, established in 1947. Along with two other faculties,

it was one of the founders of the St. Cyril and Methodius University in Skopje (UCM) in 1949. FASF organizes ten undergraduate programs, ten MSc (with 34 subprograms) and six PhD study programs in diverse areas of agriculture, food and natural resources. Courses for agrobiodiversity conservation and sustainable use have been integrated in all three levels. Currently 69 PhD holders and three MSc holders are employed by the FASF. This institution is located in a 10,000 m^2 building, equipped with modern amphitheaters and laboratories for molecular genetics, GMO detection, chemistry and quality of soil, water, seeds, plant and livestock products and processing. In addition, three years ago the FASF managed to acquire an experimental field (72 ha) in Skopje. It has an active wheat and barley breeding program with application of molecular, mutation and classical breeding methods. FASF is consisted of six institutes, out of which two are actively involved in agrobiodiversity preservation: The Institute for Plant Biotechnology (IPB), responsible for PGR, and the Institute for Animal Biotechnology (IAB), responsible for AnGR. The Department of Genetics and Plant Breeding are carrying out continuous activities for inventorization of agrobiodiversity all over the country and are creating seed collections. The Department of Fruit Production is especially active in research, *ex-situ* and *in-situ* conservation of fruit crops. All activities are undertaken voluntarily or supported by foreign donors, having in mind that MAFWE has not actually supported any activity for conservation of PGR. For the period 2011-2017, IAB was contracted on an annual basis for the commitment of the annual program for AnGR protection. Annual programs include inventorization, characterization and description (morphological, productive, reproductive and molecular) of autochthonous breeds. Also, parts of the programs are activities related to collection and cryopreservation of genetic material (semen, oocytes, embryos, blood, hair, and tissue), education, promotion and public awareness for local breeds. The annual activities depend upon the level of financial support, up to 6,000,000 MKD (~100,000 euro) in 2016. A new seven-year program for AnGR protection needs will be prepared and adopted by MAFWE.

Institute of Agriculture (IA) in Skopje is also a member of the UCM, established in 1944 with its primary focus being on research, but it also organizes two MSc study programs. The Institute for Rice (IR) in Kochani has an active rice breeding program and is a constitutive member of the IA as well. 22 PhD and four MSc holders are employed by the Institute. IA used to have five experimental fields in its possession: three in the vicinity of Skopje (~215 ha in total, out of which 72 ha were given to FASF and the rest were denationalized or taken by the government for other usage purposes), one in Kochani (20 ha, nearly all are denationalized today) and one in Sveti Nikole (80 ha, now the property of FA in Shtip). During the period 1977-1990 IA and FASF were merged in one institution, which was the leader in breeding and seed production at that time, especially for cereals, providing large a amount of the institutional budget from its own income and resources. Due to the governmental policy in the last 20 years, the research institutes had a continuous deficit of human capacities and assets for basic operational activities. Today, IA does not have experimental fields and the breeding programs (except for wheat and rice) have been terminated due to various reasons. The IA was completely equipped for storing seed collections through the SEEDNet project.

The **Faculty of Agriculture (FA)** in Shtip was founded together with the University Goce Delchev (UGD) in Shtip in 2007. All employees of the Institute of Southern Crops in Strumica were transferred to the Faculty of Agriculture, as issued by the government. Currently 20 PhD holders and eight MSc holders are employed by the FA. The experimental field in Sveti Nikole that was in possession of IA, has been given to UGD as well. The FA organizes 12 undergraduate study programs, six MSc, and three PhD study programs. It has an experimental field of 80 ha and modern laboratories for the detection of plant diseases and for the determination of seed quality. It maintains a small collection of industrial and vegetable crops.

University St. Kliment Ohridski (UKLO) in Bitola was established in 1979 by integrating six higher educational institutions and two research institutes. One of these institutions was the Higher Agricultural School, established in 1960 with only a two-year undergraduate program in animal production. In 1999 it was transformed into the **Faculty of Biotechnical Sciences** (FBS) in Bitola with seven undergraduate study programs, six MSc and one PhD study program mainly in the areas of animal biotechnology, food quality and safety. Up to the present day, this institution has not been active in agrobiodiversity preservation. Currently 19 PhD holders and four MSc holders are employed by the FBS. The **Scientific Institute of Tobacco** (SIT) in Prilep was one of the founding research institutions of UKLO. It was established in 1924 as a trial station for tobacco research and transformed into an institute in 1936. It focuses exclusively on research, breeding, and seed production of tobacco, offering MSc studies in these specific areas.

Institute of **Animal Science** (IAS) in Skopje is a member of UCM, primarily focusing on research, applicative and educational activity. IAS was established in 1952. During the period of 1977-1990 it was merged with the FASF and IA into one institution. Since, 1994 it has operated as an independent institution. Today, the IAS has ten PhDs, seven of which are professors of postgraduate studies in the field of animal husbandry and fisheries, three assistant MSc and ten associates – laboratory staff. Their role in AnGR protection is mainly in cattle, sheep and goat local population description and monitoring productive/reproductive characteristics, in agreement with the IAB (FASF).

Faculty of Veterinary Medicine (FVM) in Skopje as part of UCM has teaching, research and applicative activity in the field of veterinary medicine and veterinary public health. The mission of FVM-S is realized via organizing study, transfer of knowledge, development and promotion of the education and science in veterinary health in the Republic of Macedonia, development of creative abilities, preparing students to be doctors of veterinary medicine which needs professional knowledge and the ability to take a scientific approach in their work, promoting technological development of the veterinary profession and building positions for the future. Within the FVM, the Institute for Reproduction and Biomedicine deals with collecting, quality control and cryo-conservation of semen, oocytes and embryos. All activities related to the preservation of reproductive material from local breeds are in close cooperation and agreement with IAB (FASF).

1.4. NON-GOVERNMENTAL SET-UP

Major activities regarding the preservation of biodiversity (in general terms) are performed by the Macedonian Ecological Society (MES), which was established in 1972. Some of their projects have integrated minor components of agrobiodiversity.

Over the last several years, the organization Slow Food Macedonia (a member of Slow Food International) has been promoting traditional food based on autochthonous varieties. They have initiated a successful campaign of preserving Bukovska pepper supported by SGP GEF. The producers of this pepper have established an association Bukovska pepper with the goal of maintaining the variety and of promoting the product on the market. This organization carries out other activities directed towards promotion of traditional products as well, such as sweet relish made out of wild figs, chickpea bread – Nautlija, etc.

Many other small associations/organizations have performed temporary activities for conserving and promotion of PGR. Their work was mostly financed through specific projects supported by SGP GEF, such as the projects regarding preserving eight pear varieties, implemented by the Business Club from Kriva Palanka; preservation and reunion of the apple Ciganka, pear Sulija and plum Banska, implemented by the Association Aronija from Delchevo and preservation of apricots

and pears implemented by Eko Gol Drvo from Skopje.

Activities undertaken by the associations and farmers' organizations are not economically capable of being sustained in the future and of generating profit from the preservation and cultivation of autochthonous varieties. MAFWE offers certain possibilities (subsidies for cultivation, as well as financial support for protection of geographical indication) for developing self-sustainable businesses through agricultural production based on local varieties and populations. However, these possibilities have been used very poorly by the non-governmental sector. One recent example is the elaborate description paper on the protection of two autochthonous varieties of Ohrid cherry submitted to MAFWE in 2017 by the agricultural cooperation Ohridska chereshna.

In the area of training, education and raising public awareness regarding the conservation of PGR, many activities were implemented through the Foundation Agro-Centre for Education (FACE), which was founded in 2006. FACE participated in many training activities organized through the SEEDNet project.

The Association for Rural Development Javor from Zrnovci in 2016-17 implemented a project intended to increase public awareness on the topic of agrobiodiversity. This project was financed by the Swiss Agency for Development and Cooperation(and was comprised of an educational component along with creating collections of local seeds.

There are many NGO that deal with AnGR protection. Most of them were established solely for the purpose of the project commitment, but some of them have continued their activities after project termination; however, until now only two of them are recorded on the National Register of recognized organizations within MAFWE for undertaking breeding programs. NGO Busha is an association of farmers that keep pure Busha cattle breed. The second NGO, Pramenka Ovchepolka, is also a farmers' association dedicated to Ovchepolian sheep breed protection. Their role is to maintain the pure breed, exchange of reproductive material or/and live animals, promote the traditional value of the breed, and educate other farmers. The other NGOs are still not recognized by MAFWE and were mostly established as pioneers in AnGR protection. Their existence in the future will depend upon available financial support and initiatives of the NGOs' members, or on other options.

1.5. LEGAL FRAMEWORK FOR PROTECTION OF AGROBIODIVERSITY

The Constitution of the Republic of Macedonia regulates nature protection as a "duty to protect and improve the environment and nature". Protection and improvement of the environment is regulated with the Law on Environment. Provisions of laws concerning specific natural areas are applied as well. This law prescribes establishing a national monitoring network and National Environmental Information System (NEIS). NEIS is coordinated by the Macedonian National Information Center (Article 40), part of the Ministry of Environment and Physical Planning (MoEPP). The Law on Nature Protection regulates the protection of nature by protecting the biological and landscape diversity and natural heritage in and outside protected areas. Article 153 of this law prescribes establishing a National Biodiversity Information System (NBIS) for strengthening biodiversity protection management and decision-making. NBIS is part of the National Environmental Information System.

Ratification of international agreements (CBD, Bern, Bonn, Ramsar, UNESCO conventions etc.) represents a legal base and obligation for nature conservation in Macedonia. MOEPP is the responsible institution for the policy and implementation of the biodiversity protection and sustainable use. Concerning the European Cooperative Program for Plant Genetic Resources

(ECPGR), Macedonia is currently not a member of phase IX (with a status of invited party), while the International Treaty on PGR for Food and Agriculture (IT PGRFA) is only signed and not yet ratified by the Government.

The legal framework regulating hunting, fishing and managing and sustainable preservation of forests, pastures, water and land used in agriculture, and agrobiodiversity is under the auspices of the Ministry of Agriculture, Forestry and Water Economy (MAFWE).

Management of agrobiodiversity is regulated with the Law on Agriculture and Rural Development (LARD), which provides a legal basis for planning and implementation of the agricultural policies and different measures for organizing and supporting agriculture in Macedonia. This law defines two agrobiodiversity terms in Article 2:

- Autochthonous species of crops and livestock breeds used in agriculture are domestic plant and animal genetic resources, as part of the biological diversity in Macedonia, whether they were introduced in the past and adapted to local conditions or local varieties and species that originate from the area where they have been found. Plant genetic resources of agricultural crops are grapevine, fodder crops, vegetable plants including flowers and decorative plants, fruit crops, medicinal and aromatic plants, forest trees, mushrooms, microorganisms and wild flora that is/may be used in agriculture. Animal genetic resources are domestic animals used for agricultural production (vertebrates and invertebrates), microorganisms and wild fauna that is/may be used in agricultural production.

Note: This article needs revision as cereals and industrial crops are not part of this definition, and micro-organisms should be separately listed as resources.

- Biological diversity in agriculture is diversity that exists between and within the species of the living organisms and plants used in agricultural production or can be used for agriculture (agricultural plants, livestock, and micro-organisms).

The goals of the national agricultural policy are listed in Article 3, among which improving competitiveness of the agriculture, rural development and optimal utilization of natural resources are tackling agrobiodiversity. These goals are realized through national strategies for a period of seven years adopted by the government. The strategies are realized through five-year national programs, which are implemented through annual programs for financial support.

Policy for Rural Development is comprised in Chapter VI. One of the prescribed measures is supporting association of agricultural households for common implementation of agricultural practices (Article 74). The support for associating is predicted for several goals, among which are the investments for production of agricultural products with higher quality defined as: organic production, traditional guarantied specificity, protection of geographic indication and designation of origin.

One of the supported measures for promotion of environment and rural areas is the stimulation of agricultural practices for sustainable use of agricultural land, water and air, protection and improvement of environment and rural areas in order to preserve the plant and animal genetic diversity (Article 76). Support for this measure regarding agrobiodiversity is granted for preservation of genetic diversity of autochthonous agricultural plants and livestock breeds (Article 78). This specific support can be granted to agricultural holdings in the form of direct payments per unit of area with cultivated or propagated autochthonous agricultural plants and per breeding stock of autochthonous livestock breeds. The amount of financial support may vary depending on the plant and animal species and the degree of endangerment. For realization of this support the

Minister prescribes a list of autochthonous agricultural plants and livestock breeds, according to the regulations in the area of protection of environment and biological diversity. According to this list, the Minister specifies the manner of monitoring and analyzing the status of autochthonous agricultural plants and livestock breeds, based on the degree of their endangerment and stipulates additional measures for preservation, collection and storing of compulsory genetic reserves and their use in agricultural production. The realization of these activities can be granted by the Minister as a public service or by an authorization according to the regulations in the area of livestock production, seed and seedlings and plant health and protection. This article also states that extinction of autochthonous agricultural plants and livestock breeds is forbidden. Finally, it is stated that activities to be supported, financing conditions, defining users, general and specific conditions for granting support, and the amount of the direct payments are prescribed by the Government in the national program.

Further implementation of conservation and sustainable utilization of PGR is regulated to the Law on Seed and Seedlings (LSS), as stated in the above text. This law regulates issues regarding seed and seedlings production and trade. The only subject of regulation concerning agrobiodiversity is the storing of referent samples of seed and seedlings (Article 1) as the regulations are applied only for seed and seedlings that are intended for trade (Article 2). It also defines the gene bank as an institution that maintains and stores seed and seedlings of divergent populations and autochthonous species in order to protect biodiversity and stores referent samples of seed and seedlings of agricultural plants.

Article 51 of this law allows possibility for registering local varieties or ecotypes in the National Variety List (NVL) in order to preserve and use the genetic resources in agriculture. These local varieties or ecotypes do not fulfill the criteria required to be registered as varieties in the NVL. A local variety can be registered on the list if there is available data, obtained by scientific research or by locally-known information, regarding the variety characteristics and its value for preservation of natural or semi-natural habitats that may be endangered by modifying the variety's genetic stability. Referent seed samples of local varieties are stored in the gene bank.

Article 54 states that samples of varieties registered in the National List of Varieties are stored as referent samples in the gene bank. This is regulated with a Regulation on The Seed Quantities, Conditions and Manner of Referent Samples Storing, as well as the manner of Gene Bank operation.

Although the gene bank at the Institute of Agriculture was appointed as a national gene bank, Article 60 states that the Ministry gives authorization through announcement of public call to laboratories for seed quality analyses, and for collecting and preserving definitive samples of varieties – gene bank to accredited laboratories only (which is one of the major obstacles for utilization of the funds predicted in LARD).

The Directorate for Seed and Seedlings (DSS) under the MAFWE is responsible for implementation of this law. However, DSS has a very limited budget and the amount granted for gene banks (within the three institutions stated in Chapter 1.3) is small and discontinuous over the years. In the last two years it was not granted at all due to the statement that only accredited laboratories are eligible to receive funds. According to the EU Regulation 870/2004, a Committee for protection of autochthonous species has been established by DSS. This Committee was not operational as it was not possible to obtain a budget.

Starting from the incorrect definitions of PGR and the gene bank that are not in accordance with the definitions used in LARD, a major problem is the misinterpretation of the purpose of referent collection and gene bank in LSS.

Referent collection is a collection of seed samples of various varieties from one crop with specific characteristics determined by UPOV criteria that are used as standards in the variety trials for evaluating distinctness, uniformity and stability (DUS test) of new varieties submitted for registration. Normally, these collections are maintained by research institutions, which specialize in research and breeding of the specific crops. The budget for maintenance of such a collection comes from the applicants, directed through DSS, for performing of variety trials. The countries, even within the EU, appoint institutions that are responsible for a variety trials and performance of DUS tests for specific crops. These institutions have the obligation to maintain seeds of the new varieties as standard samples. This service is not organized through a public call, and especially not by accredited laboratories.

The analyses of seed quality are normally performed by an accredited laboratory which has the obligation to store the analyzed seed samples for a year. This service is financed by the applicants, and in the event when a particular analyses is ordered by the Ministry, the laboratory has to be selected through a public call.

Gene bank is usually a separate institution or part of a research institution that collects, characterizes, evaluates, stores, and uses plant genetic resources. It can be centralized (one national gene bank that stores documentation and/or samples from national collections) or decentralized with several research institutions maintaining information and seeds from different collections. Such institutions have separate budgets, financed by the government and additional budgets granted by foreign donations for conducting various studies. The referent samples of domesticated varieties (defined as local varieties or ecotypes in LSS) registered on the National List of Varieties may be stored in a gene bank. In that case MAFWE have to appoint the responsible gene bank and provide a budget for maintaining samples.

Due to the fact that LARD prescribes all activities for conservation of PGR to be realized through the LSS (i.e. DSS) and due to the fact that the current content of LSS comprises only the activities for maintenance of referent collection and gene bank operation (even worse by an accredited laboratory through a public call), the support predicted by LARD for conservation of PGR has remained unused to the present day.

Therefore, the LSS has to be urgently modified, upgraded and adopted by the government. Separate regulations need to be prescribed for referent collections maintenance and for gene bank operation. The National Variety List has to be revised as well, in respect to the registered autochthonous varieties as most of them are old registered varieties (including foreign ones) that were removed from the list of varieties and are not cultivated any more.

Other laws that are/may be tackling agrobiodiversity are the Law on Breeder's Rights, the Law on Organic Agricultural Production, the Law on Pastures, the Law on Plant Health Protection, the Law on State Agricultural Inspectorate, the Law on Forests that regulates the gathering/collecting of wild plants including MAPs, and the Law on Quality of Agricultural Products which regulates the protection of agricultural and food products with traditional guaranteed specificity, protection of geographic indication and designation of origin.

Various by-laws also regulate agrobiodiversity issues, such as the Regulation on the procedures and methods for analyzing species and varieties of agricultural plants and varieties of agricultural plants for which analyses of value for cultivation and use are not mandatory, the Regulation on the manner of operation, spatial and technical equipment of the authorized laboratories and methods for analyzing seed quality of agricultural plants, and the Regulation on the procedures and methods for analyzing distinctness, uniformity and stability (DUS test) of the varieties of agricultural plants.

Due to peculiarities of livestock production, AnGR is regulated mostly by the Law of Livestock Production. Chapter IV of this law is dedicated to animal genetic resources protection. Therein, several local breeds are recognized in cattle (Busha), sheep (Karakachanska, Ovchepolian and Sharplanian), goat (local), chicken (local), water buffalo (local), horse (local), donkey (local), dog (Sharplanian Shepard dog), porcine (local primitive) and honey bee (*Apis mellifera macedonica*). By that law MAFWE has a duty to take care of the animal genetic resources protection through a seven-year program (2011-2017) which acts towards:

- Protecting all autochthonous breeds and strains of livestock that are kept in Republic of Macedonia, with particular care for local breeds kept in their regions of origin;
- Protecting breeds out (*ex-situ*) and in (*in –situ*) the regions of origin;
- Establishing and operation of gene banks for livestock;
- Fulfilling international obligations related to AnGR;
- Conducting trainings for AnGR protection;
- Raising public awareness for AnGR protection;
- Linking AnGR protection with other related programs in agriculture.

