Traditional Saxon Home-Gardens as Hot-Spots for Plant Genetic Resources for Food and Agriculture Conservation – Case Study in Romania

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Article

Traditional Saxon Home-Gardens as Hot-Spots for Plant Genetic Resources for Food and Agriculture Conservation—Case Study in Romania

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Abstract: Plant biotechnology is dependent today on the need to accessing for breeding needs broader plant genetic resources for food and agriculture (PGRFA) diversity in their quest for ensuring food security for our future. Heterogenous agricultural lands are considered today as hotspot for biodiversity, and they also exist in the hilly mountain areas of Romanian's Carpathians. The scope of this review is to describe traditional home-hardens related to the land use of households and cultivated species from Moșna commune, Sibiu County, Romania. The survey was realized with the support of authorities and local stakeholders from 2010 up to 2019. The results of this survey revealed that maintenance of crop species structure and land use of traditional households is longer than 100 years. Consequently at least 15 traditional Saxon home-gardens of 120 taken into the study may be defined. Today these home-garden covers a media of 26% of the total area of a household and should be part of a surface ranging between 5,000 and 1,500 m^2. The first Local Council Decision in Romania in 2019 supporting the recognition of landraces and home-gardens as heritage values was officially adopted supporting the need to more access bottom-up approaches for supporting biodiversity conservation.

Keywords: agricultural land use; intangible culture heritage; landraces; on farm; races; traditional knowledge; Saxon-home-gardens

1. Introduction

Traditional knowledge (TK) is a concept that was coined for biodiversity conservation at the global political level through the Convention on biological diversity in 1992 into the text Preamble as well as of Art. 8 j. [1]. The same concept was further used in the provisions of Art. 5 and in direct relation with plant genetic resources for food and agriculture (PGRFA) by the International Treaty on Plant Genetic Resources for Food and Agriculture or Plant Treaty that was adopted in 2001 and having today 150 Partis [2]. In direct connectivity with the plant breeding strategy, we mention that also The International Union for the Protection of New Varieties of Plants (UPOV) first adopted in 1961 has recognized the genetic value of landraces [3]. Today, 73 Parties are signatory of this Treaty that is regulating the trade of new crop breeds at the global level. A direct connectivity it was proved that exists between TK and landraces due to the need to clarify terms for research working in crops breeding [4]. Based on this analysis Zeven is defining for the first-time autochthonous landraces as genetic resources that are cultivated for more than 100 years in the same agroecosystems and they are under traditional low input agricultural systems too. We mention that it is not an easy process to investigate the TK and local knowledge (LK) related to the conservation of biodiversity as a whole and which is a of intangible heritage value [5,6]. In this regard traditional landscapes, agricultural lands, households, and home-gardens should be investigated on crops diversity structure and land use that should be maintained during more than 100 years. It became more than obviously that TK should be based on a historical approach covering all these subjects when we are performing such assessments [7]. If from 1989 onward the term TK includes the knowledge related to environmental

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protection and agricultural sustainability however, later scientists became aware of new barriers based on which new subjects need to be defined when applying such a concept in real-life situations [8]. Thus, by applying the historical approach in TK assessment prof. Matsui succeed to envisage issues raised by the evolution of different civilizations in direct relationship to the community development mechanisms that may be faster or not, reason for which nowadays TK may be considered as archaic for the current history according to his statements [7]. However, the use of historical approach may act in scientifically substantiating the traditional or local knowledge related to a certain type of communities' assessment [9,10]. Among these we may include historical evidence of community existence in the daily life as well as the continuity of its existence as a side effect of the progress and continuous transformation of community as traditional and local knowledge are the expression of the society choice and being open including towards trades exchanges [11–13].

In case of traditional and local knowledge associated to agriculture there is nowadays a high level of interest due to the need to ensure food security for the future as well as of developing resilient rural communities [14]. Such ideas are also taken into account at the European level as we are facing dramatic climate change effects especially affecting food chain and endangering food security for the future [15]. At the global level one of the relevant definitions regarding TK had included subjects such as agricultural practices, seed selection system and environmental protection issues [16]. Other researchers are interested in developing this term by defining specific indicators that are related to the investigations of traditional agricultural practices for supporting food security at the global level [17–19]. Of high interest is to continue following these scientific achievements to understand better innovative approaches mechanisms applied and further to extend them to specific rural communities that may need such assessments to support food security for the future [20].

Based on the latest scientific evidence, traditional and local knowledge includes the knowledge related to wild and domesticated diversity conservation (i.e. species collecting, use and management), agricultural practices (i.e. seed selection system, cultivation practices for crops, shrubs, fruit trees) as well as the knowledge related to land use management at household and community levels (i.e. urban and outside urban areas) [21]. Thus, traditional land use management is discussed for different well settled communities all over the world [22], including nomadic communities [23].

The traditional proved land use into the urban and/or outside urban areas of rural communities is considered today to be of outmost importance when applying the historical approach proving in this way its role in supporting the biodiversity conservation at the landscape level [24]. It is well established today that such relevant examples for European countries are those represented by terroirs in France and similar landscapes in other European countries [25], as well as drystone enclosers in Ireland [26] or traditional agricultural plots in Germany or Austria [27]. At the global level specific traditional transformed landscapes are well documented and their roles in biodiversity conservation such as the Satoyama in Japan [28] or rice traditional landscapes in Asia [29] are worldwide recognized. Relevant similar studies have been published for North America [30,31], Central America [32] and South America [33]. In Africa such traditional landscapes are mostly connected to indigenous local communities [34–36]. In all these scientific publications the direct relationship between traditional landscapes and biodiversity conservation is well documented and, therefore at the global level they are recognized as hotspots for biodiversity conservation [37]. The above-mentioned authors are stating that heterogenous agricultural lands that also includes forests, riparian areas, live fences isolated threes are relevant for the conservation of biodiversity as a whole in Meso-America.