In addition, a few regulatory acts (by laws) were also adopted in order to make the program operational, such as:

- Regulation for criteria definition for recognized institutions have to be fulfilled in order to commit the program to AnGR protection;
- Regulation for criteria definition in commitment of monitoring in AnGR;
- Regulation for criteria definition for keeping and trading of AnGR, form and content of request for recognition of the new local breeds and form, content and registration of AnGR breed register;
- Regulation for definition of AnGR population size and way and manner for maintenance of minimum population size.

These by-laws were a precondition for the AnGR program commitment for recognizing, monitoring and recording of local breeds. The implementation of the program has been assigned to IAB (FASF), while experts from the Institute of Animal Science and the Faculty of Veterinary Medicine were also involved to the program's implementation. IAB (FASF) for realization of the annual program was granted up to € 100,000 (2016/17). The achievements in identification, registration, description and recoding of the local breeds as a result of this program have been reported to the MAFWE.

In addition to the laws and regulations, based on the legal framework, different national strategies, programs and plans were adopted by the government: The National Strategy for Agriculture and Rural Development 2014-2020, the Program for Rural Development 2014-2020 (IPARD II), the National Program for Agriculture and Rural Development 2007-2013, and the National Plan for Organic Agricultural Production 2013-2020.

1.6. FOREIGN DONOR SUPPORT FOR CURRENT AND PREVIOUS ACTIVITIES RELATED TO AGROBIODIVERSITY

The most important foreign support for conservation and sustainable use of PGR in Macedonia has been donated by SIDA (Swedish International Development Agency) through financing the project for establishment of South East European Development Network on Plant Genetic Resources – SEEDNet. This network was established in 2004 in order to assist the countries in the region in identifying, addressing and tackling their specific needs and priorities in plant genetic resources for an estimated period of 10-15 years. The SEEDNet program was aimed towards long-term conservation and sustainable utilization of PGR within the region through a well-coordinated network of functional national programs. The network activities comprised *ex* and *in-situ* conservation, utilization of PGR, institutional and capacity building and raising of public awareness. The Swedish Biodiversity Centre (CBM), Swedish University of Agricultural Sciences provided the secretariat and coordination for SEEDNet and the back stopping institution was Nordic Gene Bank (NGB). During the first phase of the project, ten signatory partners participated in the network: Albania, Macedonia, Kosovo*, Montenegro, Serbia, Federation Bosnia and Herzegovina, Republika Srpska, Croatia, and Slovenia, with three more joining the network in the second phase: Romania, Bulgaria, and Moldova.

The governing body of SEEDNet was the Regional Steering Committee (RSC), and consisted of one representative of each partner. The core of SEEDNet included seven regional working groups - six of them were crop oriented: Cereals and Maize, Medicinal and Aromatic Plants, Vegetables, Fruit Crops and Vitis, Fodder Crops and Industrial Crops, and one was thematic - Documentation and Information. The same working groups were established on a partner's level as well. RSC had two regular annual meetings and one of them was linked to a joint meeting with the chairs of the regional WGs. This proved to be a good opportunity for communication and exchange of experiences. The WGs have initiated a number of common projects. Most of those projects have been directed towards inventorying and collecting of local plant germplasm.

With the aim of capacity building and training, during the existence of SEEDNet, a total of 30 training courses have been organized covering a wide range of topics: a two-year international MSc program in Management of Biological Diversity, as well as short training on information and documentation technology, application of genetic and molecular markers in gene banks, conservation strategies, gene bank management and operations, *in-vitro*, *in-situ*/on farm conservation, PGR policy, project administration, reporting, accounting, and auditing.

Gene banks with facilities for long-term conservation of seed collections have been set into full operation in all partner institutions. Field gene banks for fruit crops and Vitis were established in most partner countries as well. Such collections in Macedonia were established at the Institute of Agriculture in Skopje. Several partners (Macedonia as well), were regularly uploading accessions' passport data to the common EURISCO catalogue and were performing characterization and evaluation of the conserved accessions.

One of the most important achievements of the SEEDNet partners in general was to raise awareness of the importance of PGR conservation and use. Many activities directed towards schools, farmers and the general public through various media have resulted in a higher degree of awareness of the need for sustainable conservation and utilization of PGR. In addition, the network participants have built up and strengthened a solid partnership and a platform for future project collaboration and sharing of conservation responsibilities.

As a summary for this project it should be emphasized that SEEDNet has contributed towards significant progress in building and upgrading of capacities, conservation of PGR, and probably to the most important element - national and regional institutional and personal collaboration. Financing of the network ceased in 2011. For the next two-three years many activities continued due to the personal efforts of the participants in the project. In addition to the lack of foreign support for future actions, the repositioning of trained staff and a lack of governmental support to IA contributed to marginalization of the gene bank collection maintenance. Moreover, the database with the information is not available on-line, contributing to inaccessibility of the collection. Therefore, future activities for conservation of PGR on a national level have to be supported and administratively organized through MAFWE, with complete access to the information and material. Research institutions that are to be appointed for coordination and implementation of the activities on a national level, as well for the preservation of the collection, must have adequate capacities for operation during a period without any financial support for conservation of PGR.

Another significant support for the conservation of plant and animal genetic resources is provided by the GEF program for small grants. This program was established in Macedonia in 2005, as part of the Global Ecological Fund with the aim to include local communities in the solution of the problems for their benefit. Among the other area of activities, several projects for protection of agrobiodiversity were successfully completed or are currently active. The scope and the realization of the projects depends directly on the concept and capacity of the applicants. Therefore, most of the approved projects were realized by an association or NGO in collaboration with a research organization or specific experts in different regions in Macedonia. To date, several projects have been supported for preservation of various fruit crops (such as apricots, apples, pears and plums), as well as of “Bukovska pepper” and cereals. A list of the projects financed by SGP GEF with their summary may be found at: http://www.gefsgpmacedonia.org.mk.

The Swiss Agency for Development and Cooperation (SDC) is financing the Nature Conservation Program (NCP) in Macedonia. This program supports the conservation of nature and local development in the eastern part of the country, in particular the upper Bregalnica Region in order to improve the institutional context and to reach the NATURA 2000 requirements (EU pre-condition). The NCP is implemented by FARMAHEM, a privately owned company, with a backstopping mandate from HELVETAS Swiss Inter-cooperation. Several activities of this program were related to agrobiodiversity and in fact, by the assistance of this project FASF has performed the inventory and created a seed collection. They are also supporting small components of public awareness rising for agrobiodiversity importance and protection.

In addition to these projects related directly to the conservation and sustainable use of agrobiodiversity, many other projects supported by foreign donations are contributing towards institutional strengthening, legal approximation to EU standards, education, raising public awareness and other issues related to agrobiodiversity.

The EU-funded Twinning project Organic Agricultural Production and Protection of the Quality of Agricultural Products (2013-2014) contributed to the modification and upgrade of the Law on Quality of Agricultural products towards the new EU regulative 32012R1151 and derogation of the EU regulative 32006R0510 and 32006R0509 and several workshops for education and raising public awareness were organized. AgBiz program (2007-2013), financed by USAID through MAFWE has supported many activities in terms of improvement of agricultural production and policies, among which the preparation of elaborate description paper for protection of geographical indications for Ohrid cherry and grapevine varieties Valandovsko Belo Zimsko. In order to use IPARD funds more efficiently, the EC through IPA TAIB 2010 approved additional assets (€ 1,198,750) for the project

Fiche Institutional Strengthening of the Administrative Capacities for Strengthening Agriculture and Rural Development. The project Upgrade of the Agricultural Informative System and Establishment of Systems for Information Exchange between MAFWE, and other relevant institutions and the EU was also financed by the EU with € 580,000. The FAO has also provided support to the amount of US$ 330,000 to the MAFWE for preparing the national strategy 2014-2020.

Since 2008, more than 12 projects for AnGR protection have been bestowed grants by the GEF Small Grants program. The total amount of grants exceeds US$ 300,000, where at least 40% is a contribution of the NGOs/Farmers' associations in kind. All projects were designed as start-ups to support the protection of AnGR. Grants were used for establishing flock/herds with local breeds and dissemination of live animals within farmers' members. Some of them have included a public awareness component, as well. Several attempts were undertaken to develop specific products in order to support the farmers' interest in local breeds. The projects deal with Busha cattle breeds, Ovchepolian and Karakachanian sheep breeds, Srebra chickens, as well as with local water buffalos and honey bees. NGOs/Farmers' associations are consisted of groups of citizens or farmers that are active in AnGR protection, and most of them rely on a dozen or so persons to be involved. However, without continuous support through various projects or donations, these organizations will have to close down their activities.

2. GENETIC RESOURCES IN AGRICULTURE

2.1. OVERVIEW OF THE STATUS OF GENETIC RESOURCES IN AGRICULTURE

2.1.1. Plant genetic resources

Cultivation of local populations and landraces

The commercial agricultural production in Macedonia relies almost exclusively on registered varieties and hybrids. It is intensive, with high inputs and market-oriented. One of the exceptions is the dry beans production, based exclusively on cultivation of the autochthonous population of Tetovski bean, maintained by farmers for decades. However, the agricultural production of the small farmers is very diverse considering the cultivated crops and varieties, as well as the final goal of the production. Usually, in the larger fields they have commercial production for market, while in the small parcels nearby their houses or in the gardens they maintain a valuable diversity of local populations and landraces for their own use or for sale at the local markets.

The main reasons for which the farmers are still maintaining local varieties are the specific taste of the varieties, the long tradition of growing specific crops, resistance to pests and diseases, poor resources or unavailability of commercial seed material, good adaptability to poor or specific climatic and soil conditions, and low input agricultural practices not suitable for commercial varieties. However, many of the landraces are facing extinction considering the aging of rural population due to migration of young generations into urban areas.

In most cases, women are responsible for the gardens, starting with actually deciding which crops and varieties to plant, continuing through to the application of traditional knowledge. They use crop rotation even in the small gardens, with all practices being carried out manually, most often without any plant protection. Manure is often used for fertilization or nothing at all, as beans are grown in almost every garden, improving the soil quality. The crops are used for fresh consumption and for processing for the winter. They often produce larger quantities for their children that live in the cities. Small amounts of extra yields are sold at the local markets. Such garden production is common in the large cities as well, and it is becoming more popular as most of the inhabitants are concerned about food quality and taste, especially of the vegetables used for fresh consumption. Within the last decade the urban gardeners have an increased interest in seeds from local varieties. Organized seed production of local varieties and their availability on the market will contribute to their preservation.

Landraces of cereal, industrial and fodder crops are maintained by men for the local markets, and/or for their own needs. They are also responsible for cultivation of fruit crops and grapevines, while the processing of these crops is performed together with the women.

Vegetables and legumes

Regarding the crops and landraces that are maintained, almost each family plants at least two landraces of garlic (autumn and spring), onion (white and red), and leek. The most popular domestic populations of onion are 'Buchinska arshlama', 'Gostivarska arshlama', 'Brazdanski pogachar' and

'Skopski srebrenjak', all registered on the National List of Varieties as landraces. 'Buchinski' kromid or 'arshlama' (onion or onion sets) is a domestic population cultivated in the Pelagonija (region of Bitola), especially in the villages Buchin, Vogjani, Bela crkva, and Pashino Ruvci. In the village of Buchin, where it was grown according to Turkish methods, specific technology of arshlama production was applied. That was the reason for the name of this population. The same type of onion is Gostivarska arshlama, grown in the Gostivar region. 'Brazdanski' pogachar or 'Melnik' (with compressed bulbs) and 'Skopski srebrenjak' (silver color of the bulb) both originated from the Skopje area. All of them are sweet and used for fresh consumption, except for Brazdanski pogachar that has a higher percentage of dry matter, it is tear-inducing with a stronger spicy flavor than the others and is mostly used for cooking. All landraces were grown on larger areas than today and were exported. Today, uncertainty regarding market demand is the main reason for the decreased production of onion.

Several landraces of leek are well known for their characteristics, like 'Kumanovski', 'Vasilevski', and 'Zrnovski'. Their names refer to the cultivation region. Because the number of farmers producing leek for the market is getting smaller each year, some villages initiated a food manifestation named Prazijada with local specialties prepared from leek. On the other hand, the leek in the municipality of Zrnovci is grown on nearly 25 ha, as there is demand on the market for this landrace. It has a long and soft white part of the stem and it can be used in preparing pies without the need for frying. Such a type of leek, with a high stem, is locally known as Kamush.

Garlic landraces are known as spring or winter, and have a white or dark color. The size and the shape of the bulbs varies from region to region.

Several different landraces are maintained from tomato and pepper, as they are traditionally used for salads, cooking and processing. Most spread tomato varieties are pink or red Jabuchar (apple-like), Volovsko srce (buffalo's heart) and the "industrial" tomato, that is used for preparation of traditional products, like salsa and pindzur. Jabuchar is preferred for fresh salads. For some of these landraces, like the Skopski Jabuchar, there is a specific demand at the markets. Jabuchar types of tomato are grown across the whole country in limited areas. As a result of the micro climatic conditions in the different areas where it is grown, many different forms are present. However, this landrace is specific for its very thin skin, it is juicy, and has high percentage of soluble sugars. The fruit is apple-like and ribbed, not suitable for storage and transport, so it is used only for fresh consumption. It is the main reason for the limited area on which it is grown.

Pepper is one of the most important vegetables in Macedonia and it is included in the everyday diet, either fresh or preserved. For that reason, a lot of families maintain three-four or more different landraces of pepper. There are several landraces with kapija-type fruits, which are sweet, large with thick flesh. They are dark green in color that turns to an intense red color and in some rare landraces can be dark red or black. Usually the fruits are compressed and suitable for baking. They are used fresh or baked in various preserved products, out of which most famous is the well-known Ajvar. Around 80% of the peppers used in the processing industry belong to the kapija-type. The most widely distributed among them is the Kurtovska kapija, cultivated across the whole country. Some landraces are named according to the region of cultivation. One of them – Molinka is cultivated in the regions of Strumica and Gevgelija, where most of the processing factories are located. It has a little bit shorter fruit than Kurtovska kapija, but a higher percentage of dry matter and a very characteristic taste. Prilepska kapija is similar to Kurtovska, but it matures from pale green to pink-red color.

Another type of pepper with large fruits is the Kavardzik, out of which the most famous is the

Skopski Kavardzik. They have long (up to 35cm) narrow fruits that are wrinkled, especially in the upper part. The fruit color turns from pale yellow/green to red. The original taste is piquantly hot, but there are sweet landraces as well. Kavardzik has very thin pericarp; therefore, it is used for frying or used fresh in salads. There are several similar landraces, like Tenkokor, Prespanska or Ohridska zelena, etc., that differ in the intensity of wrinkling and taste. Sivrija is similar to Kavardzik, but the fruit has a thicker pericarp and less wrinkles. It is can be used fresh, fried, and baked. A landrace from an old domestic variety Kozji rog – a hybrid between Prespanska zelena and Kavardzik, is also preserved.

Prilepska banana is a well-known landrace, which has a very thick pericarp (8mm) filling a large part of the apex. The fruits are very tasty, and the color turns from pale yellow to red. It is used fresh and for baking, but mostly for pickling when the color is yellow. During preservation, the color becomes lemon yellow and the tissue remains very firm and crunchy. Almost all production of this pepper is used by processing factories and is exported. Similar to this landrace is Tetovska turshijarka, which is green, with a less thick pericarp and a slightly curved fruit top.

Almost each family in the rural areas maintains a unique type of pepper named Nareznen or Vezen (meaning engraved or embroidered), grown only in Macedonia, Kosovo*, Albania and South Serbia. The fruits can be large or small (the second is named Badzanaci), from sweet to very hot, with thick pericarp, and with an intense red color and many beige thin, rough, horizontal stripes. It has a high content of dry matter and a very specific taste. Therefore, it is dried on long strings and used for preparation of a well-known spice, Bukov piper, or Bukovec (roughly crushed dry pepper with the seeds), and for cooking. However, the name bukov piper originates from a not-embroidered pepper. Bukov pepper is an autochthonous population grown in the village Bukovo, near Bitola with elongated smooth fruit and intense red color. Today it is still cultivated by the older inhabitants that prepare the spice in the traditional way. This landrace is facing extinction with the disappearance of the older inhabitants of Bukovo.

In addition, many families maintain landraces with small fruits named Gambi, Feferoni and Dzinki, used for pickling.

Along with these crops, cabbage, lettuce, eggplant, zucchini, okra, carrot and other root crops grown for salads, processing or cooking are also present in many gardens, but farmers often buy seeds for these crops.

Diverse pumpkins are also grown in the gardens or in the nearby fields, mainly for human consumption (fruit flesh and seeds for snacks) or for animal feed. They are present in several different colors, sizes, shapes and types of fruits and seeds – with or without seed coat. Gourd or squash, largely used in the past as a rootstock for grafting watermelons (farmers claim that watermelons have a much better taste) and as a bowl for drinking wine and water, is disappearing. Today, it can be found only in a few gardens, grown for decoration or for the preparation of art crafts.

In most of the rural areas, the older inhabitants still cultivate various old landraces of watermelon and melon. The most interesting ones that will be lost in one or two generations' time, are the winter and autumn types. Winter watermelons have light-pink, white or yellow flesh, are not so sweet, but at room temperature they can last until the next crop. Another specific type of watermelon, which is facing extinction, is used for preparation of sweet relish from watermelon rinds. Its fruits are extremely firm and cannot be easily broken. Melon landraces, known as Badatka and Shkoravka with seeds firmly clustered in a dark compact ball are very rare.