Furthermore, the Convention on Intangible Heritage, adopted by UNESCO in 2003, includes TK related to husbandry and nature conservation [38]. Even the subject of 'traditional agricultural practice' is not specifically defined however, the TK related to the maintenance of the Mediterranean Diet, may include traditional agricultural practices [39,40]. It is also the case of studies concerning the traditional pomegranate from Azerbaijan [41].

The traditional cultural landscapes (TCL) that includes heterogenous agricultural lands mostly conserved by subsistence agricultural practices become the real focus where such heritage values

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should be studied for local communities [42] especially related to developing innovation for fighting against climate change effects and maintaining food security [43,44].

During the past 20 years different tools and methods have been developed and published for the evaluation of traditional agro-ecosystem or heterogenous agricultural lands [45]. However, these cannot be applied without amendments or the need to explore more variables that are imposed aside the relief and heterogeneity of the landscapes by local communities believes and traditions. Nowadays it is well established that traditional rural agro-ecosystems are hotspots for biodiversity conservation reason why they are in the attention of scientists for many years [37,46,47]. Moreover, the results of scientific investigations developed inside these traditional areas rise the idea of crops erosions and new approaches have been published for scientifically substantiate the need for crops red listing in Nepal [48]. A historical approach of the crop's species cultivated since some 7000 years ago proved the lost of at least 8 crops species from the Fertile Crescent [49]. In case of Germany the need for red listing crops species was based on the phasing out from the diet of important crops species due to a specific crops-oriented trade at the global level with dramatic effects at national level [50]. Applying today such approaches in heterogenous agricultural landscapes may further support at the global level based on the Multilateral System mechanisms crops breeding strategies for ensuring food security for the future [51]. Pests, diseases, continuous existence of landraces as PGRFA inside traditional agroecosystems will further have a major continuation for enriching genetic heterogeneity at the landraces level for future breeding programs [52]. Moreover, the careful integration of certain activities already existing in these types of agroecosystems may be part of future adaptation strategies to climate change [53]. By ensuring the connectivity with seed keepers from traditional householders through the national Seeds Gene Banks it will improve for the future the access to such genetic resources based on Multilateral System [51,54]. All these scientific results also underlined the need for an official monitoring system to be in place for making effective the functioning of such networks and furthermore of crops' red lists. Consequently, the need to create an on-farm conservation network at national level should be the very first step [51,55].

In case of Romania, heterogenous agricultural lands exists especially in the hilly mountain areas [56,57] but they have not yet been evaluated for their relevance in supporting food security for the future. However, part of these subjects mostly connected with socio-economic features in the former province of Transylvania have already been investigated by different groups of researchers from Romania and Hungary [58–61]. Our team was involved in describing home-gardens from Sibiu County Romania for cultivated species and a potential identification of TK related to landraces and agricultural practices. During more than 20 missions in more than 12 Saxon-origin villages we succeed to identify potential landraces and define some indicators for defining traditional Saxon home-gardens [62–64].

The scope of this article is to study the potential existence of traditional Saxon home-gardens and traditional and / or local knowledge related to land use and landraces cultivation in Sibiu County, Romania. The study was conducted in Moșna commune (it includes 3 localities: Moșna, Alma Vii and Nemșa) which is part of the historical Saxon villages founded between the XIII and XIV centuries. Traditional land use inside traditional Saxon households was investigated as part of the local knowledge to understand if there is a potential connectivity to land use outside urban areas, including forests, pastures, and grasslands. As a result of these surveys, we will present an innovative procedure related to the local official recognition of landraces and home-gardens based on a bottom-up approach with the support of researchers. Such a procedure may be followed by similar communities in our country, Europe or in communities that may share the same social, political, and economic peculiarities.

2. Materials and Methods

Studied area. In the period 2013-2019 more than 20 missions were realized in Moșna commune that includes Moșna, Alma Vii and Nemșa localities in Sibiu's County Romania [62–64]. The geographical coordinates of the sites are as following: 46°04'39''N 24°24'31''E.

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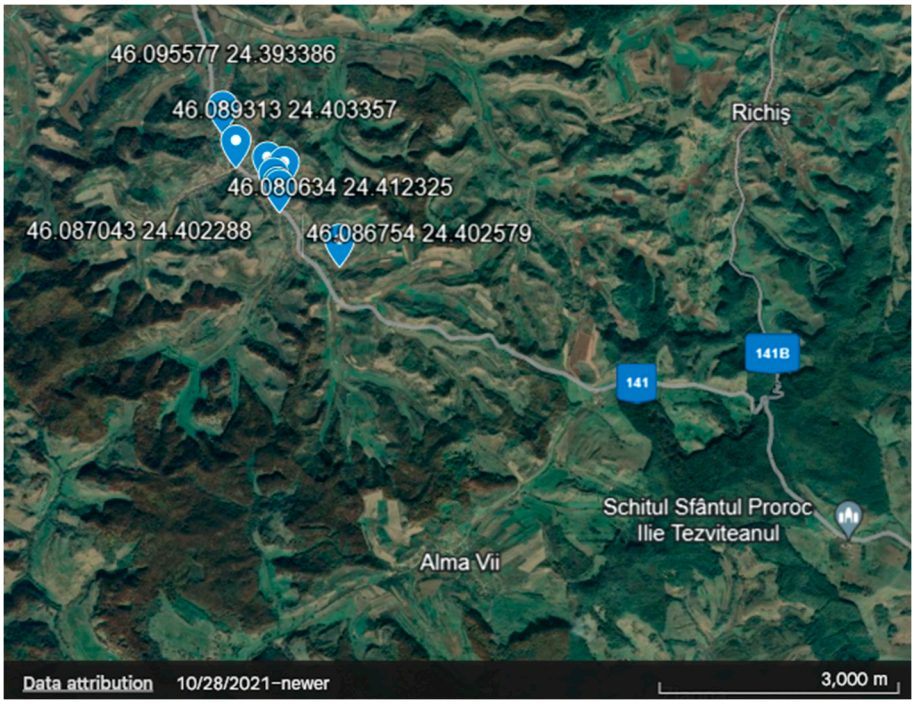

Figure 1. Mapping the traditional Saxon households of Moșna commune (i.e. Moșna, Alma Vii and Nemșa, Sibiu county, Romania), was realized with the support of the free mapping software provided by Google Earth Map [65].

Land-use mapping was realized with the support of Google Map [65] and a Bosch GLM 50-22 laser telemeter. The telemeter was used inside and outside the property of householders and general data were compared to the Google mapping results. The ratio between households and home-gardens land areas was investigated. All in field investigations were conducted during July-September, 2019.

Questionnaire applied. In all these cases a common questionnaire was applied through direct interviews on local authorities and householders [66]. The questionnaire includes for this study relevant information related to landscape properties, land-use inside households, home-garden practices and cultivated species.

Procedure development for the recognition of local / traditional knowledge related to agriculture to support food security was discussed at the mayor's level, followed by the main stakeholders in the commune (i.e. non-governmental organizations, local school) and with local Council Members. Thus, it was agreed to first present the results of surveys as tables and after discussions to finalize the Council Decision to be voted. The principles for capacity building have been applied [67].

Data bases The official scientific names of plant species are documented based on the International Plant Name Index [68] as well as other related and connected inside the website.

3. Results

At a major scale the landscape units are defined by natural relief formations such as hills, valleys and cricks. Forests as well as pastures and meadows may define the ancestral landscapes units of the former spatial planning and occupying almost 50% of the total surface of such types of villages with the highest altitude of 600 m. The territory of commune is defined among others by 47.54% of natural and semi-natural landscapes (forests, pastures, meadows and riparian) that is continuing with agricultural landscape units such as vineyards, agricultural lands covered with crops and grasslands fenced mostly by natural vegetation (i.e. 46.31%) [69–71]. The rest of the land is covered by roads, watercourses and reeds and the constructed areas of the three villages (i.e. 6.15%) (Figure 2).

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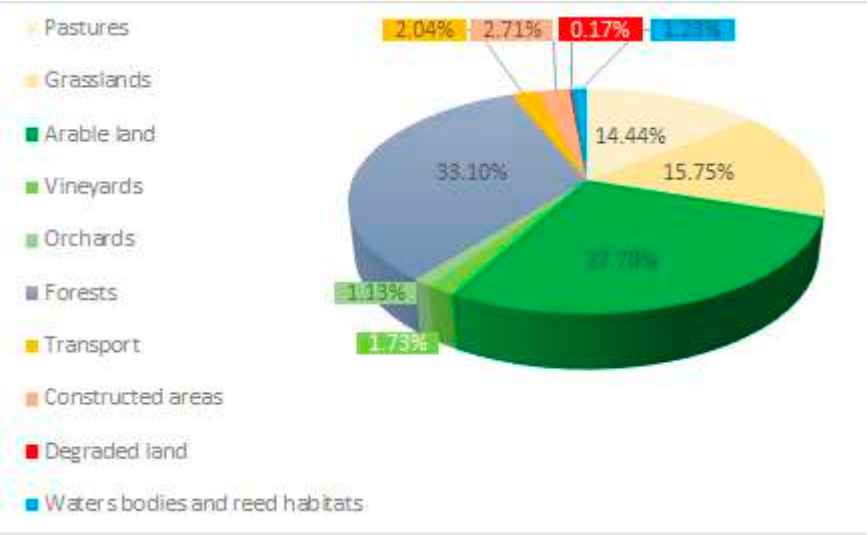

Figure 2. The land use in the Saxon origin Moșna Commune, Sibiu County, Romania. The graph is based on open sources official data provided by local authorities during 2019 [71].

Today the whole commune relies products and services that are provided by agriculture and forest by trying to keep the forest ratio towards the entire agricultural lands such as pastures, grasslands and arable lands as this ratio which has remained unchanged for more than 6 centuries based on historical evidence [69–71].

Interventionary studies involving animals or humans, and other studies that require ethical approval, must list the authority that provided approval and the corresponding ethical approval code.

3. Results

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation, as well as the experimental conclusions that can be drawn.

Heterogenous agricultural land not defined up today for Moșna was investigated for land use inside households as well as for the potential landraces cultivated inside home-gardens.

3.1. Traditional land use of Saxon-origin households

From 2013 to 2019, a total of 15 former traditional Saxon gardens in Moșna commune were investigated for cultivated crops species, vineyards and orchards, ornamental and common garden-weeds. Aside these up to 120 properties have been investigated, with the support of local authorities for the land use inside households that are considered as traditional by local community in terms of home-gardens preservation and households land use. As a general peculiarity we mention that for Saxon origin the heterogeneity of agricultural land that is in direct connectivity to the forests, pastures, cricks, and grasslands (Figure 3.a) also in line with previous studies [69–71]. On the other hand, the mosaic appearance of arable land provides excellent conditions for the richness of biodiversity in direct connectivity to wildlife. Under these conditions that are also imposed by the relief, arable land plots can be found both inside and outside urban areas [71]. Each of the agricultural plots outside the urban areas are cultivated with different crops on less 10 ha, most of them less than 1 ha and larger plots areas are integrated into the semi-natural landscape.

The analysis of land use investigations for 120 properties and considering the preservation of the former land use of the original Saxon population revealed that still exists at least three main categories of households such as the following:

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- *traditional Saxon properties* where land use was preserved for more than 100 years;
- *slightly modified traditional Saxon properties* where land use inside the household has slightly changed over the last 100 years, but where the main characteristics of land use, such as the ratio between the property area coverage and garden area, have been retained, and
- *profoundly modified properties* where no traditional land use can be observed.

These three categories will be further discussed for the traditional land use of the households and the continuous use of traditional home-gardens in our research.