Bean populations are surely the oldest, originating from a few centuries ago. They also have the highest diversity, concerning the plant and seed characteristics. Two types of dry beans are maintained almost by each family, the high ones (runner type) in the gardens, as they need irrigation, and the short ones (bush type) in the nearby fields, as they withstand dry conditions. The runner beans are grown on pricks or as a joint crop with corn. Some farmers have still preserved the old tradition to mix the three crops: corn that supports the beans that supply it with minerals, and pumpkin, that preserve the humidity for the first two crops. Each type of bean has many different landraces. Every family grows at least one and sometimes more landraces with white seeds. Most widespread are landraces with large compressed kidney-shaped seeds like the Tetovski bean or similar. Other beans with white seeds that are often present, especially in the drier areas are Valavka, with round seeds, Cacar, with elongated seeds and Bubreg, with elongated kidney-shaped seeds. All these landraces may be found with small, medium or large-sized seeds on the green markets. Populations with colored and patterned seeds are less cultivated, grown for the farmers' own use, or for the local markets. Out of the populations with colored seeds, most of the farmers maintain Yellow or Green beans. It is named based on the seed color, which varies in different light shades of yellow to green. Other colors of the seeds like beige, brown, gray, dark red and black can also be found, but very rarely and solely for the farmers' own use. Populations with patterned seeds are very diverse, having all combinations of color, type of pattern, size and shape of seeds. At the local markets, beans with beige or pink colored seeds speckled with dark purple or lilac and with various shades of brown seeds striped with dark brown or black can be found. The scientific predictions are that there are more than 300 different bean populations in Macedonia. Almost all of the colored and patterned populations will disappear in the near future. Another species of bean, scarlet beans, with white, colored or patterned seeds, distinguished by being two to five times larger than the seeds of the common bean, which was often grown in the gardens for decoration and for cooking, has been almost lost. However, along with the growing trend of eating more healthy food, this type and the patterned common beans can be found in health food shops, albeit at double the price.

Green beans also exhibit great diversity, but are much less present in the gardens as the period for their consumption is quite short. Furthermore, farmers nowadays often buy the seeds for this crop.

Different types of legumes belonging to Vigna species and the faba bean were almost lost, but today their cultivation is slowly increasing due to customers' demand for healthy food.

Lentil is a crop that is widely used for food and many landraces were maintained in the past to grow this crop. Today, farmers buy seeds for cooking and only a small number maintain the old seeds. Similarly, the pea landraces are also endangered. Chickpea was also widely cultivated in the past for cooking, for snacks and as replacement for coffee. Few farmers are still maintaining old landraces, while many are replacing them with Turkish varieties. This crop was also used for preparation of a special bread named Nautlija (coming from the Macedonian name for chickpea – naut). It was connected with the celebration of the Dormition of the Mother of God (28th August). It is prepared using wheat flour and chickpea, without yeast. Due to its unique flavor and aroma it was very popular on the markets in the past. Today it is prepared only at home and the number of women who know the recipe is very small. There are some initiatives from the Slow Food organization to promote and protect this product.

Cereals

The majority of the cereal production relies on commercial varieties, especially of wheat and barley. Even within the small parcels for own use, farmers grow old commercial varieties. They

also represent valuable genetic resources, as some of them are not present at the seed market any more. Very rarely in faraway rural villages some farmers claim that they preserve old landraces of wheat and barley. There is an increased interest among the farmers for the old wheat landrace Belojka or Belica (with white grains) used for cooking, and for the landrace Litarka or Shutarka (meaning without awns). In some villages, old landraces of rye and oats are still present due to the lack of commercial seeds. The first rye landraces were introduced from Russia (named Stara ruska - Old Russian and Petkusova). Most of the rye landraces have the local name of Letica (spring type). They have much smaller grains and a softer stem; as such, the straw was used for making horse saddles.

In almost all cases old landraces are not pure, they are very often mixed with other cereal crops as well. Some farmers still maintain the tradition to grow wheat and rye in a mixture, claiming that this practice contributes to higher yields. Sorghum (broomcorn) is still maintained by older families, represented by various landraces with white and red grains. It is used exclusively for the production of brooms. The pearl millet used for bird food has almost disappeared although there is a small demand on the market for this crop, which is nowadays increasing with the growing trend for health food.

Very often farmers cultivate corn in the gardens and they are represented with a rich diversity. Even if they have large fields with commercial hybrids, for their own use they maintain corn landraces for cooking, flour and for popcorn only because of the taste. Small amounts of such corn can be found on the local markets as well. The landraces for cooking have light yellow to yellow, smooth or shriveled grains with a specific taste that is quite different from the commercial sugar-types. These landraces mature early and because of that are named Brzica. In some villages their use is also connected with the celebration of the religious holiday Varvara (17th December) as a symbol of fertility. Varvara means to cook, i.e. to have cereals in the barns. Traditionally the grains were cooked with ash, which was later proven to improve the availability of some vitamins. The shriveled types are very rare and probably will be lost in the near future. Landraces for flour have yellow grains with various shapes. They are maintained for preparation of the traditional dish Kachamak. Diversity of popcorn landraces is quite high concerning the size of the ears and the color of the seeds (from light yellow to black). The most valued landraces are the ones with a larger sharp tip on the grain, and farmers claim that they are growing well. Colored popcorn landraces are grown only for the famers' own use and for the local markets, and are facing extinction in the near future.

Rice is traditionally grown in the Kochani area and is well known in Balkan countries as Kochanski rice. This name indicates only the area of production, while the varieties cultivated over the years are mostly Italian (such is San Andrea) or old domestic commercial varieties which are well adapted to local climatic conditions. Lately, Turkish varieties are participating in the production, but a large number of farmers prefer to grow domestic ones. Although there is constant demand for this crop, the sown area this year was significantly decreased due to a water deficit. The Institute of Rice maintains the largest rice collection with 277 accessions in total, out of which the highest share belongs to breeding material. There were two old landraces of rice in the past: Mesen Blatec and Masurka. The original germplasm for both landraces is lost, with only improved breeding lines originating from Mesen Blatec being maintained.

Fodder crops

Some old landraces can be found for alfalfa, among which is an old commercial variety, Debarska. The interest of the farmers for this landrace is high and distribution of seeds should be organized in order to avoid its disappearance. Old landraces of grass pea (chickling pea) and common sainfoin are also lost, while the ervil which was largely grown in the past as a high energetic feed is still

maintained today for medicinal use only. Small quantities are even being sold at the local markets.

Industrial crops

For the last 50 years, the highest loss of diversity both on a crop and landrace level occurred to the industrial crops. A few decades earlier the most widespread crops were cotton, hemp, poppy, and sunflower; but also peanuts, flax, sesame, castor bean, hop, oilseed rape, and sugar beet were cultivated. Almost all of the landraces of these crops have been lost, while cotton, hop and hemp are not cultivated at all.

The first Macedonian poppy was planted in 1835 in the area of Shtip, during the Ottoman Empire. Towards the end of the 19th century, 30% of the total output of poppy of the Turkish Empire came from Macedonia. One century later, in 1936 a pharmaceutical company Alkaloid was established for the extraction of poppy alkaloids. After World War Two, Macedonia remained the sole opium poppy producer in the Former Republic of Yugoslavia. Its production boasted one of the world's varieties with the highest raw morphine content, ranging between 14% to 16%. The quality of the Macedonian poppy, which for a long time has been regarded as “black gold”, was undoubtedly crucial for setting up the factory. Nearly 14,000 hectares of white seeded opium poppy with white and pink flowers and grey seeds and violet flowers were traditionally grown to support the livelihood of many rural Macedonian families who sold their crops to Alkaloid. The image of the poppy flower, a proud synonym for the quality of Macedonian agricultural products, is printed on the 500 MK denar banknote, while the poppy capsule is printed on the national coat of arms.

Poppy production nearly stopped after Macedonia became independent in 1991 due to the fears that the capsules could be used for illegal drugs. Alkaloid stopped buying the crop and farmers encountered growing legal obstacles. Several years ago, Alkaloid initiated organized production of poppy in cooperation with smaller farmers, providing the seeds from an old registered variety Alkaloid 1 (grey seeds and violet flowers) and buying the capsules. This variety has lost its yielding and quality potential over the years, which is one of the reasons for low farmers’ interest in cultivation. Finally, production rose to approximately 100 hectares over the last few years. According to the National Strategy (2014-2020) current production satisfies only 30% of pharmaceutical requirements, while the rest is covered by imports. The destiny of the Macedonian poppy is a typical example of the disappearance of a valuable genetic resource that may be needed and profitable in the future. Regardless of this situation in many rural areas a few plants of poppy landraces can be found in the gardens. An inventory of plant genetic resources undertaken by the Faculty of Agricultural Sciences and Food, resulted in a collection of 66 samples of poppy landraces, probably some of them originate from Alkaloid 1. However, nearly half of the farmers maintain white seeded landraces, claiming that the seed is very old. There are many old inhabitants that keep old seeds in jars in the basement in order to preserve them. Having in mind the demand of the market, they should be characterized and evaluated in order to obtain improved variety or landrace that they can be commercially valued, which is also one of the planned measures for support in the National Strategy 2014-2020.

The old sesame and flax landraces are maintained by very few households and will be lost in the near future, as these crops are grown on small areas and younger farmers are buying seeds for their cultivation. Commercial sunflower production is based on foreign varieties, while some farmers cultivate a few plants from old landraces in their gardens for snacks.

The old autochthonous varieties known as Strumichki peanuts, grown in the area below Belasica, in the villages Mokrievo, Mokrino, and Koleshino, have specific tastes and are of excellent quality. They are well known and there is continuous demand on the market for them. Activities for their

preservation were undertaken in 2014 by the association Grinvizija from Turnovo, financed by GEF.

Fruit crops

Commercial orchards are almost exclusively consisted of registered varieties; moreover, farmers are replacing old varieties in the gardens and fields with new ones. However, old fruit varieties or wild fruit trees are still present in many villages in the hilly-mountainous regions, mainly as solitary trees, very often along the sides of roads, in meadows, or in abandoned areas. A few examples of farmers-collectors of old fruit varieties are registered as well, or small collections in the schoolyards and monasteries established approximately 80 years ago. Such a collection of four pear autochthonous varieties: Avajlija, Kolachara, Ciganka, and Pershla are still maintained in the schoolyard in the village of Machevo (eastern part of the country).

Old domestic pear varieties named as Arapka, Arganche, Avche (Carigradsko and Evropsko), Bardaklija, Eriasma or Vodenka, Begrem or Karamanka, Drvenjak, Ekshikuti, Ekshija, Ekserka, Gorica, Grmjak, Ilindenka, Kakishka or Kajkushka (summer and winter ones), Kantarka or Popska pear which is a domesticated variety present in other Balkan countries as well, Kurtizaim, Lerinka, Maslarka, Mitrun, Petrovka, Prga, Rashka, Sari armut, Sitnica, Shalganka, Sulija, Tatlija, Tiranka, Trnovka, Trupnjak, Turshijarka, Zimorka, Zutajka etc., were cultivated in the Republic of Macedonia and can be found in some places, mostly as solitary trees. The only orchard with a collection of old pear varieties is registered in Probishtip, where Karamanka, Vodnjak, Carigradsko Avche, Lubenicharka and Ilinka are grown by farmer-collectors on 2,5 ha. Most widespread of the old variety is Karamanka (originating from Karaman, Small Asia) that was introduced by the Turks. Four varieties (Sulija, Vodenka, Karamanka and Drvenjak) are described with the project supported by SDC within the nature conservation program in the River Bregalnica region.

Apple diversity is represented by old varieties Alamanka, Avajlija, Bela (Belicnik), Blaga Vaska, Blazica, Boshnjacka, Bugarka, Ciganka, Drvenica, Gjulabija, Karapasha, Kiselica, Kojce, Kolacharka, Krstovaca, Lepocvetka, Livadarka, Mislimka, Parmenka, Pariska palma, Pasinka, Persha, Petrovka, Pogachara, Radarka, Sareno blago, Tetovka, Zvecarka etc. Fourteen of these varieties are described in the catalogue Balkan Pomology-Apples, supported by the SEEDNet project, planting material is produced and six trees from each variety are planted in a farmer's private orchard in Valandovo. SDC has also supported research on five varieties (Avajlija, Ciganka, Kolachara, Parmenka, and Pogachara) in the Bregalnica region.

Old plum varieties grow in many gardens and fields, especially in the eastern regions of the country. They have different local names such as Banska, Beluvra, Kiselica, Krupna chachanka, Panagjurka, Pozegacha, Pukovica, Stenlei, Zolta, Zimna etc. Trees of the wild cherry plum Dzanka (commonly named as Ohridska Bela, Petrovka, Bistricka Dzanka) with small yellow or red fruits are dispersed in many abandoned areas and in the yards of houses. Local inhabitants use them for preparation of juice and a type of brandy called rakija. The characteristics of Bela sliva (White plum), Bistricka, Beluvra, Magareshka crna sliva (Donkey black plum), Modra sliva, Panagjurka are described in the catalogue Balkan Pomology-plums, supported by the SEEDNet project.

The most famous Macedonian cherry is the Ohridska cresha, referring to the region of cultivation. Practically, several local varieties constitute valuable diversity comprised with this name (Ohridska brza, Dalbazlija, Ohridska Krcka, Dolga shishka, Ohridska crna and Ohridska bela). They are grown in the region of the Ohrid basin in a small area with several villages, between the village Velgoshti and the eastern periphery of Ohrid. It is assumed that cherry production in this region dates from 1,000 years ago. The largest portions of the trees are found in the villages Leskoec and Velgoshti. The agricultural cooperation "Ohridska Chereshna 2015" submitted an elaborate description

paper for protection of geographical indication under the name Ohridska cresha for two of these autochthonous varieties (Dolga shishka and Ohridska crna), approved in 2017. Dolga shishka has slightly larger fruits (23 mm diameter) with a dark red color, shares nearly 90% of the production and in fact it is a synonym for the Ohridska cherry. Both varieties have firm flesh with a sweet taste, but their main economic value is late maturation (beginning of July), when the season for cherries at the market is already closed. It is a valuable characteristic having in mind that Ohrid is a tourist place with its peak in July and August. Ohridska crna matures even later in the season. The fruits of Ohridska bela (white) are used for preparation of the well-known sweet relish from the Ohridska cherry.

Some of these old trees, along with 100-year old trees from other cherry varieties in the regions of Resen and Strumica (approximately 100 trees in total) are marked within a bilateral project with Croatia. Commercial cherry orchards are planted exclusively with foreign varieties.

Similarly, the production of sour cherry is based on the commercial variety Oblachinska (95%), known in Serbia as Ciganchica. An old Macedonian commercial variety Bitolska Marela is still present locally and in the Balkan countries. Wild cherries and sour cherries are also dispersed as solitary trees in many abandoned areas.

The orchards with apricots and peaches are planted with commercial varieties only. The Krupna Skopjanka apricot was accidently noticed in an orchard in 1974 in the vicinity of Skopje by FASF's researchers that also established a large fruit collection in that period. This apricot was intensively propagated, registered in the National Variety List and exported as a variety to other Balkan countries as well. Various commercial varieties are present in the peach orchards as the characteristics of this crop can be easily inherited through seed propagation. For that reason and because of the peach trees' short life, the farmers are not interested in maintaining old varieties. Wild peaches and the local variety Lozarska praska (Vineyard peach) may be found in abandoned places.

In addition to the foreign varieties of pomegranate grown in the commercial orchards in the south-central part of Macedonia, old domesticated varieties like Bejnarija, Karamustafa, Lifanka, Zumnarija and Bejli can be found in the region of cultivation. Quince orchards are mostly planted with Serbian varieties. Mespilus or medlar, named as Domestic medlar, is often present in many yards, as well as the figs. One of the local fig varieties spread throughout the Balkan countries is Petrovka. Other local varieties are probably present within commercial production as well, but so far they have yet to be analyzed. Immature fruits from the wild figs are used for well-known sweet relish that is promoted by Slow Food Macedonia.

Wild nuts are often found in forests, meadows and yards, but their origin is not known, as they were not subject to any analyses due to the difficult description of the morphological traits. Commercial orchards of walnuts, hazelnuts and almonds are planted exclusively with foreign varieties.

All of these local varieties are threatened with extinction if conservation measures are not urgently applied. According to the Law on Forests, permission is needed to cut a forest tree, while fruit trees may be cut at any time without any legal consequences. Some countries have solved this problem by marking fruit trees of importance, which are treated in the same way as forest trees.

Berry production in Macedonia, mainly strawberries and raspberries, relies on commercial varieties only. In fact, wild blueberries, raspberries, blackberries and forest strawberries are collected and sold fresh to buyers or processed in juices and relishes and sold as traditional products.

Grapevine

Wine production is a proud tradition for Macedonia, originating from the ancient times, i.e. the 13th century BC. It is based on the cultivation of many different grapevine varieties. Stanushina is an autochthonous variety, which is grown only in Macedonia, where it has grown in the Tikvesh region for centuries. Historically it is used for making red wine with an aroma of strawberries, raspberries and dry fruits, as well as for the production of Madzun. The recipe for preparing this fermented-grape beverage has been known from ancient times. It is traditionally used as a medicine for liver problems and respiratory infections and as a sugar substitute in home cooking. Though many families have gradually stopped making Madzun, around 60 families still preserve the tradition for their own consumption, while selling a small amount locally. This variety was discovered by the winery Popova Kula, multiplied and reintroduced in the production, followed by other wineries. Another old red variety that is indigenous to Macedonia, Serbia, and Montenegro is Vranec (meaning black stallion). In Macedonia it is considered to be the most important grape variety and represents almost 70% of all cultivated red varieties, and 20% of all vineyards. Kratoshija is a local Balkan variety with black grapes, usually cultivated in the vineyards with Vranec as an additional variety. The most widespread old white variety is Smederevka, which is cultivated in other Balkan countries as well.

In addition to these four varieties, 20 more are included on the list of autochthonous varieties published by MAFWE: Begljarka (white and black), Belo zimsko, Bojana, Veleshko crno, Zilavka, Zupljanka, Kadarka, Konchanka, Manastirsko belo, Ohridska (white, pink and black), Plovdina, Prokupec, Drenok (red and black) and Chaush (pink and white). Table varieties gained importance during the Ottoman Rule, used for the preparation of various sweet specialties and for fresh consumption. Traditionally, bunches of grapes were hung in dry windy ceilings and preserved for fresh consumption until April. This practice is named Vishala.

An elaborate description paper for protection of indication of origin for Valandovsko Belo zimsko grozje (Valandovsko White Winter Grape) was submitted by the company Agrofruktis from Strumica. This variety (synonyms: Jarama, Bel Valandovski drenok, Petrichka esen) is cultivated in Bulgaria and Greece as well and in the Gevgelija-Valandovo region, was the leading table variety in the past.

Old grapevine varieties are threatening to disappear as farmers switch towards modern varieties or are transferring to other businesses.

Medicinal and aromatic plants (MAPs)

There are approximately 3,500 vascular plant species in Macedonia, out of which 700 are considered to have medicinal properties, but only 120 species are utilized. Larger parts of these plants are herbaceous, the rest are shrubs and the smallest portions are woody plants. Their distribution in terms of quantities and quality has not been fully determined; therefore, available information does not reflect the real status of MAPs.

Wild gathered/collected plants consist mainly of high mountain fruits. Most important are blueberries, which are found in almost all high pastures (over 1,300 m above see level.) and used primarily for export (e.g. 83,000 kg in 2001 were worth $US 250,000). They are followed by dog rose, raspberries, blackberries, Cornelian cherry, and plums, used in the preparation of juice and jam. Collecting wild apples, pears and cherries all over the country has increased lately in order to satisfy the increasing demand for the export of fruit teas. Approximately 250,000 kg of chestnuts are collected per year, mostly for the domestic market.

Medicinal plants are collected for own use by local inhabitants and collectors for trade and for other economic purposes. Economically driven collecting varies widely regarding the collected species, collectors and the seasonal quantity of collected material. According to the plant material used (e.g., root, fruit, leaf, flower or stem), plants which are used whole are the most threatened, followed by plants collected for roots. Although there is not reliable and sufficient data, older reports indicate an alarming situation with maximum annual quantities of MAPs exported two decades ago: *Althaea officinalis* (80 t), *Chamomilla recutita* (75 t), *Gentiana lutea* and *G. punctata* (3-4 t), *Hypericum perforatum* (5,000 t), *Lichenes* (1,200 t) and *Tilia cordata* (60 t). Species with a restricted area of distribution are most endangered (e.g., *Acorus calamus*, *Salvia officinalis* and *Sideritis scardica*), although other species are also threatened: *Adonis vernalis*, *Colchicum autumnale*, *Herniaria glabra*, *Herniaria hirsuta*, *Gentiana lutea*, *Gentiana punctata*, *Hypericum perforatum*, *Lichenes*, various Orchidaceae species (bulbs are used for producing salep), *Sideritis raeseri* and *Thymus spp*.

Wild collections in the past contributed to uncontrolled and unsustainable exploitation of the MAPs diversity. Manuals and monographs for collectors of MAPs were prepared in 2004 (issued by MAFWE, supported by SIPPO and GTZ) to educate the collectors. Also under the Law on Forests, the rulebook on the other forest products species and on the manner of usage and collection of other forest products was adopted by MAFWE to regulate the collection of the forests flora and mushrooms. However, the authorities do not apply the existing legislation efficiently.

Based on EPI CENTAR research (data collection and interviews) performed for the creation of Profile of the WGPs value chain in Republic of Macedonia in 2008, supported by AgBIZ, USAID, there are around 80 companies in Macedonia that appear on the export market. In 2007 wild berries and MAPs export accounted for US$ 1,249,000 and US$ 2,239,000 respectively.

According to the project CuLT (Strengthening capacities of farmers for cultivation of MAPs through transfer of knowledge and good practices, implemented in 2016-2017 by Probio, Skopje and other partners), approximately 1,255 t of MAPs were exported in 2012 with a total value of US$ 2,6 million. The potential of this sector is much larger and according to gatherers' estimates, exports could be worth over US$ 20 million. Nearly 50,000 families in Macedonia and 600-700 seasonal workers in the buying centers provide income from gathering wild products. Moreover, a large number of families receive an additional income from gathering, mainly in the hilly and mountainous rural regions.

Cultivation of traditional MAPs (like sesame and anise) started in the 1970s for the needs of a few pharmaceutical companies. In 2011, MAPS were cultivated on 300 ha (mainly poppy, anise and chamomile). Due to insufficient statistical and research information from this sector it is hard to be precise in regard to the area and quantity of cultivated MAPs. It is predicted that 15% of the quantity sold to the buying centers originates from cultivation.

According to the State Statistical Office, the quantity of total purchased medicinal herbs, nearly all from individual producers (collectors) was 432 t in 2012, 959 t in 2013, 403 t in 2014, 374 t in 2015, and 387 t in 2016 with a value of 269,739; 1,007,691; 646,390; 370,081 and 386,406 euros respectively.

2.1.2. Animal genetic resources

In the Republic of Macedonia indigenous or native breeds exist, completely adapted to the circumstances and conditions in particular geographical locations. However, there are also recently introduced and continually imported breeds. Since a national breeding program for improvement of the local breeds has never being in place for all species, farmers looking for highly productive

animals either have imported breeds or used crosses of the local breeds. In the last few years there were attempts at establishing a national breeding program concerning pure breed improvement of the Ovchepolian sheep breed and the local goat. Breeding programs are still in their initial phase, without much progress. Intensive production of cattle, pig and chicken is based on imported breeds, lines or cross breeds. Water buffalo, horses and donkeys have never been part of any recording scheme or part of a monitoring program, except for AnGR protection.

Cattle population in 2015 consisted of 253,442 heads of cattle (Statistical Yearbook, 2016), out of which 156,699 were pregnant heifers and milking cows. Although it is supposed that the population size could be a good base for the dairy industry in the country, the farms' size limits further development. Farmers prefer to produce milk rather than beef in order to improve their cash flow. On the other hand, beef production in the country has never been competitive enough to imported one due to the fact that the grain and forage productions are limited by national agro-ecologic conditions. The greatest number of cows is kept on small family farms where modern technology, sophisticated feeding regimes and highly productive genetics are not applied; however, they are still an important source of income for the family farms. The production system is unfavorable where imported breeds are kept mainly in improper conditions and often crossbreeds are used. However, in remote rural areas, particularly close to hills and mountains, the predominant cattle breed is still the local Busha and its crossbreeds. Crossbreeds are used in order to increase the productivity of the local breed and perhaps to increase the income for the farmers. Although this local breed is still present in some of the farms, it has insignificant importance to the national cattle production. Hence, in the future incentives will be necessary in order to maintain the biological minimum of the breed, which is already integrated in the national subsidy payment scheme. So, in 2016, this local breed was supported with € 25 in addition to the basic € 45 per registered head.

The Busha breed is spread out across mountainous regions. Over the last 30 years, various crosses with different breeds have occurred (Simmental, Hereford, Montafon and Tyrol grey). However, most of them were carried out without a serious program in mind and consequently, without beneficiaries. The Busha cattle breed is an indigenous trans-boundary breed spread out over almost all Balkan countries. It was the most predominant breed in Macedonia until the 1960s. In lowland areas it was rapidly replaced with more productive dairy breeds. Busha is triple purpose breed, used in meat and milk production and in some instance for drafting. Productivity is low due to the poor production systems used. There is evidence where in improved feeding regimes and environments they can grow faster and can produce more milk. Based on coat color, many strains of Busha cattle are distinguishable, and out of them three can be still found in the Republic of Macedonia, i.e. black, red, and gray. Usually production systems are semi-nomadic systems, where during winter, (October – April), animals are kept in rural mountain areas, and the rest of the year are on grazing areas on mountain pastures. Today, most of the Busha cattle are used for extensive beef production and also they are hand milked. Milk is solely used for home consumption.

According to the recent Report of National Identification and Registration Office (Agency for Food and Veterinary, 2016) there are 10,868 Busha heads (4.8% of the total cattle population). About 47.62% of all cattle population is identified as Busha crossbreeds. Besides the population of over 10,000 heads, the estimated population of Busha animals with typical morphological, productive and reproductive description is smaller. A few herds that account for more than 50 heads are mainly spread out in the southern and central part of the country. The rest of the population is in herds with heads located mainly in the east, northwest and south west of the country. All farms are located in the hilly mountain areas where a modified Mediterranean climate is predominant, as well as continental and alpine climate. In the national register for Busha currently there are 898 heads

(831 cows and 62 bulls) kept on 55 farms (ranging from 5 to 64 heads). In 2016, an additional 79 farms were visited and 880 animals were identified (Annual report for AnGR protection, MAFWE, 2016). Their characterization and description is in progress. If the criteria for breeds are met, then those animals will be recorded in the national register.

Sheep production has a long tradition in the Republic of Macedonia. Because of specific semi-arid climate conditions and relief of the country, characterized by large and high mountain massifs, sheep are the animals that provided the basic animal products in the past. In 2015, the population was estimated to 619,839 heads (Statistical Yearbook, 2016). Two-thirds of them were ewes for breeding, while 113,671 were replacement stock. Annually, there is a production of about 450,000 lambs, sold on the meat market. Sheep production has a dual purpose, as lamb meat is considered to contribute 40% of the farm income and the remaining 60% comes from the milk, which is predominantly used in on-farm cheese production. About 50% of sheep products come from Ovchepolian and Sharplanian crossbreeds. The population size of Ovchepolian breed is stable, mainly due to the considerably higher productivity compared to Sharplanian breed. Other highly productive breeds such as Merinolandshaf and Awassi were widely used in the past for crossbreeding and their crossbreeds are still predominant in sheep flocks. The annual subsidies in sheep production in 2016 were € 16 per head, € 12 per produced young (age 6-18 months) animal for replacement, and € 8 additional payment for a registered head of local breed.

There are three Pramenka type breeds in the Republic of Macedonia, Karakachanska, Ovchepolian and Sharplanian. The Ovchepolian breed, as well as its crossbreeds and crossbreeds of Sharplanian breed are broadly used in sheep production.

Karakachanska sheep are characterized by black or black–brown color. The estimated population size is less than 1,000, this strain of which was kept by nomads. The name came from the Karakachans, a Balkan nomadic people. It is considered that due to their extremely conservative livestock traditions, Karakachans saved the most primitive and pure domestic forms of animal breeding. However, this tradition has being abandoned over the years and nowadays a pure Karakachanska sheep is rarely found. This sheep is a very temperamental animal, very dynamic in mountain areas, durable and resistant. Recent farm visits suggest that the population has decreased and currently there are 74 ewes and 14 rams recorded. This breed has been classified as critically endangered from a conservation point of view.

Ovchepolian sheep are white animals with black spots on the head. They are found in the eastern and central part of the country and accounts for 30% (pure breed or crossbreeds) of the total sheep population. It has been massively used in traditional sheep production and farmers are interested in pure breeding. However, this breed has been extensively evaluated and currently in the register of the Recognized Organizations of Ovchepolian Sheep there are 191 males and 5,672 females. It is worth mentioning that the effective population size has increased over the last few years, so the current status of the breed has been changed from endangered to vulnerable. The morphological, productive and reproductive characteristics of this breed have been described, while a description at the molecular level is in its early stage. In the future it is expected that steps towards making a full-description will be taken.

Sharplanian sheep are completely white, being a bit lighter than Ovchepolian sheep. They are located in the west mountainous area of the country, at Sar Planina (the name is related to this mountain). The breed was widely used in crossbreeding program and its crossbreeds account for close to 30% of the whole sheep population. However, currently few farms have been registered with animals that can be morphologically identified as close to the breed's description and further

description is necessary. The current status of the Sharplanian sheep is unknown. It is supposed that the same breed can be found in Kosovo* or Albania. This needs to be proven, if they are animals of the same breed and identify the status of those populations.

Goat production used to be strongly established until goat breeding became prohibited on the territory of the Republic of Macedonia in 1947. The ban reduced the national goat herd from 517,000 heads in 1947 to only 47,000 in 1949. Goat breeding became permitted again in 1989. Since then, the number of goats in Macedonia has risen rapidly. In 2015, a population of 88,064 goats was registered (Statistical Yearbook, 2016). The majority of the goat population was local goat and crossbreeds with Sannen or Alpine breeds. Today, only few pure breed farms of Sannen or Alpine exist. Goats are mainly kept in small flocks (3 to 10 heads), but also 10% of the population is kept in medium-size farms with no more than 200 heads. Unlike the sheepherders, specialized goat farmers are sedentary, keeping their animals on pastures in the vicinity of the farms. Goats on these farms are additionally fed with grains and feed supplements. Similarly to sheep production, the same scheme for subsidies was imposed for goat producers.

The local goat (Macedonian) population has been rather stable over the last decade without any differentiation. The goats may be white, grey, or of mixed colors, typically with long hair. The production is very variable, as well as the body size and condition. It is usually kept on family farms individually (1-3 goats) or in small flocks (less than 30). A number of crossbreeds have been produced with French Alpine and Sannen. Today, different types of animals can be morphologically identified. The current population size of recorded pure local animals is 1,178 does and 79 bucks.

Pig production is a very important sector in livestock production, due to the fact that it continuously supplies the local market with fresh pork. The population has been rather stable over the last decade with 195,443 heads in 2015 (Statistical Yearbook, 2016). Mainly Yorkshire (Large White) landrace and Duroc and theirs crosses are used for pork production. Direct subsidies were set to € 16 per hog in 2016. No additional payments are foreseen for local breeds.

The local primitive pig is present both in the central and eastern part of the country. Local breeds used in the pig industry are insignificant. There is a lack of knowledge on the current population status and production data are not available. Without any scientific data it is difficult to determine whether it is the Djumajliska breed, mentioned on page 318 of the World Watch List – 2nd Edition (FAO, 1995), or some other breed. Until now, more than 50 farms were visited but according to the morphological characteristics only 14 heads were identified as local breeds. Therefore, this primitive pig has to be intensively examined in the near future.

Poultry is predominanted by chickens. In 2015 (Statistical Yearbook, 2016), the population was estimated to be 1,423,841 layers and 51,256 broilers. Other poultry is represented with about 1%. Egg production is organized on modern farms with intensive production system. The commercial stock is used in the production. In 2016, subsidies were set to € 0.5 per broiler, € 0.46 per used hen, and € 0.05 or € 0.08 per one day old chick for on-farm replacement or sold, respectively. No additional subsidies are foreseen for maintaining local breeds.

Srebra is a local chicken breed. Up to now, more than 60 farms were visited where about 1,213 chickens were examined. Currently, only 119 hens and 30 cocks have been recorded in the national register.

The **water buffalo** population in the Republic of Macedonia is continuously decreasing in number. The production is insignificant and completely neglected. Water buffalos were kept close to wetland areas in the past. In 2016, the population consisted of only 55 animals (28 cows and 6

bulls). There has been a decrease in that number by 10 animals since 2015. The status of the local water buffalo breed is critical and it is questionable if it will survive in the future. All animals are located on five farms. Due to the current status of water buffalo population, besides the support of € 46, an additional € 40 per head was allocated in 2016.

The **equine** population in the country accounts for more than 18,000 heads, but it has never been seriously studied. There is only one local type of horse used in hilly mountains. Until now, 110 mares and 15 stallions have been recorded. The local donkey population is also unknown, but so far 31 mares and 8 stallions have been recorded in the national register. They are mainly kept as working animals. The current status of this population is unknown and has to be examined in the future.

2.2. CONSERVATION EFFORTS OF GENETIC RESOURCES

2.2.1. Plant genetic resources

The first organized activities concerning PGR conservation and utilization in the Republic of Macedonia were undertaken during the period 1969-73, as a segment of a large project for collection of crop populations and landraces on the territory of the former Yugoslavia. Thousands of samples were collected and evaluated in Macedonia, while the seed samples were transferred to various gene banks in the USA. Passport, characterization and evaluation information about these accessions are available at GRIN database (Germplasm Resources Information Network) - a program within the U.S. Department of Agriculture.

Field collection of fruit crops and grapevine has been gradually enlarged over the years, by hard work of researchers from FASF and IA. The majority of the trees were planted in 1970s were of foreign material. Following the institution's separation the collections stayed in possession of the IA and were continuously upgraded with new samples.

As explained in Chapter 1.3, three research institutions, IA, ISC and SIT, received support for the establishment of gene banks and for the conservation of agrobiodiversity. However, the financial support (approximately 15,000 euro per year, with the largest share distributed to the IA) was symbolic and intermittent. In addition, the institutions used the funds for solving other operational problems and deficits. Subsequently, ISC has created a very small collection of industrial and vegetable crops, while SIT preserves a collection of tobacco only, while IA was preserving a seed collection and a large collection of fruit crops and Vitis. Predominantly, that material consisted of foreign and domestic varieties, breeding lines and a very small percentage of autochthonous and local varieties. Moreover, the accessions in all collections were not characterized, evaluated and documented adequately. Many of them were regenerated each year within the breeding collection, considering that the IA and the FASF had active breeding programs in that time. All information regarding the collections was preserved by breeders, often in notebooks for their use only.

In 2003, GTZ supported a project "Initial activities for conservation of agrobiodiversity in the Republic of Macedonia", which was implemented by the FASF. The activities for inventorying the PGR and AnGR were carried out in 20 sites in Maleshevo (13) and Strumica regions (7). Approximately 730 seed samples of local populations were collected and promoted in the Skopje Agricultural Fair in 2003. The results were published in a brochure, while the samples were stored in the IA's collection.

Conservation efforts were dramatically increased in the period 2004-2010 in the scope of the

SEEDNet project. The Institute of Agriculture in Skopje was appointed as the national gene bank, responsible for maintenance of all national collections. For that purpose, IA was equipped with 30 vertical freezers (-18°C to -20°C) with a storage capacity of 10,000 seed accessions and a facility for seed preparation before storing. An inventory of the old collections was undertaken with priority for regeneration given to the domestic breeding material and landraces. In addition to this, during that period many field trips were organized for collecting crop landraces, wild species and MAPs. The medicinal and aromatic plants were planted at the Botanical Garden at the Faculty of Natural Sciences, Skopje. All accessions that were stored in the gene bank were documented according to gene bank standards and maintained in the form of active, base, safety duplicate, and distribution collection. Various activities were performed for raising scientific, governmental and public awareness. Although the fact that Republic of Macedonia was the only country without any significant governmental support, it was the leading country in the conservation activities since the beginning of the project. Therefore, many trainings and meetings were organized in Skopje. Finally, data on 2,158 accessions were uploaded in EURISCO and seed samples were packed as safety duplicates to be sent in Svalbard Global Seed Vault (SGSV). After the finalization of SEEDNet support, the gene bank of IA consisted of 2,666 accessions in total, out of which 1,579 belonged to the seed collection, while the field collection had 603, 439 and 45 accessions of fruit crops, Vitis and MAPs respectively. More than half of the accessions were commercial varieties and breeding material. Autochthonous and local or wild material (in the case of fodder crops and MAPS) comprised 44.5% of the collection, or 1041, 234 and 123 of the seed, fruit crops and Vitis collection. Within the 773 accessions in the cereal collection, there were 277 rice accessions maintained by the Institute of Rice, which is a member of the Institute of Agriculture. All activities were ceased after SEEDNet support termination.

Unfortunately, the successful results turned out in completely different present situation, due to various reasons. Currently, the IA has the passport data regarding the seed collection that is uploaded to the EURISCO site. Safety duplicates were never sent in SGSV, and since 2013, samples have not been regularly checked for germination status, due to the critical financial situation of the IA. MAPs collection in the botanical garden has also been abandoned, as most of the plants were annual or biennial plants and were not regenerated. The experimental fields that were in the possession of the IA had different destinies. Fruit crop collection was established in two fields. Almond (74 samples), peach (~200 samples) and apricot (~250 samples) trees were planted in the experimental nursery “Rasadnik Kisela Voda” of ~2 ha. That area was denationalized by law and returned to its former owners, after which the collection was destroyed. The rest of the fruit collection was planted at the 72 ha experimental field in Dolno Lisiche (Skopje periphery), which was transferred to the possession of FASF in 2014 by the decision of the Ss. Cyril and Methodius University in Skopje. This collection, which once consisted of 183 apple accessions, 90 pear, 48 plum, 46 cherry, 17 strawberry, 9 sour cherry, 8 hazelnut, 7 raspberry, and 4 blueberry accessions is also lost due to the absence of tree nursing and denationalization of some parcels. Vitis collection (438 samples) was placed in another experimental field of the IA in Butel (in Skopje). This area was used for construction of a ring road and the whole collection was destroyed. The experimental field in Kochani has also been denationalized, meaning that the maintenance of the rice collection will be insecure as well.