3.1.1. Traditional Saxon properties

Two types of traditional Saxon properties were identified based on telemeter measurements and interviews such as: traditional Saxon households from Moșna commune and the Evangelic Church's Garden of Moșna locality (Figure 3).

1. Traditional Saxon households. Based on measurements realized with telemeter at the local level and compared to data provided by Google MyMap it can be considered that the traditional Saxon households cover a land area ranging between 6,000 and 2,000 m^2. In the case of traditional Saxon gardens, they currently still cover 20,17% at the commune level that means that they include all three localities (i.e. 268 of 1,330 properties and over 3,300 people according to official reports) [71].

The land use of households' property is relevant in this study. In the case of traditional Saxon households, which may be older than 100 years, the covered area for the house construction is between 80 and 140 m^2 for the investigated households. The built area is covered with different dependencies or outhouses and the covering area ranges between 1,400 and 300 m^2. We identified that it may be applied a ratio between the house and outhouse terrain of at least 1:3 or higher. Generally, the rest of the land was covered by legume gardens, orchards as well as grasslands and it was identified to be in a ratio of 2:1:2. The vineyard is now usually associated with the garden and/or the built house.

A construction peculiarity for these groups of households is that some of the outhouse buildings are placed at the street view (i.e. warehouse for hay) being integrated into the rural landscape of the locality. Such land use was due to the presence of a marshy land area inside the urban area and alongside one of the streets where one of the oldest properties was located. Therefore, the houses construction locations in that area, were placed at the foot of the hills level, the upper part of the properties behind the outhouse constructions. We mention that the orchard and grassland area was integrated into the upper part of the marshy land and to the street view is the home-garden and vineyard (Figures 4.a. and 5). The same land use inside the households was found for all 8 groups of properties (Figure 4.b).

(**a**) (**b**)

Figure 3. Image of a household where no boundaries exist between urban and outside urban areas (a). The direct connectivity to the grassland and forests can be also observed the presence of ornamental plants as well (i.e. *Zinnia elegans* L.) in the home-garden. In the Evangelic Church Garden

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mainly species adapted to humidity and shadow are cultivated (i.e. *Cucurbita maxima* Duchesne) (b) (Moșna, Sibiu county, Romania).

(a) **(b)**

Figure 4. Google Earth Map modified - aerial view of Moșna locality. The oldest property of the village, unchanged for more than 100 years (a) as part of a group of households located in the marshy area.

The measurements analysis carried out for all the 120 properties claiming that are applying traditional practices according to local authorities and investigated householders and that are in the possession of traditional home-gardens revealed among others that at an average of 26% of the households are covered by traditional home-gardens (Figure 6 upper part of the graph).

(a) **(b)**

Figure 5. General views for the oldest household of the village – the street view (a) and upper remote part of the household in Moșna locality. Different land use inside the household can be identified: vegetable garden, vineyard, grassland and orchard.

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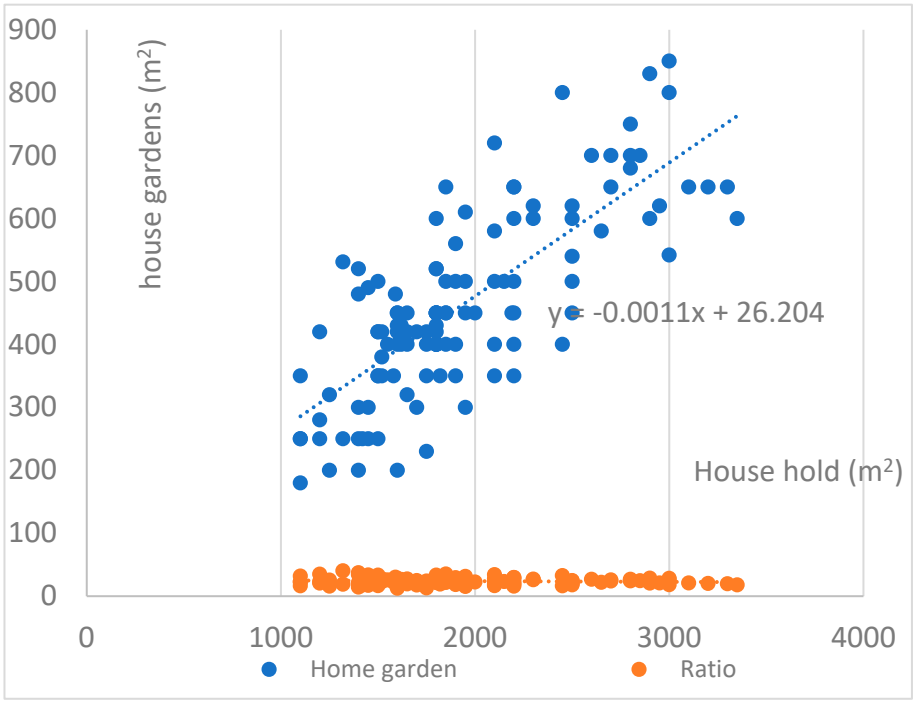

Figure 6. The traditional Saxon gardening is preserving a media range ratio of 26% (y = -0.0011x + 26.204). The survey was realized on 120 households' properties in Moșna, Sibiu county, Romania.

Similar traditional Saxon households can be found in Nemșa village with an average surface between 5,000 m² and less than 1,500 m². The two houses involved in our survey occupied 2,500 m² and were covered by less than 1/3 with constructions, the rest of the households being covered by garden, orchard, and grassland. In Alma Vii, the survey of one property considered at the limit of traditional Saxon household covered some 1,200.00 m². In this respect, the traditional rural landscape was permissive with the place choosing of the built areas inside the households due to the relief conditions but at the street view it was compulsory to be a uniform distribution of the property boundaries (fences and gates). As a general remark, for agricultural practices, these traditional Saxon home-gardens are functioning as integrated parts of the households and cover 24% for 3,000 m² and less in case the property is larger (i.e. in case of 6,000 m²) where a home- garden may cover up to 16% and the rest is covered by field crops for the rest of the green areas.