The Department of Genetics and Plant Breeding (DGPB) at FASF has been active in the area of PGR conservation for several decades. Motivated by the current status of IA’s collection, in 2014 the DGPB initiated the establishment of a new seed collection of autochthonous and local germplasm only. A smaller percentage of the seed samples were collected within the project “Preparation of an Ecological GAP Analysis and ecological sensitivity map for Bregalnica river basin”, carried out in 2015. Intensive field trips to 150 villages in 14 municipalities resulted with a collection of 3,770

seed samples of 58 crops. Currently, the seed collection of FASF consists of 5,946 accessions of 72 crops, collected from 438 sites in 69 municipalities in Macedonia. DGPB is equipped with facilities for seed preparation before storage, and with a modern laboratory for molecular genetics. However, these accessions have a small number of seeds and urgently need to be multiplied, while characterization and evaluation should be done gradually according to the prioritization of crops. Material that will be classified as traditional and divergent will be maintained in the gene bank.

Small GEF projects have also supported conservation of fruit varieties. Among them, initial activities for preservation of eight rare pear varieties: Petrovka, Ilindenka, Zutajka, Begrem, Vodenka, Tiranka, Kakishka and Trupnjak in the Northeastern region (municipalities Staro Nagorichane, Rankovce, and Kriva Palanka), were implemented by the organization Business Club from Kriva Palanka. A project for preservation and reunion of the apple Ciganka and pear Sulija, typically present in the regions Pijanec and Malesh, was implemented by the Association Aronija from Delchevo in 2008 and reinforced in 2012/13. The same association implemented a project in 2006-2007 in the region of Pijanec for the preservation of the autochthonous blue plum variety “Banska”, known as “Gornodzumajska” as well. Preservation of autochthonous varieties of apricot (Krupna Skopjanka) and pear (Karamanka) in the vicinity of Markov Manastir (near Skopje) was initiated in 2014-15 by the association Eko Gol Drvo.

Except for the fruit crops regarding some trees that are marked in their natural habitat during realization of specific projects, official *in-situ* conservation (in garden and on field) has not been established in Macedonia. The first attempts to conserve PGR *in-situ* were undertaken in 2007 with the establishment of collaboration with farmers for on farm conservation of 12 pear landraces. Later on, other fruit trees were conserved *in-situ*, mostly with the projects supported by GEF (described in the Chapter 2.1.1.). Gene banks have information with contact details regarding the farmers that maintain certain landraces, but such preservation of PGR is not institutionally regulated with contracts that will secure long-term *in-situ* conservation or supported by the government. Therefore, *in-situ* conservation depends on the farmers’ needs and decisions only.

Having in mind the aging population of these rural areas, migration of young people to urban areas, and twisting the agricultural production towards higher profit, based on commercial varieties, local varieties and populations are under the increased threat of disappearing. Previous studies indicated that farmers have a strong interest to grow locally adapted varieties, especially the small farmers that produce food for own needs and for the local markets. They are not satisfied with the taste and quality or with the high inputs needed to obtain satisfactory yields of the commercial varieties. This fact may be used to increase on farm conservation and the participatory approach of the farmers, based on mutual interest with the research institutions. Research institutions with available facilities, infrastructure and human capacities should be appointed to organize a national seed vault or seed network. This institution, supported by the government, will conclude contracts with farmers maintaining various local varieties from different crops. In addition to the on-farm conservation that will be sustainable in this case, researchers will collect *in-situ* long-term information from the farmers about the varieties’ morphological and productive characteristics; moreover, samples for the seed collections in gene bank will be regenerated each year in this case. This is specifically adequate for the open pollinated crops that acquire isolation systems during regeneration. The farmers will have access to scientific results and will be provided with the contacts of seed/products buyers.

2.2.2. Animal genetic resources

Local breeds have recently been examined and according to the latest report for AnGR protection (MAFWE, 2016) the following breeds have the current status:

- Busha cattle breed - classified as at risk.
- Ovchepolian sheep breed - not endangered.
- Sharplanian sheep breed – unknown.
- Karakachanian sheep breed – critical.
- Local goat breed – critical.
- Local primitive pig – unknown.
- Local water buffalo – critical.
- Local chicken Srebra - at risk.
- Local horse – unknown.
- Local donkey – unknown.

Two recognized organizations for the protection of the autochthonous breed were recorded in the MAFWE register (associations for Busha cattle and Ovchepolian sheep breeds). The farmers' association for Srebra chicken was established, but it is still not recognized by the MAFWE. Farmers' associations have been established in order to enhance the breeding program, but also to represent, as an umbrella organization various activities for conducting educative and promotional events for raising public awareness.

Current protection programs are running for Busha cattle, Ovchepolian sheep, and Srebra chickens. Farmers' participation and initiatives have been encouraged, but are still not sufficient. In most cases, experts are motivating and initiating farmers to deal with local breeds. In all three cases, the breeding programs are in their early stages, and the outcomes have not yet been recognized. If the National Program for Protection of AnGR for the next seven years is able ensure financial support for the continuation of activities, perhaps a base for future sustainability can be reached. Hence, further continuous work will be necessary in order to ensure sustainable on-farm protection. In addition, the GEF small grants program supports protection programs in Karakachanian sheep and water buffalos. Those programs are in their initial phase and their outcomes have not been integrated in the national report for AnGR (MAFWE, 2016). Nevertheless, all activities are strongly coordinated by the experts from IAB (FASF).

Under the seven years' program commitment material for the gene bank was collected. The current status of the gene bank is a public service provided by FASF and FVM. In accordance with the Law of Livestock Production, the legal entity of the gene bank was not foreseen in order to provide organizational and operational flexibility. Ownership of the genetic material maintained in the gene bank is under the Republic of Macedonia. However, a very limited number of persons are aware of the gene banks existence, as its presence is not widely known or publicly available (the web page is under construction). The institutional framework and legal entity of the gene bank of AnGR also needs to be considered in the future. Currently, access to genetic material has not been foreseen for breeding or research purposes.

So far, cryo-conservation of genetic material has been done for Busha cattle, Ovchepolian and Karakachanska sheep, and the local goat.

Currently, there are 1,003 semen doses for Busha cattle in the gene bank. Blood samples, hair and tissue samples are conserved as well. About 50 DNA samples of this breed were sent for

SNP characterization. From the Ovchepolian sheep breed, 3,906 semen doses and 19 oocytes have been cryo-conserved along with blood, wool, and tissue samples. Karakachanska sheep are represented with 204 semen doses in the gene bank, as well as with blood, wool, and tissue samples. From the local goat, there are 937 semen doses collected, in addition to blood, hair and tissue samples.

For all conserved samples there is limited documented information publicly available concerning the origin of animals, their pedigrees and characteristics. Hence, it is unclear how the current gene bank can serve for the future protection of AnGR.

2.3. SOCIO – ECONOMIC ASPECTS OF AGROBIODIVERSITY PROTECTION

Today, it is widely accepted that the transfer to cultivation of commercial varieties with narrow genetic base and neglecting of indigenous knowledge results in the rapid loss of traditional varieties best suited to the prevailing agro-economic conditions. This has contributed towards the cultivation of unsuitable crops for marginal farming areas.

Traditional varieties are even more important for Macedonia as it is a small country, unable to provide large quantities of commercial crops for export. In fact, a significant amount of the agricultural income of the small farmers, especially in the rural areas, is still provided by selling well-known traditional varieties in the local markets. Almost all households with a garden, even in the larger cities, produce food for family consumption, maintaining the quality of their life at a higher level than it would have been possible to have done with their income. Lately, the income of many farmers has increased by adding value to the primary products through applying different post-harvest technologies or through processing the crops into different type of relishes. In terms of rural development, especially for promotion of eco-tourism, traditional food is important link to the cultural and historical aspects.

A large part of the food production in Macedonia relies on small agricultural holdings. According to the Statistical Review (2013), out of the total number of household members participating in agricultural production (in total), women contribute with an almost equal percentage (43%) as men. This contribution is well acknowledged by the scientific community, but remains underestimated to the policy makers and as a consequence is not properly valued and integrated in the governmental policies and strategies. Furthermore, their significance in maintaining stable food security and livelihood is rarely recognized by the opposite gender, especially in the rural areas and in some minor religion and ethnic groups.

In the small agricultural holdings in Macedonia, there are clear differences between the role and farming practices of men and women, based on a complex of interrelated socio-economic and agro-ecological factors. Women largely contribute their labor and farm management as well and moreover, they are custodians of the crop diversity. They are responsible for the cultivation of food crops, storage, processing, and seed preservation. In respect to food security, productivity is not their main priority for the selection of crops and landraces. They give much greater attention to the non-monetary values of the resources, and prefer to grow locally adapted, diverse, and traditional crops. This enables them to keep their culinary habits, without feeling pressure on their time and land resources and gives them full market autonomy. Such tradition is reversing the erosion of many crops and as a result many neglected or underutilized crops have been saved from extinction, which is completely opposite to the formal seed distribution system based on several cash crops.

On animal farms man is responsible for keeping animals, mating schemes, feeding and growing/ providing forage. On the other hand, in small farms, where on-farm processing is conducted, women are involved in milking, handling and processing. For milked animals, an important aspect is on-farm cheese production, but also other dairy by products with added value. Women are also involved in the selling of products at traditional green markets.

Rural women also possess indigenous knowledge on farming and use of the products, based on unique experiences acquired over the centuries. A wide range of indigenous agricultural land use practices by farmers is based on generations of informal experience, experiments and intimated understanding of biophysical and social environment. This knowledge allows communities to control local environmental problems as well, using endogenous solutions.

2.4. STATUS OF PUBLIC AWARENESS

The status of public awareness regarding agrobiodiversity has increased significantly over the last decade, due to many activities undertaken mostly by SEEDNet project, projects supported by GEF, and various workshops and trainings organized by MAFWE and local communities.

SEEDNet activities at the initiation phase were concentrated on the training of researchers regarding collecting, characterizing, evaluating and documenting samples, on farm conservation as well as gene bank management. A broad range of activities were undertaken for raising the awareness of the general public through TV and radio media (for that purpose TV spot was created), distribution of leaflets, publishing articles in newspapers, organizing workshops and meeting with the farmers, etc. After SEEDNet was started and many activities were accomplished the journalists became familiar with the PGR preservation and value of PGR and started to write stories about many old Macedonian varieties. Great pressure was placed on policy level as well, which resulted in the establishment of the Gene Bank Division at MAFWE. This aggressive campaign resulted in a small component for the agrobiodiversity protection integrated in the national strategy 2007-2013, followed by significantly enforced policy support in the strategy 2014-2020. Politicians are well informed about the importance of agrobiodiversity and its potential for profitable agriculture. However, the process leading to practical realization of such goal is still misunderstood by the government administration. That may be improved by *various workshops and informal trainings created for improving institutional capacities and legal framework*.

Courses regarding the conservation of the PGR are integrated at FASF's curricula at all three levels of study. Research on GR in Macedonia on mainly beans, pepper, poppy, wheat, and barley is subject of several graduation, MSc and PhD theses. Following current agriculture and food policy trends, formal education needs new and/or enforced courses on breeding, seed production and adding value to traditional products. The MAFWE continuously organizes workshops and supports trainings to promote possibilities to cultivate and use autochthonous genetic resources and to protect traditional varieties, breeds or food products with specific designation for quality. Although such activities are supported by the new strategy (2014-2020), farmers and associations are not well informed about all possibilities. Aside from workshops, *practical guidebooks* should be distributed to the farmers so as to disseminate information on agrobiodiversity values and potentials in each region, and local communities need to establish an *on-line catalogue of local traditional genetic resources* with photographs, description and contact details about the farmers that maintain those resources. The results obtained by the conducted inventory so far indicate farmers' interest in the cultivation of certain landraces, such as Debarska alfalfa and Belica wheat that are almost lost. *Seed Exchange Fairs*, with the possibility to exchange material and knowledge

on the local markets, could increase farmers' interest and accessibility to autochthonous varieties.

Until now, four courses have been developed for training of farmers in characterization, morphological description and general breeding aspects for local breeds (Busha cattle, horse, sheep and goat and chicken) with the courses having been developed by the experts from IAB (FASF). A few promotions of the local sheep breeds were organized during the annual exhibitions for sheep. Media coverage was substantial during the exhibitions, but less so afterwards. Public media coverage was carried out during the annual assembly of Busha farmers' association. The association is attempting to be regularly presented in the local publication (four issues annually), focusing on cattle production.

Aside from large coverage on TV/radio/internet with information on agrobiodiversity in general and of different specific products (Tetovo bean, Bukovska pepper, traditional dairy and meat products obtained by milk of local breeds), subsistent promotion may be provided by regular TV shows on presenting one traditional agricultural product/food in each show enriched with information about its characteristics, origin, use, value and contacts to obtain seeds or local breeds.

Finally, for a practical exchange of information and ever-growing awareness there is a need for the *National Agrobiodiversity Information System*, created and maintained by an institution that possesses knowledge, information and/or seed and AnGRs genetic material collections, link to farmers' associations and other relevant information.

3. CONCLUSIONS

The Republic of Macedonia is considered to be a biodiversity hot spot of international importance. Its climatic and geographic characteristics, combined with its strategic position at the crossroad between Europe and Asia have contributed to the cultivation of various agricultural plants since ancient times. Unfortunately, economic stagnation, high unemployment, and the status of poverty, poor infrastructure and the isolation of rural areas are the main reasons that the valuable diversity of genetic plant resources are still maintained by the “custodian farmers”.

Landraces originating from domesticated foreign varieties introduced decades ago or locally developed as autochthonous are often inherited within the families with generations, together with the traditional knowledge on agricultural practices and use of crops. The highest diversity of landraces is preserved for beans, corn, vegetables, fruit crops and grapevine. Some of them, such as the Tetovski beans, are cultivated on large areas accounting for the majority of commercially produced bean product. A larger part of the diversity is maintained for the farmers’ own use or for the local markets. Landraces of many industrial and forage crops have already been lost, while many old vegetable and fruit varieties are under the threat of extinction. The preservation of landraces predominantly depends on women's decisions regarding starting with the selection of preferable crops and landraces, maintaining and exchanging of seeds, up to the specific use of the products.

Most of the activities for research and conservation of agrobiodiversity are performed by the Faculty of Agricultural Sciences and Food and Institute of Agriculture in Skopje are mainly supported by foreign donations. The SEEDNet project (2004-2014), financed by Sida, significantly contributed towards establishment or upgrade of infrastructure, facilities, and human capacities. The Institute of Agriculture was appointed as a national gene bank, currently maintaining a seed collection of 1,579 accessions in total. Nearly half of the collection are landraces, while the rest is comprised of commercial varieties and breeding material. All accessions have documentation data and approximately half are characterized. This project provided a scientific base for excellent regional cooperation as well as a notable increase of awareness of the general public and policy-makers. Due to various governmental decisions and lack of further support, the maintenance of the created national collection is not sustainable. Starting from 2014, Faculty of Agricultural Sciences and Food has been creating new seed collections, exclusively of landraces. Currently it has approximately 6,000 accessions collected from 438 sites in Macedonia that are not multiplied, characterized or evaluated. In order to preserve this national treasure, both institutions need sustainable support from the government. All national collections and performed activities are not transparent and available on-line, the conservation of agrobiodiversity on a national level needs an organized and systematic approach, allowing long-term sustainability.

Commitment from the National Program for AnGR Protection (2011 – 2017) and GEF small grant projects provided substantial achievements in AnGR conservation. Although Busha cattle and Ovchepolian sheep have had considerable protection, their long-term sustainability could easily be jeopardized if further financial support is no longer available. Other breeds are in the initial phase of characterization and documenting, but unfortunately, water buffalo will, in all likelihood, become extinct. Gene bank for AnGR conservation has been initiated, but it is still not fully operational. Hence, in the future the institutional and operational set-up of the gene bank is necessary.

The support from the Government for conservation and use of agrobiodiversity over the last few years has been negligible and sporadic. The national strategy for the period 2007-2013 comprised

measures for conservation of PGR and AnGR with increased financial support. The budget for PGR conservation was not used due to poor harmonization between the legal documents referring to the seed and planting material. These documents have to be revised and modified urgently in order to enable the implementation of the significant financial support for agrobiodiversity conservation predicted in the current national strategy (2014-2020). In addition, the seven-year program (2018-2024) for AnGR protection needs to be prepared, adopted, and supported by the MAFWE.

4. PERSPECTIVES AND RECOMMENDATIONS

4.1. RECOMMENDATIONS FOR CREATION AND UPGRADE OF POLICY AND LEGISLATION

Despite the possession of valuable genetic resources used in agricultural production, Macedonian governmental policy over the last few decades has not been directed towards supporting the preservation and use of those resources; moreover, intensive measures have been applied in reforming agriculture to develop a modern and economically profitable sector. National breeding programs that were maintaining and using agrobiodiversity resources for creation of new varieties and breeds were not sufficiently supported as they were considered to be self-sustainable. This durable *poor assessment of the agricultural goals and institutional capacities led to the termination of all breeding programs and to a significant loss of national genetic resources*.

Today, agrobiodiversity is identified as one of the main critical and/or emerging issues on an international and national level regarding food security, nutrition and improvement of rural farmers' livelihood. Corresponding to this statement, the *national policy is significantly incorporating measures for preservation of agrobiodiversity in various legal documents. However, neither horizontal nor vertical integration between institutions has been prepared for successful implementation of the planned measures*.

There is a new measure in the national strategy 2014-2020 for support of organized breeding and seed production of autochthonous varieties with the potential for profitable agricultural production, specifically for Tetovski beans, Buchinska arshlama (onion), tomato Skopski jabuchar and pepper Kurtovska kapija. This measure may be applied to many other landraces as well. Direct payments for cultivation of autochthonous varieties will be enlarged and will be provided according to the current legal documents based on the *List of autochthonous varieties*. Autochthonous and local varieties may be registered on the National Variety List under that designation and take part in the formal seed trading process, based on previous research results or well-known information considering their value. *The content of both lists has to be revised and complemented with many local varieties*.

The initial set-up of AnGR protection in Republic of Macedonia has been done; however, certain improvements are still necessary. In particular, policy and legislation should enhance breeds that are at risk or unknown status. In the past, most of the activities were focused on easily accessed local breeds. The main reason was uncertain support for longer periods (annual contracting cannot ensure planning and obtaining satisfactory results on yearly basis). Mid-term projects (3-5 years) could enlighten the current status in those populations and take measures for their protection.