2. Evangelic Church Garden. The Evangelic Church Garden is positioned next to the church, covering around 1,900 m² (Figure 7) and it is cultivated mainly with plant species that are resistant to shade and high humidity due to the defending bricks walls, surrounding the church. Thus, most of the cultivated species belong to the shrubs group. Today the surface of the Church Garden is unchanged since the Church construction (i.e. XVI century). Upon discussions with the church curator, it appears that for more than 100 years the cultivated species have been almost unchanged, and this may be considered today as a traditional garden too.

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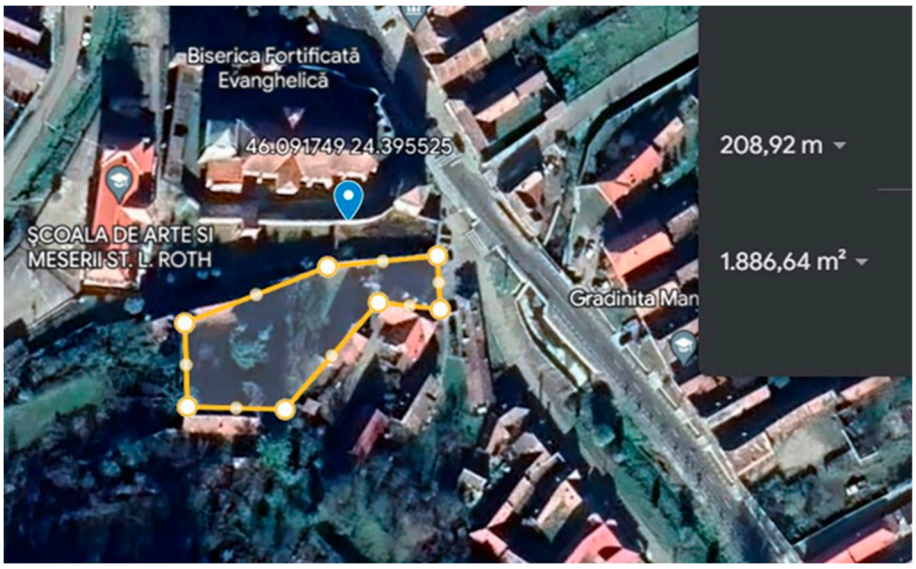

Figure 7. The aerial view of the Evangelic Church Garden generated with the support of MyMap of Google. https://www.google.com/maps/d/u/0/ and https://earth.google.com/web/.

3.1.2. Slightly modified traditional Saxon properties

The second pool of properties in Moșna commune is represented by households that own smaller properties than 1,500 m² but they preserved the traditional way of land use inside their property and especially for traditional home-gardens. In this respect they use to have gardens no larger than 500 m² and down to 200 m² that are managed in a traditional way (i.e. seeds selection system, preservation, cultivation, use) [see central part of Figure 6. Such households have been developed more after the Second World War especially after 1970, when an important part of Saxon population migrated to Germany and their properties have been sold to the Romanian population from the region. Most of the larger properties have been split in two or more. Today, based on the householders survey these home-gardens are assumed to be enough to cover the needs for 3-4 persons and covers for more than 40% of all properties of commune.

3.1.3. Profoundly modified properties

Today a proportion of 38.72% of households are smaller compared to the traditional Saxon households in terms of surface area as well as land use in the urban area [see left down part of Figure 6]. However, in some of them the traditional way of gardening is still well preserved, but there are also householders not interested to apply traditional agricultural practices. In our analysis we consider only householders that still apply traditional practices. Thus, such a property is at house no. 254 that covers around 1,100 m² and comprises a green area of 800 m². In this case their vegetable garden is not integrated in the household being too small, but it is cultivated outside urban area, in the crop field near to the forest area. At the border to the forest are only natural fences between gardens towards the field or the forest and usually the large herbivores such as boars or dears as well as other wild species including bears are in constant contact with these gardens. However, the vineyard cultivated into the field and covering 500 m² is protected against rodents with a simple crafted fence. In the same area the common peach trees are cultivated based on the self-selecting seeds technology that takes no longer than 6 or 7 years long. In a similar situation more than 50% of the householders' properties that are positioned inside urban area but oriented and in close connectivity to the forests are. We mention that most of these properties placed into the urban area and at the limits of the forests are fenced towards the forest areas. Mainly the vegetable gardens positioned inside the field crops are not fenced and cover roughly about 2,000 m².

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Figure 8. The aerial view of the profoundly changed property and preserving the traditional Saxon gardening in the field outside the urban area realized with Google Earth Map. Moșna Sibiu County Romania.

3.2. Traditional and local knowledge related to home-gardening

The survey of household owners as well as the representatives of authorities revealed that the cultivation of all vegetables is part of their traditional knowledge as they have been orally transmitted from their ancestors or at the community level [62–64]. In this case today we are witnessing the use of agricultural practices thar are either part of their traditional knowledge or are newly integrated and it can be considered as a local knowledge.

It can be considered that the knowledge associated with the selection of crop species cultivation inside their garden or in the field is part of the traditional knowledge transmitted up to nowadays. In this particular case they are cultivating small plots areas in their traditional gardens (i.e. a plot area is of 3- 4 m^2) and the mosaic of cultivated legumes inside the plot areas is part of the traditional knowledge. Thus, they know that some species should not be cultivated next to others. More than that they also inherited a traditional knowledge related to the shrubs, vineyards and orchards cultivation and management and from the beginning they know what part of the garden they need to use for their cultivation, how to graft new varieties or how to apply maintenance cuts. Some of these results have been published already [62–64]. Thus, these traditional and local knowledges are essential to make householders to understand the relevance of integrating new crop or ornamental species into their today gardening. It is the case of 'apple'-pepper variety especially cultivated by the Hungarian population very much appreciated in this region too and also integrated into their gardens [63].

As a general feature, into all home-gardens either they are in the urban area or outside urban areas the local people cultivate ornamental plant species for the beauty of their flowers that are mainly blooming during summer up to autumn period (i.e. most abundant are *Zinnia elegans var. purpurascens* DC., and *Callistephus chinensis* Nees). Another plant species cultivated among the ornamental plants and not missing from traditional gardens is basil (*Ocimum basilicum* L.).

We mention that this community is still applying agricultural practices based on the Christian calendar (i.e. either Orthodox, Evangelical or other confessions). Thus, they stated that all agricultural practices that are traditional are following the religious calendar and inside the garden are starting at least one week before St George (i.e. 15 of April) and in the field they start one month later (i.e. 15 May).

Traditional knowledge is also associated with garden's weed species management. All these families have the knowledge related to the usefulness of some of the species or for the futility of others up to being considered as real pests for their gardens.

Among the undesired weed species we mention: *Ecballium elaterium* (L.) A.Rich. *Agropyron repens* (L.) P.Beauv., *Cirsium arvense* (L.) Scop., *Sonchus arvensis* L.

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Some of the weed species are appreciated for being used in their traditional practices (i.e. for cuisine, farm or for different remedies) reason why they preserve them inside the gardens such as: *Melissa officinalis* L., *Geranium robertianum* L., *Portulaca oleracea* L., *Symphytum officinale* L., *Polygonum aviculare* L., *Equisetum arvense* L., *Achillea millefolium* L., *Matricaria chamomilla* L. Collecting, drying, preserving and use of the medicinal plants in their home is a continuous process enriched all the time and nowadays it can be considered as local knowledge developed already on traditional knowledge .

In case of wild species local community is also in the possession of traditional knowledge related to mushrooms collection from the wild (i.e. collecting from the forests or pastures, preserving and cooking) as well as of other wild fruits from the forests. The most appreciated mushrooms are: *Macrolepiota procera* (Scop.) Singer, Armillaria mellea (Vahl) P.Kumm. and Cantharellus cibarius Fr., and Agaricus arvensis Schaeff. They know based on traditional knowledge when and where to find all these food resources, preserving and preparing being part of local knowledge developed on traditional knowledge too.

The major risks for community are the invasive alien species spreading inside arable land areas such as *Erigeron annuus* (L.) Desf. and *Solidago canadensis* L. Both species have been seen in the marginal parts of the arable land mostly on the paths from the village to the field of crops. In these three villages the abandonment of the arable land is under 0.1% (i.e. part of the degraded arable land of 0.17%, Figure 2) and these species could not spread too much compared to neighboring villages such as Ațel or Dupuș also from Sibiu County [51].

3.3. PGRFA listing for their heritage value

Based on the results of applied survey and published in 2020 [63,64] we identified for this study 20 PGRFA that are important for locals to be cultivated in their home-gardens for more than 100 years (Table 1). These results have been endorsed by local authorities and stakeholders due to their experience.

In the same survey authorities agreed that for animal bred they would recognize as having heritage value for the local Bazna Pig. For this the householder from no 268 in Moșna was also recognized at local level for its TK related to animal husbandry in line with UNESCO Intangible Heritage Convention.

A second set of data covered genetic resources that are recognized by local householders only that are slightly different compared to the first list and covers additional 10 crop species (Table 2). In this specific case some of the landraces are cultivated for less than 50 years and therefore they can be considered as creole and having good chances to become landraces.

Table 1. Local genetic resources used in traditional home-gardens of Moșna commune for more than 100 years, Sibiu County Romania. Data results based on home-garden survey and locals' statements.

Crt. no	Scientific name (vernacular Romanian name)	Household no. in Moșna localities
	Crops as landraces	
1.	*Allium sativum* L. (usturoi)	Alma Vii (182), Moșna (19, 254*, 268, 418) Nemșa (51,111)
2.	*Anethum graveolens* L. (mărar)	Alma Vii (182), Moșna (268, 418, 420), Nemșa (51,111)
3.	*Apium graveolens* L. (țelină)	Alma Vii (182), Moșna (254*, 268, 417, 418), Nemșa (51,111)
4.	*Armoracia rusticana* G.Gaertn., B.Mey. & Scherb. (hrean)	Alma Vii (182), Moșna (420), Nemșa (51,111)
5.	*Artemisia dracunculus* L. (tarhon)	Moșna (417)
6.	*Brassica oleracea* var. capitata L. (varză de Moșna)	Alma Vii (182), Moșna (1/C, 254*, 268, 418, 402, 461),Nemșa (51,111)
7.	*Petroselinum crispum* (Mill.) Fuss (pătrunjel)	Moșna (268, 417, 420)
8.	*Phaseolus vulgaris* L. var 'nana' (fasole oloagă)	Alma Vii (182), Moșna (418), Nemșa (51,111)
9.	*Rheum rhabarbarum* L. (rubarbăr)	Evangelic Church Garden Moșna 530
10.	*Satureja hortensis* L. Cimbru	Moșna (254*, 206, 420)

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11.	*Zea mays* L., (porumb pe 8 rânduri)	Moșna (12)
12.	*Zea mays* L. (porumb roșu de Moșna)	Moșna (543)
	Fruit trees, shrubs and vineyards	
13.	*Cydonia oblonga* Mill. (gutui)	Moșna (19, 206)
14.	*Prunus armeniaca* L. (cais)	Moșna (19, 268)
15.	*Prunus domestica* L. (prun)	Alma Vii (182), Moșna (268), Nemșa (51,111)
16.	*Prunus persica* (L.) Batsch (piersic)	Alma Vii (182), Moșna (254*, 268), Nemșa (51,111)
17.	*Rubus idaeus* L. (zmeură săsească – local[)	Alma Vii (182), Moșna (19, 417, 530), Nemșa (51,111)
18.	*Vitis vinifera* L. 'Perla negra' (viță Perlă Neagră)	Alma Vii (182), Moșna (254*, 417)
19.	*Vitis vinifera* L. 'Risling' (viță Risling)	Moșna (254*), Nemșa (51)
20.	*Vitis vinifera* L. Hybrid (viță Nova)	Moșna (417)

* Traditional gardening is located outside the urban area.