Another important issue is the sustainability of the AnGR gene. Now it is also a part of the yearly program support. As was often seen in the past, continuous coverage of genetic material maintenance costs is missing. In addition, AnGR gene bank is presently defined as a public service, and it needs to be deeply regulated by laws and regulatory acts. It is of particular importance to determine the ownership, proper characterization and description, public presentation and to enable easy access of the genetic material for farmers or other stakeholders.

In order to improve the policy for agrobiodiversity conservation and use, the national strategy with

an action plan has to be elaborated and adopted with a clear division of responsible institutions for the implementation and financing of various actions.

4.2. RECOMMENDATIONS FOR IMPROVEMENT OF INSTITUTIONAL CAPACITIES

Scientific capacities have been improved in terms of knowledge and experience in conducting activities for agrobiodiversity preservation mainly by foreign donations. Two research institutions have been specifically active in the creation of collections and their use for breeding in the past. The Institute of Agriculture has had insufficient human capacities and a severe lack of budget for regular operations for several years now. Since 2014, the Institute has had no experimental field due to poor governmental decisions, meaning it has been unable to maintain and regenerate the created seed collection. Meanwhile, the Faculty of Agricultural Sciences and Food in Skopje has had the sufficient human resources, with a regular budget for basic activities, modern laboratories, a large number of seed samples collected during inventorization activities and a large experimental field in the vicinity of Skopje. *Both institutions have to be supported by MAFWE and systematically integrated into the conservation process*.

In the case of AnGR, institutional capacities for the time being are sufficient, but further improvements could be made in areas such as modernizing laboratories (testing production level, biotechnology and cryo-preservation).

4.3. RECOMMENDATIONS FOR IMPROVEMENT OF AGROBIODIVERSITY CONSERVATION

The conservation process itself, in order to be systematic, transparent and sustainable has to be organized with the contribution of several institutions. One research institution with the highest potential in capacities has to be appointed as a holder of the *Information System on Agrobiodiversity and National Inventories*. For that purpose, a separate Centre of Agrobiodiversity has to be established within the institution with at least two regularly employed researchers, one for plant and the other for animal genetic resources. New employment should be supported by the Government. In that way, all information regarding collecting, characterizing and evaluating genetic resources in the country acquired by various institutions, NGOs and organizations will be stored and organized on one database, transparently published online and available for all interested parties. Such centralization of information will assist in performing unique actions instead of repeating the same activities over the years.

Considering the large number of educational and research institutions in a county as small as Macedonia, it is not feasible that all educational and research institutions have strong capacities in each area of agrobiodiversity. Therefore, separate gene bank collections of various crops may be maintained and stored by separate institutions that have infrastructural and human capacities for regeneration and maintenance of the specific crops. For that purpose, they a need regular and sufficient budget provided through the Directorate of Seed and Seedlings. In return they will be obliged to report the status of the collections twice a year to MAFWE and to the Centre of Agrobiodiversity for update of information database. Another benefit of this system is that seeds collected by various NGOs without any capacity to store them will be preserved in the gene banks.

The Centre of Agrobiodiversity will collect information from MAFWE about the farmers that have

received support for cultivation of local and autochthonous varieties. Along with the farmers' contact details collected during the inventory missions, they will represent a solid base for the creation of a *Register of Farmers* that maintain specific landraces.

In order to assist such support in the future and to organize efficient control of the seed production from local varieties, the collected material of a specific crop preserved in the gene banks has to be experimentally described and evaluated in comparative trials. All different landraces of that crop will be determined and published in a Catalogue of Landraces, with appropriate information and photographs. Only those seeds will be stored in the gene banks, which will reduce the size of the inventory collection and the costs for its maintenance as well. The *Catalogue of Landraces* with the contacts of farmers that preserve such landraces will be available on-line and distributed to each local municipality in the country. In that case farmers that are interested in growing certain specific local varieties will have ready access to seed material. That will contribute to conservation efforts and even more importantly to the diversification of the agricultural production, which is also one of the strategic goals of MAFWE.

Comparative trials for a crop with a large number of collected accessions will consume a significant amount of time, labor and budget. Physically it is impossible to construct catalogues for all crops, simultaneously, over a short period. Government support in this case should be planned based on the *List of Priority Crops and Landraces*, i.e. starting with the four crops that have already been mentioned above. For the rest of the crops a temporary catalogue of inventory collection may be prepared.

The on-farm conservation needs to be supported by MAFWE in order to secure adaptation of local varieties to the local growing conditions, especially to drought and diseases. This type of conservation needs to be enforced by contracts with the farmers that maintain specific varieties. Contracted farmers will receive financial support from the MAFWE to cultivate a landrace and provide a certain amount of seeds each year to the gene bank indicated in order to ensure the preservation of that crop. Farmers will be also obliged to provide information regarding the size of the field/number of plants, cultivation practices, and major morphological and yielding characteristics to the Centre of Agrobiodiversity. This system will enable consistency in long-term evaluation of the landraces and provide accurate information for scientific research. Moreover, *on-farm conservation based on mutual interest* will increase the active participation of farmers in the conservation process. In return, farmers will be able to receive free advice and extension services through the Centre of Agrobiodiversity.

In most cases, valuable genetic diversity is maintained by small farmers in small sized gardens and fields fragmented into many parcels. Such land resources represent a major gap in approaching commercial production levels. That said, the preservation of agrobiodiversity relies on this fragmentation which motivates farmers to grow diverse local landraces. In addition to providing food for themselves and their family, many farmers sell surplus products on the local markets. An incentive measure predicted in the national strategy 2014-2020 is the support for the association of farmers producing common crops in order to provide higher product quantities or to add quality value. Some of the rare landraces are still maintained for preparation of traditional sweet relishes (from pumpkins or from watermelon rinds), spices, bread, etc. *The efficient support for protection of traditional products will reduce the erosion of rare landraces*.

Another strategic goal of the MAFWE is to increase organic agricultural production. This type of production has to rely on local varieties as they have a better taste and high resistance to biotic and abiotic stresses. The organic producers have to be motivated to select a landrace, instead of

a commercial variety for cultivation. They can also use the on-line catalogs and registers to select a specific landrace.

Sustainable use of already protected breeds should be ensured. The Busha cattle breed is not endangered, but in order to prevent crossbreeding and genetic erosion it should be integrated into a continuous breeding program for improved milk production. Similar activities are necessary for the Ovchepolian sheep breed, where by increasing the milk production, the breed will be more attractive for the farmers in the future. A further deeper description of the breeds is still necessary in order to identify the potential added value of their products. Special attention should be given to the development of such added-value products for niche markets, in particular milk products, that can be rather easily promoted within the already established facilities for rural tourism.

A notable share of the resources still present in the field have been collected over the last 15 years. However, a large part of the current resources will be lost in the rural locations with enforced aging and emigration of the population. Having in mind that Macedonia is a small country and that almost half of the populated places were visited in seed collecting missions, the inventory in the rest of the territory should be continued in order to preserve the remaining PGR.

4.4. RECOMMENDATIONS FOR IMPROVEMENT OF SCIENTIFIC AND PUBLIC AWARENESS

Promotion, education and public awareness on agrobiodiversity importance should be continuous, since most of the activities conducted so far have scientific approach. In order to increase the importance and meaning of the local varieties and breeds and their perception in society, activities for promotion of their traditional, environmental and cultural values should be carried out. *Public presentation of traditional products* on media and various events/fairs can significantly increase the knowledge and demand by consumers. *Education and training of farmers* has to be supported for the possible benefits of maintaining local varieties/breeds and producing traditional products. Traditional knowledge and the crucial role of woman in conservation should be emphasized to the farmers, especially in the rural areas. Public awareness may be raised through *specific education programs in kindergartens and schools*. The awareness level of policy makers has to be upgraded through trainings and workshops.

Scientifically sound research projects are also beneficial in order to increase the knowledge for the genetic value of the local breeds. It can enlighten their adaptability to the local environment, their role in high nature value areas protection, potential diseases tolerance or specific composition of the animal product for food consumption. The results of those research projects can be broadly used in promotions of local breeds' importance and value-added products. Promotion, education and public awareness needs be continuous, as most of the activities conducted for AnGR protection (identification, registration and description of local breeds) have a scientific approach. In order to increase the importance and meaning of the local breeds and their perception in society, projects for promotion of traditional, environmental and cultural values of the local breeds should be set. Public presentation of animal products can significantly increase the knowledge and demand by consumers. Education of farmers, high school students and researchers in terms of local breeds use in non-crossbred systems will be also beneficial. Public awareness is still at a low level and should be raised in rural areas, but also in consumers and policy makers. Presentations in the media are mainly limited to specific events. Generally, media coverage is during the local fairs or exhibitions of live animals. Support and encouragement is needed in order to increase local media (radio, TV) interest for frequent broadcasting of local varieties/breeds value and their products.

4.5. RECOMMENDATIONS FOR IMPROVEMENT OF REGIONAL COOPERATION

Regional cooperation is necessary for efficient evaluation and conservation of specific varieties grown in several neighboring countries. For example, some of the fruit crops and grapevine varieties are commonly found across several Balkan countries. Collection, characterization and evaluation of such varieties have to be performed through regional projects and published in a regional catalogue. Traditional products should be also promoted on a regional basis, as many of them are prepared in a similar way in several countries. It is the only way towards providing higher quantities of the products for commercial sale and export. Exchange of practical and scientific information through the Centre of Agrobiodiversity will potentially enforce the collaboration and participation of the countries in joint research projects and attract higher support by the foreign donors.

The cooperation will be more efficient through a regional agrobiodiversity network involving various participants in the process of agrobiodiversity use and conservation. Results and activities should be disseminated through the web portal created by the network. In addition, regional cooperation will help in conservation efforts for the varieties/breeds that are common for the region as well as for the exchange of experience, knowledge and expertise.

As is the case with some other countries/entities in the region, Macedonia is not a contracting party of the ITPGRFA, meaning that it cannot apply for various supporting funds. *Providing membership in the Treaty is crucial for participation in regional projects and enforced collaboration*.

5. CASE STUDIES

CASE STUDY – BUKOV PEPPER

The name of the spice Bukov pepper or Bukovec originates from an autochthonous population grown in the village Bukovo, near Bitola. The elongated fruit has an intense ruby red color and the milled Bukov pepper is sweet, aromatic, and slightly spicy and has a long and pleasant finish. Today, it is still cultivated by the older inhabitants that prepare the spice in the traditional way. The peppers are dried on long strings and crushed in a wooden bowl along with the seeds. This landrace is facing extinction with the disappearance of the older inhabitants of Bukovo.

The name of this spice has become a synonym for all spices made of crushed pepper, with the name Bukov pepper being very often used for a spice prepared from an embroidered pepper, while the spice from the original Bukov pepper is named Red pepper. It is well known in the region, as is extensively used in the meat processing industry, and the market is expanding overseas in the cities with a large number of its inhabitants originating from Balkan countries.

Conservation activities of this landrace and promotion of the product were undertaken by Slow Food Macedonia in 2014-15, supported by PSG GEF. The producers of this variety have established an association “Bukovska piper” aiming to select and revive seeds and maintain the purity of the variety, by improving preservation methods and product packaging and promoting the product on the market. A short movie (26 minutes) entitled “Na trpeza kaj … Makedonija” (To sit down at table with ... Macedonia), made in 2016, explains the story of this pepper variety. It generated great interest in Germany in 2017.

References for this case study are listed in the public awareness Annex

CASE STUDY - OVCHEPOLIAN SHEEP

A large part of the local sheep population (about 60%) is currently considered to be pure or crossbreeds of Ovchepolian sheep. In order to increase the productivity Ovchepolian sheep have been widely used in crossbreeding programs. Almost a decade ago (PSG GEF project ref.1, 2006-2008), aiming to protect the breed a flock of pure breed was established in the village of Petarlica. The final goal of this initiative was to provide pure breeds of Ovchepolian sheep for farmers in the rural areas interested in maintaining such a breed. In 2009-2011, with the assistance of two PSG GEF projects (ref. 2 and 3) and, additional pure breed flocks were established in eastern (Pehchevo) and mid-western (Makedonski Brod) areas of the country. Establishments of the flocks were followed with improved housing facilities, feeding practices, sanitary conditions for milking, and on-farm cheese production. Farmers were provided with basic training in traditional farming practices, as well as with the transfer of knowledge for milking and milk processing. Currently, another PSG GEF project (ref. 4) is ongoing (2017-2018) supporting farmers in the development of value-added products. A union of farmers has been established in order to promote the Ovchepolian sheep. These flocks were later on subjected to inventory, characterization and registration onto the national register of Ovchepolian sheep.

1. http://www.gefsgpmacedonia.org.mk/proekti.html
2. https://sgp.undp.org/index.php
3. https://sgp.undp.org/index.php
4. https://sgp.undp.org/index.php

ANNEX 1

STRUCTURE OF AGRICULTURAL PRODUCTION

Agricultural area by categories of use (in '000 hectares)

	Agricultural area	Cultivated land						Ponds, reed beds and fishponds
		Total	Arable land and gardens	Orchards	Vineyards	Meadows	Pastures	
2012	1,261	509	413	15	22	59	751	1
2013	1,261	509	413	15	22	59	751	1
2014	1,263	511	413	15	23	60	751	1
2015	1,264	513	415	16	23	59	750	1
2016	1,267	516	417	16	24	59	750	1

Arable land by categories of use (in '000 hectares)

	Arable land and gardens	Sown area						Fallow land and other arable land
		Total	Cereals	Industrial crops	Vegetable crops	Fodder crops	Plant nurseries	
2012	414	276	163	27	51	35	1	137
2013	413	281	168	25	51	36	1	132
2014	413	278	163	26	53	36	1	134
2015	415	277	162	24	53	38	1	137
2016	417	281	168	22	52	39	1	135

Harvested area and production quantities of major crops

Crop	Harvested area (ha)	Production (t)	Average yield (kg/ha)	Harvested area (ha)	Production (t)	Average yield (kg/ha)
	2012			2016		
Cereal crops						
Wheat	79,745	214,963	2,696	79,832	306,433	3,838
Barley	41,057	90,384	2,201	41,297	144,832	3,507
Rye	3,767	7,288	1,935	4,483	10,210	2,277
Oats	2,618	3,898	1,489	3,607	7,612	2,110
Maize	29,180	115,928	3,973	31,045	143,823	4,633
Rice	4,656	24,361	5,232	5,040	24,792	4,919
Industrial crops						
Tobacco	19,639	27,333	1,392	16,376	25,443	1,554
Sunflower	3,752	4,765	1,270	3,896	6,266	1,608
Poppy seed	180	91	506	105	90	857
Fodder crops						
Alfalfa	19,224	115,692	6,018	19,579	111,731	5,707
Fodder maize	2,249	44,467	19,772	6,378	193,708	30,371
Clover	3,305	12,565	3,802	3,725	17,200	4,617
Vetch - hay	2,168	5,815	2,682	1,922	7,052	3,669
Fodder pea - hay	1,625	4,836	2,976	1,269	4,210	3,318
Fodder beet	418	3,700	8,852	387	3,596	9,292

Vegetable crops						
Potato (+interfiled)	13,410	169,976	12,675	13,554	198,529	14,647
Cabbage (+late cabbage)	4,804	128,571	26,763	5,792	185,227	31,980
Beans (+interfiled)	13,806	10,978	795	13,480	12,960	961
Pepper	8,626	166,247	19,273	8,751	181,852	20,781
Tomatoes	5,614	145,818	25,974	5,604	161,951	28,899
Melons and watermelons	5,691	127,593	22,420	5,445	139,679	25,653
Onion	3,527	43,732	12,399	3,581	60,958	17,023
Garlic	936	4,081	4,360	978	4,221	4,316
Lentils	74	77	1,041	84	110	1,310
Meadows	60,441	89,237	1,476	59,437	112,597	1,894
Pastures	756,558	415,200	549	749,772	493,377	658
Vineyards	20,948	240,461	11,478	23,192	333,319	14,372

Fruit-bearing trees and production of fruits

Fruit crop	Trees (in 000)	Production (t)	Average yield (kg/tree)	Trees (in 000)	Production (t)	Average yield (kg/tree)
	2012			2016		
Grapevine	79,160	240,431	3	85,950	333,319	4
Apples	4,373	127,171	29	3,856	101,088	26
Pears	368	6,937	19	409	7,207	18
Quinces	55	1,237	22	55	1,279	23
Plums	1,527	35,444	23	1,657	33,684	20
Cherries	191	5,539	29	201	5,574	28
Sour cherries	682	8,127	12	892	8,072	9
Apricots	151	4,503	30	195	3,471	18
Peaches	429	8,987	21	575	12,108	21
Walnuts	162	4,952	31	172	5,147	30

Area under organic farming (%)

	2009	2010	2011	2012	2013	2014	2015	2016
Cultivated agricultural area	0.27	1.03	1.29	0.91	0.62	0.46	0.51	0.63
Total utilized agricultural area	0.14	0.47	0.59	0.37	0.25	0.19	0.21	0.26

Livestock, poultry and beehives (by number)

	2012	2013	2014	2015	2016
Cattle (Total)	251,240	238,333	241,607	253,442	254,768
Cows and heifers in calf	161,012	154,487	155,432	156,699	160,603
Pigs (Total)	176,920	167,492	165,054	195,443	202,758
Sows and gilts	23,534	23,581	20,990	18,696	25,478
Sheep (Total)	732,338	731,828	740,457	733,510	723,295
Ewes for breeding	520,767	530,760	531,160	580,840	555,932
Goats	63,585	75,028	81,346	88,064	/
Horses	21,676	20,682	19,371	18,784	19,263
Poultry	1,776,297	2,201,550	1,939,879	1,761,145	1,865,769
Beehives	52,897	68,294	73,869	73,960	81,476

ANNEX 2

LIST OF INSTITUTIONS AND GOVERNMENTAL BODIES

Institution	**Ministry of Environment and Physical Planning (MoEPP)**
Contact details	http://www.moepp.gov.mk/
Role in agrobiodiversity protection	Responsible for protection of biodiversity in general, protection, conservation and sustainable use of the natural heritage.
Capacity assessment (human and infrastructure)	Efficient human resources and good infrastructure capacities.
Important specific actions undertaken by the institution	Successfully implemented many projects and strategies for protection of environment and biodiversity in general. All activities regarding biodiversity protection are conducted through the Unit of Biodiversity established in 2001 under the Department of Nature. Agrobiodiversity has been integrated in the institution's plans, actions and documents in a very negligible way.
Requirements for further enhancement of capacities	

Institution	**Ministry of Agriculture, Forestry and Water Economy (MAFWE)**
Contact details	http://www.mzsv.gov.mk
Role in agrobiodiversity protection	Responsible institution for creation of policy and legal documents and their implementation.
Capacity assessment (human and infrastructure)	Overemployed, but not sufficiently efficient in conservation of agrobiodiversity, especially for PGR. All activities for PGR legally have to be directed through the Directorate for Seed and Seedlings (DSS). Within the Directorate there is a Division for Gene Bank and GMO with two employees, but their activities are mainly focused on commercial seed issues.
Important specific actions undertaken by the institution	DSS put some effort into working on the Program for Protection of Autochthonous Varieties according to the EC regulative, but this process ended with the uncertain political situation over the last two years.
Requirements for further enhancement of capacities	DSS's human capacities should be enhanced to assist successful implementation of the support measures for conservation and maintenance of PGR, predicted in the National Strategies. The activities of the Division for Gene Bank and GMO need to be redirected towards conservation and sustainable use of PGR. This Division should be responsible for systematic organization of the complete plant agrobiodiversity framework on a national level.