Table 2. Local genetic resources used in traditional home-gardens of Moșna commune for more than 50 years, Sibiu County Romania. Data results based on survey and locals' statements.

Crt. No	Scientific name (vernacular Romanian name)	Household no. in Moșna localities
	Crops as landraces	
1.	*Allium cepa* L., (ceapă locală)	Alma Vii (182), Moșna (254*, 268, 417, 418, 420), Nemșa (51,111).
2.	*Cucumis sativus* L. (crastraveți)	Moșna (254*, 268, 417, 418, 420), Nemșa (51,111)
3.	*Cucurbita maxima* Duchesne (bostan plăcintar)	Evangelic Church Garden, Moșna (530).
4.	*Lactuca sativa* L. (salată verde)	Alma Vii (182), Moșna (19, 254*, 268, 417, 418, 420), Nemșa (51,111)
5.	*Mentha* L. sp. (mentă)	Moșna (420)
6.	*Phaseolus vulgaris* L. (fasole de haraci)	Alma Vii (182), Moșna (19, 418, 417, 420), Nemșa (51,111)
7.	*Solanum lycopersicum* L. (roșii)	Alma Vii (182), Moșna (19, 206, 254*, 268, 420, 417, 418), Nemșa (51,111), Evangelic Church Garden
8.	*Solanum tuberosum L.* (cartofi albi)	Moșna (417)
9.	*Spinacia oleracea* L. (spanac)	Moșna (417)
10.	*Zea mays* L., Turda 200 (Porumb Turda 200)	Moșna (254*)

* Traditional gardening is located outside the urban area.

Very important are the species with two years per life cycle such as onion or cabbage. The cultivation of such species implies the knowledge required for seed selection, seedlings cultivation, crops maintenance and use for the future. These skills are essential for applying the best agricultural practices in these traditional villages.

3.4. Traditional home-gardens recongition for their heritage value at local level

Upon the analysis of the composition of home-gardens it was established based on the proved knowledge including agricultural practices for at least 15 householders as families the continuing implementation during their life long the same agricultural practices (i.e. seed selecting system, cultivation, storage, use) as they were transmitted and inherited from their ancestors. We mention that all surveyed locals proved to be able to test and introduce new species and keep co-existence for different cultivars (e.g. Saxon raspberry and without thorns raspberry, new peppers varieties such as apple pepper and other classic cultivars, tomato cherry versus old landraces of tomato) [62–64].

During these discussions all lists suffered slight changes upon which all agreed to be part of the future local Council Decision.

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Table 3. Traditional Saxon home-gardens in Moșna commune, Sibiu County, Romania that have been recognized by local authorities.

Crt. no	Household no. in Moșna localities	Landraces and animal bred in home-gardens of heritage values
1.	Moșna 254*	Garlic, onion, tomatoes, Moșna cabbage, thyme, yellow maize with 8 rows cobs, celery.
2.	Moșna 418	Moșna cabbage, tomatoes, dwarf beans, thyme, celery.
3.	Nemșa 111	Onion, garlic, plum-trees, thyme, celery, Saxon raspberry.
4.	Moșna 206	Thyme, celery, horseradish.
5.	Moșna 268	Salad, tomatoes, Moșna cabbage, dill, cucumbers, Bazna pig.
6.	Moșna 12	yellow maize with 8 rows cobs, thyme, celery.
7.	Alma Vii 182	Garlic, onion, Moșna cabbage, eggplants, Saxon raspberry.
8.	Moșna 420	Tomatoes, thyme, beans, parsley, dill.
9.	Moșna 417	Vine Nova, beans, potatoes, Saxon raspberry, thyme, celery
10.	Moșna 19	Saxon raspberry, quince, apricot, thyme, celery.
11.	Moșna 530	Pumpkin for pies, tomatoes, Saxon raspberry, rhubarb, thyme, celery.
12.	Nemșa 51	Garlic, onion, Saxon raspberry, plum-trees, thyme, celery.
13.	Moșna 461	Moșna cabbage, thyme, celery.
14.	Moșna 1/C	Moșna cabbage producer for selling, thyme, celery.
15.	Moșna 402	Moșna cabbage, thyme, celery.

* Traditional gardening is located outside the urban area.

4. Discussion

The evolution of human civilization in the past 100 years created tremendous changes at the interface human and environment associated nowadays with huge costs over nature restoration and conservation [72,73]. The quest for accessing new natural resources as well as for developing or maintaining polluting technologies for the past two centuries is paid today with the tremendous loss of biodiversity at the global level [52,74–76]. Among major threats to the future of our civilization at the global level we may cite the decreasing access to nutritional food [53–55,77] and potable water [78] as the ground foundation for our continuity [79]. However, human civilization is today facing additional challenges such as those generated by biodiversity loss [51–55,80], shook effects of climate change and desertification [16,81].

Of particular interest in our future development are the appropriate measures to be implemented for agriculture under the sustainable development goals [82] where a focus should be on soil fertility preservation and improvement [83]. On the other hand, by recognizing the values of intangible cultural heritage rural communities becomes once again the subject of such types of analysis at the global level [9,10,15,20,84].

4.1. Traditional land use of Saxon-origin households

Moșna locality is historically documented since 1280 as a Saxon village with fortified church called "Mäschn" in German or sparrow. Today the commune includes the villages Nemșa (original German name is "Nymps") first historically documented in 1359 and Alma Vii (original German name "Almasium") mentioned in 1356 all three being originally inhabited by Saxons. Other at least 11 similar communes exist, located especially in the Northeast of Sibiu County and all of them have been constructed based on a rigorous village spatial planning dominated by fortified churches for creating independent resilient communities that proves their success during history [69,85]. During the XIX century these localities started accepting Romanians ethnics and after 1970 the ratio changed for Romanians [70,86]. Nowadays the above authors identified and defined the strong local cultural identity for these Saxon origin's communities.