Institution	**Faculty of Agricultural Sciences and Food (FASF)**
Contact details	http://www.fznh.ukim.edu.mk/
Role in agrobiodiversity protection	Inventorying, collecting, missions, characterization, phenotypic and molecular characterization, evaluation, documenting and storing of PGR, research projects for use of PGR, education with course programs on PGR on undergraduate and postgraduate level, elaboration of MSc and PhD thesis on PGR, participation in creation and implementation of governmental policy on PGR, participation in elaboration of strategic documents (studies, strategies, programs, and action plans on biodiversity).
Capacity assessment (human and infrastructure)	111 employees, out of whom 69 are PhD holders, a trial field of 72 ha, various laboratories for phenotypic, agronomic and qualitative PGR analysis, laboratory of molecular genetic analysis, inventory collection of seed samples, and a small gene bank with four refrigerators.
Important specific actions undertaken by the institution	Inventory and collecting of PGR in 1970's (funded by USA), 1990's (funded by the World Bank) and 2003 (funded by GTZ). Establishment of field collection of fruit crops and Vitis. Participation in SEEDNet project on conservation and sustainable use of PGR in 2004-2014 (funded by SIDA). Participation in the project Ecological GAP analysis and ecological sensitivity map for Bregalnica river basin in 2014-2015, in regards to PGR assessment, resulted in 3,500 seed samples being collected. Intensive collection of seed samples of landraces from 2014 up to the present, funded by its own resources, which along with the previously listed activity resulted in an inventory collection of 6,000 seed samples from 72 crops, collected in 400 sites in Macedonia.
Requirements for further enhancement of capacities	Financial support for upgrading the seed gene bank infrastructure, multiplication and maintenance of the seed and fruit crops collections and support for continuation with the inventory in the unvisited sites of Macedonia. For sustainability of these activities, establishment of separate department/centre with new employees is needed.

Institution	**Institute of Agriculture (IA)**
Contact details	http://zeminst.edu.mk/
Role in agrobiodiversity protection	In the previous decades, it was the main breeding institution with an organized seed production, especially for cereals. The IA conducted activities for inventorying, collecting, characterizing, evaluating, documenting and storing of PGR during the SEEDNet project.
Capacity assessment (human and infrastructure)	Due to governmental policy of the last 20 years, it has a continuous deficit of human capacities and assets for research activities. It has eight divisions, with a total of 26 researchers (22 PhD's and four MSc's). The IA has been completely equipped for a gene bank for maintaining a seed collection through the SEEDNet project. The fruit crops and Vitis field collections were created on IA's experimental fields. Today, the gene bank is not operational due to lack of financing and experimental field.

Important specific actions undertaken by the institution	Establishment of field collection of fruit crops and Vitis. Participation in SEEDNet project on conservation and sustainable use of PGR in 2004-2014.
Requirements for further enhancement of capacities	There is a need for employment of additional researchers that will be responsible for specific crop collections in the gene bank and acquiring a new experimental field for regeneration and multiplication of seed material.

Institution	**Faculty of Agriculture (FA)**
Contact details	http://zf.ugd.edu.mk/
Role in agrobiodiversity protection	FA maintains a small seed collection of industrial and vegetable crops.
Capacity assessment (human and infrastructure)	Scientific staff of 28 employees, experimental field of 80 ha, modern laboratories for detection of plant diseases and for determining seed quality.
Important specific actions undertaken by the institution	
Requirements for further enhancement of capacities	The main activities of this Institution are not focused on conservation of PGR, so financial support is needed for maintenance of industrial crops' collection.

Institution	**Scientific Institute of Tobacco (SIT)**
Contact details	http://www.tip.edu.mk/
Role in agrobiodiversity protection	Exclusively focused on research, breeding and seed production of tobacco, maintaining the tobacco seed collection consisted mainly of registered tobacco varieties and breeding material.
Capacity assessment (human and infrastructure)	Experts only for tobacco, available storage chambers and well equipped laboratories.
Important specific actions undertaken by the institution	
Requirements for further enhancement of capacities	The main activities of this Institution are not focused on conservation of PGR.

Institution	**Institute of Animal Science**
Contact details	www.istoc.ukim.edu.mk
Role in agrobiodiversity protection	Breeds inventory, monitoring of productive and reproductive characteristics, and breed description.
Capacity assessment (human and infrastructure)	Researchers (12 PhD's), laboratories for feed, milk and aquaculture.
Important specific actions undertaken by the institution	
Requirements for further enhancement of capacities	

Institution	**Faculty of Veterinary Medicine**
Contact details	https://fvm.ukim.edu.mk
Role in agrobiodiversity protection	Cryo-conservation of semen doses, oocytes and embryos.
Capacity assessment (human and infrastructure)	Full equipped laboratory for MOET and cryopreservation of livestock semen, oocytes and embryos. (5 PhD's)
Important specific actions undertaken by the institution	
Requirements for further enhancement of capacities	

ANNEX 3

LIST OF NGOS, CSOS, FARMERS ORGANIZATIONS

Macedonian Ecological Society, Skopje	http://mes.org.mk/nov-sajt
Slow Food Macedonia	http://www.slowfood.mk
Ecologists movement of Macedonia	http://www.dem.org.mk
Foundation Agro-center for Education, Skopje	http://www.ace.org.mk
Aronija – Association of producers of organic products, Delcevo	https://www.facebook.com/aronija.macedonia
Association for rural development Javor, Zrnovci	http://www.javor.org.mk
Grinvizija, Turnovo	grinvizija@gmail.com
Association for environmental protection EKO GOL DRVO, Skopje	ekogoldrvo@gmail.com
Agricultural cooperation Ohridska Chereshna 2015, v. Leskoec.	
Federation of farmers of the Republic of Macedonia	http://www.ffrm.org.mk
NGO Utro	utronovoselo@yahoo.com
10 septemvri 12, Novo selo, 2434	napredok@freemail.com.mk
NGO Napredok, Pehcevo	Eko_pcela@yahoo.com
Vanco Kitanov 17, Pehcevo, 2326	zgzlatnoruno@gmail.com
Honeybee association Eko pcela	Ljupco_123@hotmail.com
Tome Stefanovski 4b, Skopje, 1000	tanevskimarjan@gmail.com
Farmer Association Zlatno Runo	info@cekornapred.org
Gorno Krusje, Makedonski Brod, 6530	nikolaodzaklieski@gmail.com
BUSHA, Association of citizens Bul A. Makedonski bb, Skopje, 1000	momemlad@yahoo.com
Association of citizens SILVER HENS SREBRA Ivan Naumov Alabakot 63a, Skopje, 1000	tanevskimarjan@gmail.com
CEKOR NAPRED Karposovo Vostanie 10/3/11, Skopje, 1000	info@cekornapred.org
AKADEMIK, Association for education Ilindenska bb, Krusevo	nikolaodzaklieski@gmail.com
NVO Pramenka Ovcepolka Bul A. Makedonski bb, Skopje, 1000	momemlad@yahoo.com

ANNEX 4

LIST OF NATIONAL LAWS AND BY-LAWS

- **Constitution of the Republic of Macedonia** (Official Gazette of the Republic of Macedonia, no. 52/91).
- **Law on Agriculture and Rural Development** (Official Gazette of the Republic of Macedonia, no. 49/2010; 53/2011, 126/2012, 15/2013, 69/2013).
- **Law on Seeds and Seedlings** (Official Gazette of the Republic of Macedonia, no. 55/11).
- **Law on Breeders Rights** (Official Gazette of the Republic of Macedonia, no. 52/2009).
- **Law on Livestock Production** (Official Gazette of the Republic of Macedonia, no. 7/2008, 116/2010 and 23/2013).
- **Law on Pastures** (Official Gazette of the Republic of Macedonia, no. 3/98, 101/00, 105/09, 116/10, 164/13, 193/15, 215/15).
- **Law on organic agricultural production** (Official Gazette of the Republic of Macedonia, no. 146/2009, 53/2011, 149/2015, 39/2016, 132/2016).
- **Law on Quality of Agricultural Products** (Official Gazette of the Republic of Macedonia, no. 140/2010; 53/2011, 55/2012).
- **Law on Plant Health Protection** (Official Gazette of the Republic of Macedonia, no. 29/2005; 81/2008; 20/2009; 57/2010; 17/2011, 148/2011).
- **Law on Agricultural Land** (Official Gazette of the Republic of Macedonia, no. 135/07, 18/11, 42/11. 148/11, 95/12).
- **Law on waters** (Official Gazette of the Republic of Macedonia, no. 87/08, 06/09, 161/09, 83/10, 51/11, 44/12, 23/13, 163/13).
- **Law on State Agricultural Inspectorate** (Official Gazette of the Republic of Macedonia, no. 20/2009).
- **Law on Forests** (Official Gazette of the Republic of Macedonia, no. 64/09, 24/11, 53/11, 25/13, 79/13, 147/13, 43/14, 160/14, 33/2015, 44/2015, 147/15, 07/16, 39/16).
- **Law on Hunting** (Official Gazette of the Republic of Macedonia, no. 26/09, 82/09, 136/11, 1/12, 69/13, 164/13, 187/13, 33/15, 147/15, 193/15).
- **Law on Environment** (Official Gazette of the Republic of Macedonia, no. 53/05, 81/05, 24/07, 159/08, 83/09, 48/10, 124/10, 51/11, 123/12, 13/13, 163/13, 41/14).
- **Law on Nature Protection** (Official Gazette of the Republic of Macedonia, no. 67/04, 14/06, 84/07, 35/10, 47/11, 148/11, 59/12, 13/2013, 163/13, 41/14, 146/15, 39/16). Regulation on the manner of operation, spatial and technical equippedness of the authorized laboratories and methods for analyzing seed quality of agricultural plants (Official Gazette of the Republic of Macedonia, no. 61/2007)
- Regulation on the procedures and methods for analyzing species and varieties of agricultural plants and varieties of agricultural plants for which analyses of value for cultivation and use value are not obliged (Official Gazette of the Republic of Macedonia, no. 85/2009)

- Regulation on the procedures and methods for analyzing distinctness, uniformity and stability (DUS test) of the varieties of agricultural plants (Official Gazette of the Republic of Macedonia, no. 110/2010).
- List of autochthonous agricultural plants and autochthonous livestock breeds (Official Gazette of the Republic of Macedonia, no.71/11)
- Rulebook on the other forest products species and on the manner of usage and collection of other forest products (Official Gazzette of the Republic of Macedonia, no. 54/00).
- Decision for establishing national network for monitoring of the environment (Official Gazette of the Republic of Macedonia, no. 122/11)
- Regulation for records keeping for nature protection (Official Gazette of the Republic of Macedonia, no. 102/2012)
- Regulation for criteria definition for recognized institutions have to full field in order to commit the program for AnGR protection (Official Gazette 151/10);
- Regulation for criteria definition in commitment of monitoring in AnGR (Official Gazette 151/10);
- Regulation for criteria definition for keeping and trading of AnGR, form and content of request for recognition of the new local breeds and form, content and registration of AnGR breed register (Official Gazette 151/10);
- Regulation for definition of AnGR population size and way and manner for maintenance of minimum population size (Official Gazette 151/10).

LIST OF NATIONAL STRATEGIES, PROGRAMS AND PLANS

- **National Strategy for Agriculture and Rural Development 2014-2020**
  http://www.mzsv.gov.mk/NSZRR%202014-2020.pdf
- **Biodiversity strategy and action plan of the Republic of Macedonia**. 2004, MoEPP, 128p.
  http://www.moepp.gov.mk/wp-content/uploads/2014/12/Biodiversity-strategi-of-the-RM.pdf
- **National Strategy for Sustainable Development in the Republic of Macedonia**, Part I/II, 41p.
  http://www.moepp.gov.mk/wp-content/uploads/2014/12/NSSD-1-EN.pdf
- **National Strategy for Sustainable Development in the Republic of Macedonia**, Part II / II, 2008, 49p.
  http://www.moepp.gov.mk/wp-content/uploads/2014/12/NSSD-2-EN.pdf
- **National Program for Agriculture and Rural Development 2013-2017** (Official Gazette of the Republic of Macedonia, no.134/2012).
- **National program for Agriculture and Rural Development 2007-2013**
  http://www.mzsv.gov.mk/nacionalna_programa.pdf
- **Program for Rural development 2014-2020** (IPARD II)
  http://www.mzsv.gov.mk/files/%20II%20Програма.pdf

- **National Plan for Organic Agricultural Production 2013-2020**. http://www.mzsv.gov.mk/files/Nacionalen%20Plan%20za%20Organsko%20Proizvodstvo_2013%20-%202020.pdf
- **Program for animal genetic resources protection (2011-2017)**, MAFWE, 2011.

RATIFIED CONVENTIONS:

- **Convention on Biological Diversity**, (www.cbd.int) ratified by law (Official Gazette of RM 54/97)
- **Cartagena Protocol on Biosafety to the Convention on Biological Diversity**, http://bch.cbd.int/protocol, ratified by law (Official Gazette of RM 40/2005)
- **Convention for the protection of the World's Cultural and Natural Heritage** http://whc.unesco.org/en/conventiontext, ratified by law (Official Gazette of SFRY 56/74)
- **Convention on International Trade in Endangered Species of Wild Fauna and Flora** www.cites.org, ratified by law (Official Gazette of RM 82/99)
- **European Landscape Convention, ratified by law** (Official Gazette of RM 44/2003). http://www.coe.int/t/dg4/cultureheritage/heritage/Landscape/default_en.asp
- **United Nations Framework Convention on Climate Change**, http://unfccc.int/2860.php, ratified by law (Official Gazette of RM 6/97)
- **Kyoto Protocol to the United Nations Framework Convention on Climate Change** http://unfccc.int/kyoto_protocol/items/2830.php, ratified by law (Official Gazette of RM 49/2004)
- **United Nations Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa** http://www.unccd.int ratified in February 2002 (Official Gazette of RM 13/02)
- **International Convention on Plants Protection**, https://www.ippc.int/en/core-activities/governance/convention-text ratified in 1985 (Official Gazette of SFRY 1/85);
- **International Treaty on Plant Genetic Resources for Food and Agriculture** (signed, no contracting party).

ANNEX 5

LIST OF REFERENCES OF GENETIC RESOURCES IN AGRICULTURE)

- Macedonia in numbers, 2017. State statistical Office, 86p.
- Statistical Yearbook of the Republic of Macedonia. 2017. State statistical Office, 649p.
- Balkan Pomology-plums. 2012. Editors: Inger Hjalmarsson and Lidija Tomić. SEEDNet's WG for Fruit and Vitis, 172p.
- Balkan Pomology- Apples. 2012. Editors: Inger Hjalmarsson and Lidija Tomić. SEEDNet's WG for Fruit and Vitis, 226 p.
- Bunevski Gj, Nikitovic J, Saltamarski Z. 2016. Conservation of the genetic material of Macedonian Busha cattle. Acta Agriculturae Serbica, Vol. XXI, 41; 17-24.
- Bogevska Z., Popsimonova G., Agic R., Davitkovska M., Iljovski I. 2014. Technology of production of onion Buchinska arshlama in the past and nowadays. JAFES, Vol 63, (2014)86-91.
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- Country study for biodiversity of the Republic of Macedonia - First national report. 2004. Ministry of Environment and Physical Planning, Skopje.
- Elaborate for protection of geographic indication of "Ohridska cresha". 2014. Agricultural cooperation Ohridska chereshna 2015. http://mzsv.gov.mk/files/%20Охридска%20цреша%202017.pdf
- Elaborate for protection Belo Zimsko with designation of origin. 2012. Agrofruktis, Dooel Strumica. http://pdf.usaid.gov/pdf_docs/PA00J9P5.pdf
- GEF Small Grant Programme in Macedonia. www.gefsgpmacedonia.org.mk
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- Ivanovska S., Jankulovska M. 2016. Contribution of women to *in-situ* conservation of agrobiodiversity in Macedonia. International Conference Women in Science and Technology for the Developing World and OWSD 5th General Assembly, 16-19 May, 2016, Kuwait Institute for Scientific Research (KISR), Kuwait.
- Ivanovska S., Jankulovska M., Jordanovska Nechkovski E. 2016. Genetic resources of Agricultural crops in the region of river Bregalnica basin. Abstract Book of the 5th Congress of ecologists of the Republic of Macedonia with international participation, 19-22 October 2016, Ohrid, Macedonia, p. 135.
- Ivanovska S., Jankulovska M., Ajruli G., Popsimonova G. Kratovalieva S., Agic R. 2013. Genetic variability of some morphological and productive traits of local bean populations (Phaseolus vulgaris L.). Proceedings of International Symposium for agriculture and food, Faculty of Agricultural Sciences and Food, Skopje, Vol. 2, 608-618.
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and Food. Year 53, 17-32.

- Jankulovska M., Ivanovska S. 2016. The status and role of Macedonian woman in agriculture, food security and agrobiodiversity conservation: from rural areas to scientific research. International Conference Women in Science and Technology for the Developing World and OWSD 5th General Assembly, 16-19 May, 2016, Kuwait Institute for Scientific Research (KISR), Kuwait.
- Kiprijanovski M., Gjamovski V. 2014. Technology of Sour Cherry Production in Macedonia. https://www.bordeaux.inra.fr/cherry/docs/dossiers/Activities/Meetings/2014%2009%2015-17%20WG1%20Meeting_Novi%20Sad/Posters/Gjamovski__Novi-Sad2014.pdf
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- https://easterneurope.helvetas.org/en/projects/biodiversity_project_macedonia/
- SDC/Farmahem/MoEPP "Programme for Conservation of Nature in Macedonia". More information about the programme are available at: www.bregalnica-ncp.mk
- http://www.gefsgpmacedonia.org.mk/
- Annual Report on Agriculture and Rural Development. 2015. Ministry of Agriculture, Forestry and Water Economy, Skopje. 125p.
- http://www.gefsgpmacedonia.org.mk/dokumenti/letok_stari_jabolka_i_krusi.pdf

LIST OF REFERENCES FOR CONSERVATION EFFORTS OF GENETIC RESOURCES

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- Kratovalieva S., Popsimonova G., Ivanovska S. 2012. Conservation status of plant genetic resources in Republic of Macedonia. Book of Abstracts, I International Symposium and XII Scientific Conference of Agronomists of Republic of Srpska, Trebinje, Bosnia and Herzegovina, 19-22.3.2012. p. 126.
- Kratovalieva S., Popsimonova G., Ivanovska S., Agic R., Simeonovska E., Beleski K., Dimov Z., Stefkov Gj. Gjamovski V. 2009. Catalog of national *ex-situ* conserved plant genetic resources. Institute of Agriculture, Skopje, 193 pages.
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ANNEX 6a

LIST OF NATIONAL COLLECTIONS - PLANT

National/entity collection		Conservation status						
		No of samples		Completely documented	Characterized	Evaluated	Multiplicated	Duplicates in other GB
CROPS		*ex-situ*	*in-situ*	approximate % of the total crop samples				
CEREALS and Maize								
Corn	*Zea mays*	757	0	23	15	0	15	0
Barley	*Hordeum vulgare*	226	0	27	27	27	27	0
Millet	*Panicum miliaceum*	18	0	1.1	1.1	0	1.1	0
Oats	*Avena sativa*	150	0	34	34	34	34	0
Rice	*Oryza sativa*	296	0	93	93	75	93	0
Rye	*Secale cereale*	94	0	48	48	48	48	0
Sorghum	*Sorghum bicolor*	34	0	0	0	0	0	0
Wheat	*Triticum aestivum*	278	0	52	52	52	52	0
Durum wheat	*Triticum turgidum*	68	0	100	100	100	100	0
LEGUMES								
Beans	*Phaseolus vulgaris*	1288	0	13	13	0	13	0
Runner bean	*Phaseolus coccineus*	170	0	30	30	0	0	0
Adzuki bean	*Vigna sp.*	23	0	0	0	0	0	0
Broad bean	*Vicia faba*	1	0	0	0	0	0	0
Chickpea	*Cicer arietinum*	89	0	0.1	0	0	0	0
Lentil	*Lens culinaris*	36	0	0	0	0	0	0
Peas	*Pisum sativum*	46	0	10	10	0	10	0
Soybean	*Glycine max*	16	0	0	0	0	0	0
FODDER CROPS								
Alfalfa	*Medicago sp.*	41	0	60	60	0	60	0
Clover	*Trifolium sp.*	75	0	87	87	0	87	0
Ervil	*Vicia ervilia*	199	0	89	89	0	89	0
Fodder beet	*Beta vulgaris ssp. vulgaris*	18	0	0	0	0	0	0
Grass	*Dactylis glomerata*	36	0	100	100	0	100	0
Meadow grass	*Poa annua*	4	0	0	0	0	0	0
Sainfoin	*Onobrychis viciifolia*	3	0	34	34	0	34	0
Vetch	*Vicia sativa*	4	0	100	100	0	100	0
Vetchling	*Lathyrus cicera*	16	0	0	0	0	0	0
Fescue	*Festuca sp.*	92	0	100	100	0	100	0
Brome	*Bromus sp.*	7	0	100	100	0	100	0
Prairie junegrass	*Koeleria macrantha*	1	0	100	100	0	100	0
Forage pea	*Pisum sativum ssp. arvense*	5	0	100	100	0	100	0
INDUSTRIAL CROPS								
Anise	*Pimpinella anisum*	23	0	0	0	0	0	0

Castor bean	*Ricinus communis*	8	0	0	0	0	0	0
Cotton	*Gossypium hirsutum*	3	0	0	0	0	0	0
Flax	*Linum usitatissimum*	14	0	0	0	0	0	0
Hemp	*Cannabis sativa*	4	0	0	0	0	0	0
Hop	*Humulus lupulus*	1	0	0	0	0	0	0
Peanuts	*Arachis hypogaea*	32	0	84	0	0	0	0
Poppy	*Papaver somniferum*	66	0	0	0	0	0	0
Rapeseed	*Brassica napus*	6	0	0	0	0	0	0
Sesame	*Sesamum indicum*	6	0	0	0	0	0	0
Sugar beet	*Beta vulgaris*	1	0	0	0	0	0	0
Sunflower	*Helianthus annuus*	102	0	0	0	0	0	0
Tobacco	*Nicotiana tabacum*	65	32	0	0	0	0	0
VEGETABLE CROPS								
Asparagus	*Asparagus officinalis*	1	0	0	0	0	0	0
Brussels sprouts	*B. oleracea var. gemmifera*	2	0	0	0	0	0	0
Cabbage	*Brassica sp.*	69	0	20	0	0	0	0
Calabash, Gourd	*Lagenaria siceraria*	85	0	5	0	0	0	0
Carrot	*Daucus carota*	21	0	18	0	0	0	0
Cauliflower	*Brassica oleracea var. botrytis*	1	0	0	0	0	0	0
Celery	*Apium graveolens var. dulce*	17	0	21	0	0	0	0
Chard	*Beta vulgaris var. vulgaris*	17	0	1	0	0	0	0
Chicory	*Cichorium intybus*	1	0	0	0	0	0	0
Cucumber	*Cucumis sativus*	127	0	0.3	0	0	0	0
Eggplant	*Solanum melongena*	38	0	1	0	0	0	0
Leek	*Allium ampeloprasum*	80	0	22	22	0	22	0
Lettuce	*Lactuca sativa*	83	0	6	6	0	6	0
Melon	*Cucumis melo*	275	0	3	3	0	3	0
Mustard	*Sinapis sp.*	5	0	0	0	0	0	0
Okra	*Abelmoschus esculentus*	54	0	12	12	0	12	0
Onion	*Allium cepa*	45	0	6	6	0	6	0
Orache	*Atriplex hortense*	5	0	0	0	0	0	0
Parsley	*Petroselinum crispum*	82	0	7	0	0	0	0
Parsnip	*Pastinaca sativa*	10	0	25	0	0	0	0
Patience dock	*Rumex patentia*	13	0	38	0	0	0	0
Pepper	*Capsicum annuum*	933	0	11	11	0	11	0
Potato	*Solanum tuberosum*	1	0	0	0	0	0	0
Pumpkin	*Cucurbita sp.*	716	0	0.1	0	0	0	0
Radish	*Raphanus sativus var. radicula*	7	0	30	0	0	0	0
Red beet	*Beta vulgaris*	18	0	99	0	0	0	0
Rocket salad	*Eruca sativa L*	2	0	0	0	0	0	0
Spinach	*Spinacia oleracea*	50	0	8	8	0	8	0
Tomato	*Licopersicon esculentum*	304	0	25	25	0	25	0
Watermelon	*Citrullus lanatus*	191	0	1	1	1	1	0
Zuccini	*Cucurbita pepo*	69	0	0	0	0	0	0
Basil	*Ocimum basilicum*	32	0	1	0	0	0	0
Dill	*Anethum graveolens*	18	0	27	0	0	0	0
MEDICINAL AND AROMATIC PLANTS								
Oregano	*Origanum vulgare*	4	100	100	0	0	0	0

ANNEX 6b

LIST OF NATIONAL COLLECTIONS - ANIMAL

Current status of breeds' diversity, number of breeds for which characterization has been carried out and their status in conservation programs

	Current Total		At Risk		Widely used		Lost (last 20 years)		At population level			At individual level		
									Baseline survey	Genetic distance	Protection status	Performance recording	Genetic evaluation	Molecular evaluation
	L	I	L	I	L	I	L	I						
Cattle	1			N/A	1		N/A	N/A						
Water Buffalo	1	N/A	1	N/A	N/A	N/A	N/A	N/A						
Sheep	3	3	2	N/A	1	2	0	0						
Goats	1	2		N/A	1	2	0	0						
Horses	1	N/A		N/A	1	0	N/A	N/A						
Donkeys	1	N/A		N/A	1	0	N/A	N/A						
Pigs	2	N/A	1	N/A	0	N/A	1	N/A						
Chicken	1	N/A	1	N/A	0	N/A	N/A	N/A						
Turkey	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A						
Ducks	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A						
Geese	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A						
Honey bees	1	N/A	0	N/A	1	N/A	N/A	N/A						

- L = Locally Adapted or Native; I = Introduced/Imported (Recently Introduced and Continually Imported).
- Breeds at risk use FAO classification (http://www.fao.org/docrep/010/a1250e/a1250e00.htm).
- Consider breed characterization during the last ten years.
- Baseline survey summary data describing the identification and observable characteristics, location, uses and general husbandry of the AnGR for each species used in the country for food and agricultural production.
- Genetic distances among breeds computed from molecular analyses.
- Protection status: *In-situ* (includes all measures to maintain live animal breeding populations, including those involved in active breeding strategies in the agro-ecosystem where they either developed or are now normally found, together with husbandry activities that are undertaken to ensure the continued contribution of these resources to sustainable food and agricultural production, now and in the future); *Ex-situ* conservation (genetic material within living animals but out of the environment in which it developed - *Ex-situ*, *in-vivo*, or external to the living animal in an artificial environment, usually under cryogenic conditions including, the cryo-conservation of semen, oocytes, embryos, cells or tissues - *Ex-situ in-vivo*.
- Performance recording is based on individual animal data for milk yield, growth, reproduction, etc.
- Genetic evaluation refers to estimation of breeding values.
- Molecular evaluation includes information of markers, DNA, blood type, protein alleles, etc.

ANNEX 7

ACTIVITIES FOR RAISING PUBLIC AWARENESS

- Participation in the Agricultural Fair in Skopje, 2003, for promotion of the results of the project Initial Activities for Conservation of Agrobiodiversity in the Republic of Macedonia, financed by GTZ. A brochure "Let us protect the aerobiological diversity" was also published.
- Several activities for raising public awareness organized by Rural Development Network of the Republic of Macedonia are available at http://ruralnet.mk/
- Promotion of agriculture with high natural values and agrienvironmental payments with NGOs in Macedonia, organized by Ecologists' Movement in Macedonia (DEM) http://www.dem.org.mk/projects_trifun.html
- Promotion of Macedonian products (Grapevine Stanushina, Bukovska pepper, sweet relish of wild figs) at the World Fair for Traditional Food in Torino, Italy, 2016 by Slow Food Macedonia.
- Short movie on Bukovska pepper "Sitting at the table with … Macedonia" youtubbe.com/watch?v=yxpSqDPpK6c
- Promotion of agricultural and dairy products in the South-west planning region http://www.southwestregion.mk/Proekt-en.aspx?ProektID=1746
- Activities organized through Nature Conservation Program in Macedonia, supported by SDC:
  - Protection and promotion of agro-biodiversity in the Municipality of Zrnovci
  - http://www.bregalnica-ncp.mk/portfolio/protection-and-promotion/?lang=en
  - Good agricultural practices – rich biodiversity
  - http://www.bregalnica-ncp.mk/portfolio/good-agricultural/?lang=en
  - Video: Sustainable rice production in the basin of Bregalnica https://www.youtube.com/watch?v=D4ekPxoYZ9E
  - Video: Beekeeping - the link between biodiversity and socio-economic benefits https://www.youtube.com/watch?v=8I2hk-1120I
  - Video: BIODIVERSITY VALUES OF BREGALNICA RIVER BASIN https://www.youtube.com/watch?v=fP1GcXUp_DA
  - Video: Bregalnica – Nature Conservation Program in Macedonia 2014 https://www.youtube.com/watch?v=RqZBF1yvapI

ANNEX 8
PHOTOGRAPHS

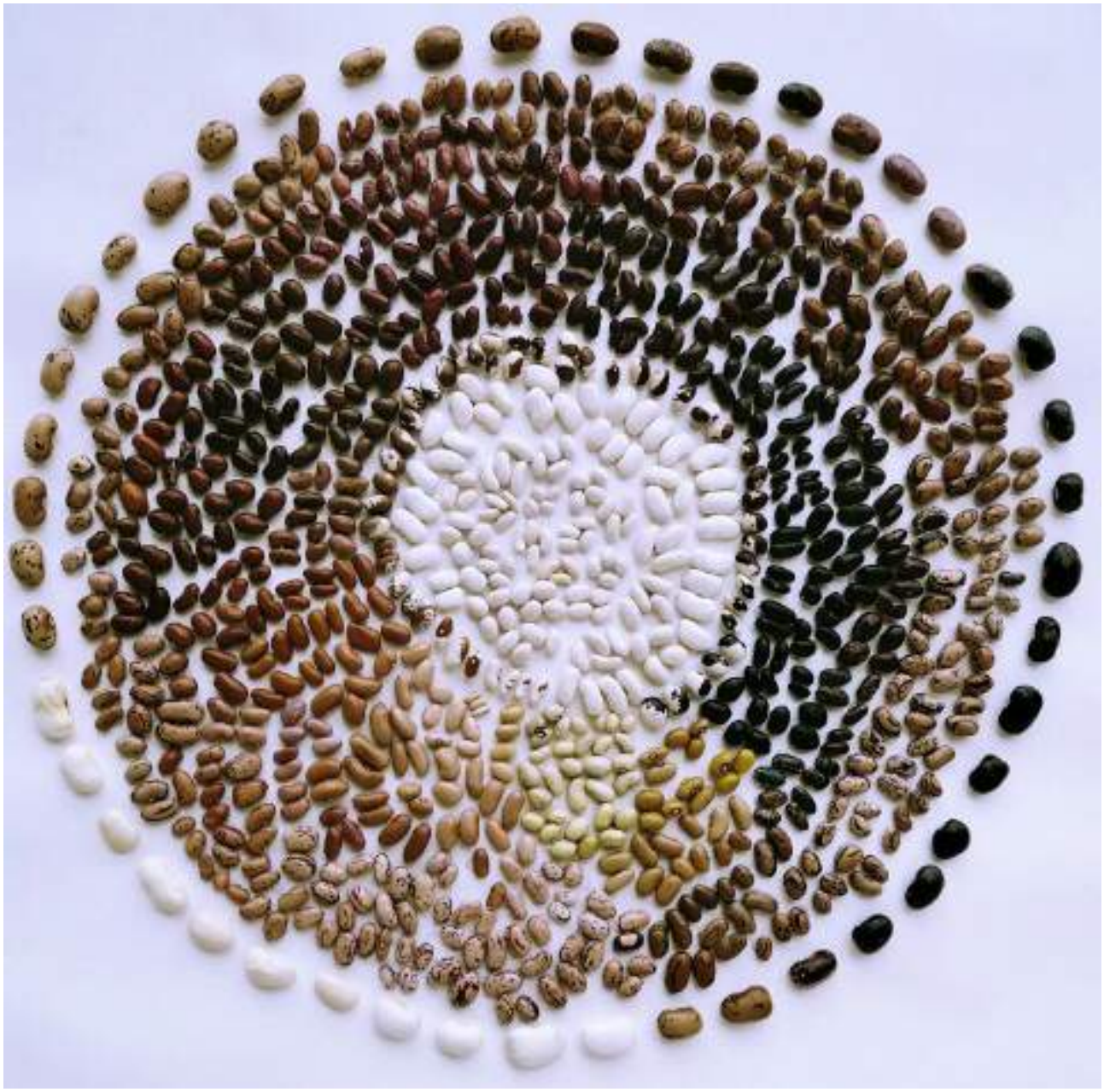
Zrnovski leeks (Photo taken from http://www.televizijastar.com)

Different tomato landraces cultivated in Macedonia (Photo by Sonja Ivanovska)

Different pepper landraces cultivated in Macedonia (Photo by Sonja Ivanovska)

Macedonian fresh and dry embroidered peppers (Photo by Sonja Ivanovska)

Bukovska peppers promoted by Slow Food Macedonia (Photo by Ivo Danchev)



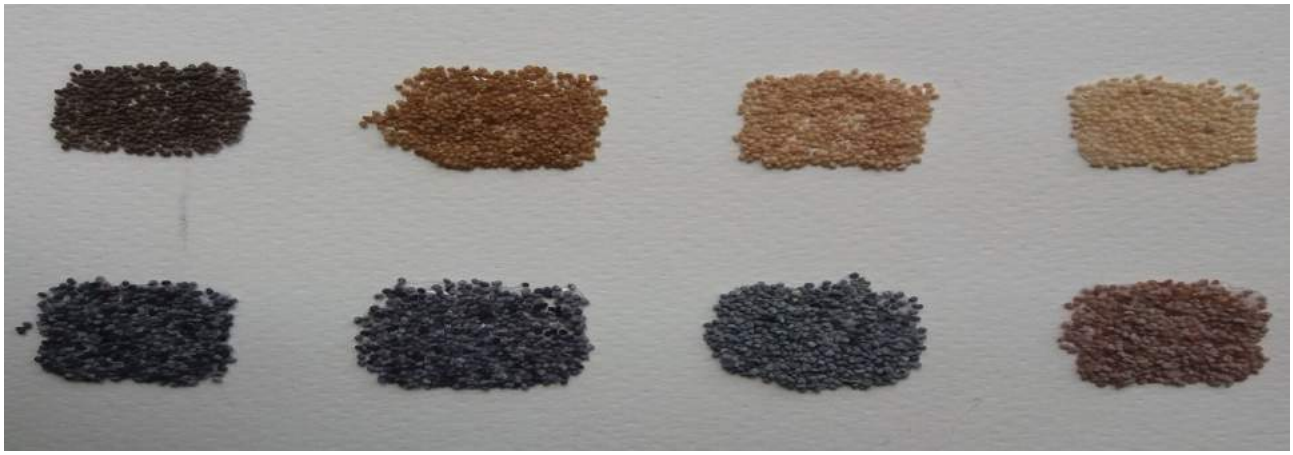
Different dry beans samples in the inventory collection of FASF (Photo by Mirjana Jankulovska)

Different melon landraces cultivated in Macedonia (Photo by Sonja Ivanovska)

Different watermelon landraces cultivated in Macedonia (Photo by Sonja Ivanovska)

Accessions of corn landraces in the inventory collection of FASF (Photo by Mirjana Jankulovska)

Poppy flowers (Photo by Mirjana Jankulovska)



Characterization of Macedonian opium poppy landraces (Photo by Mirjana Jankulovska)

Strumichki peanuts (Photo by Sonja Ivanovska)

Ohridska Cherries (Photo taken from: MRTV photo archive)

Autochtonous grape variety Stanushina (Photo taken by www.fondazioneslowfood.com)

Water Buffalos, (Photo by Sreten Andonov)

The local goat breed, (Photo by Sreten Andonov)

Apis Mellifera Macedonica (Photo by Sreten Andonov)

Ovcepolean sheep breed, (Photo by Sreten Andonov)

Sharplanian sheep breed, (Photo by Sreten Andonov)

Karakachanska sheep breed, (Photo by Sreten Andonov)

Ovcepolean sheep breed, (Photo by Sreten Andonov)

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