The general spatial planning and land use management including agricultural land of the commune were well preserved and included in the current spatial planning mostly due to the relief peculiarities not supporting intensive agricultural practices. The main access transport roads are towards Mediaș (i.e. 10 km) being at least in the XIX century the main producer of high wine quality

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in the region. As the distance towards Sibiu was high (i.e. 66 km) and the location was off the national roads, these localities remained archaic or remote compared to others in terms of implementing intensive agriculture practices [70,86,87]. As a result, we are embracing nowadays a high nature value of biodiversity in this village and in similar Saxon origin villages as well [85–88].

The commune Moșna is also located in a hilly area covered for 43.38% of its territory by the ROSPA0099 Podișul Hârtibaciului, the most extensive SPA in the interior of Romania and 0.01% by ROSCI0227 Sighişoara – Târnava Mare [71,89].

Investigating traditional land use

In this particular case, by starting survey research for landraces for Moșna commune on several occasions after 2013 up to 2019, new subjects became of high interest for us. Thus, the interviews with local authorities and householders revealed new subjects of high interest such as the discovery of TK related to agricultural practices. Moreover, it was underlined once again the relevance of these villages for nature conservation as a whole and related to the heterogenous landscape. Thus, in our attempt to define home-gardens we discovered that up today no study was realized in Romania on this subject even certain studies revealed the relevance of farming positive impact on nature conservation [86,90]. Therefore, based on our observations several indicators were already defined for home-gardens survey and assessment among which we may mention the following: 1) the historical topography inside the households, 2) the continuous cultivation of old landraces, 3) the integration of wild genetic resources in the household needs, 4) risks and vulnerabilities for traditional and local knowledge erosion, and 5) capacity building at the local level [62]. However, the topography or traditional land use inside the households was not studied yet in Romania for this subject. Such studies have been realized also in different countries being recognized the lack of academic studies that may further substantiate the spatial planning for the sustainable use of natural resources [91]. Now we mention the results of similar studies in China [92], Ghana [93] or Ecuador [94]. In Europe similar studies have been published for Spain [95], Greece and others [96], but not too many for the Eastern European countries and not at all for Romania.

The major attribute of these Saxon origin villages is their position in natural fragmented landscapes due to the relief properties, having access to major natural resources and ensuring all community's needs to survive as fortified church [70,85]. As mentioned above, during the XIXth century these villages were occupied mostly by the Saxon population but slowly also integrated Romanians [70]. The transfer of traditional knowledge related to agriculture and not only was ensured at the community level and transmitted up to nowadays based on similar principles already identified in different indigenous communities [97]. Our results supported the idea that in these remote distance of Sibiu villages it was possible to be further preserved customs and knowledge related to agriculture such as seeds selecting systems, crops cultivation, traditional land-use inside the household as well as the sustainable access to natural resources.

The main characteristics of these three Saxon origin villages that can support further the sustainable rural development ideas for circular economy under the Green Deal [98] in the regions, and relevant for this study are as following:

- general land use inside households is similar;
- traditional home-gardens, orchards, vineyards and grasslands are mostly located inside the urban area;
- the intimate contact of households and gardens with forests and pastures or meadows is ensuring the wild-life long-term contact with agro-ecosystems and further support their status of hotspot of biodiversity conservation.

The fact that traditional Saxon type home-gardens still exists in localities such as Moșna, Alma Vii, Nemșa entrust us to consider that the future spatial planning in the rural areas in Romania needs to refer to such households to ensure the resilience of rural communities for the future [99].

Based on these study results three different types of land-use exists today in these villages: 1) traditional Saxon properties; 2) slightly modified traditional Saxon properties and 3) profoundly modified properties. Also, we mention that the alteration of the traditional land-use of household is not so profound, and it is relevant for the future that the urban spatial planning to be realized

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according to the principles of ensuring a sustainable access to resources as in case of citadels. These principles may further support the development of strong resilient communities facing the dramatic effects of climate change but also ensuring the integration of new technologies based on existing local knowledge [97].

Genetic resources for food and agriculture listing

Upon the listing discussions with all involved stakeholders, it was presented a list of legal reasons why such lists should be recognized at the local level as having cultural heritage value for their communities.

The major question was who can be certified that these genetic resources are unique? This is a pertinent question. However, the need to identify their existence with specific landraces or old animal races raises new questions. Thus, if there is a traditional knowledge already transmitted through generation in their families or in their community, the process itself should be preserved as it will support further the access of local communities that are well trained in the cultivation of specific plant genetic resources [51]. Consequently, the discussion of paradigm certified seeds versus self-recognized gained for local authorities towards the second in similar cases like in Amazonia [100]. And way? Because of proving the existence of erosion process in terms of social dimension of local community for more than 30 years [51].

Old families are cultivating traditional gardens with traditional genetic resources and such a recognition should support the promotion of these values to all community furthermore supporting food security for the future.

Aside such discussions the traditional and local management of heterogenous agricultural lands were recognized that will becomes more complex under the shock events of climate change as well as food insecurity installing at the local rural level. As a consequence, the very first measure should be the securing of all resources (i.e. tangible and intangible) [100]. Among these resources we underline that local knowledge securing need in direct connectivity with agriculture management [101]. Moreover, if this activity is associate with local pride the future implementation of innovative agricultural practices is ensured for long term [102,103].

Thus, among the legal documents pointed out as reasoning of the Local Council Decision issuing and approval we mentioned before [51] two European directives:

1. Commission Directive 2008/62/EC of 20 June 2008 providing for certain derogations for acceptance of agricultural landraces and varieties which are naturally adapted to the local and regional conditions and threatened by genetic erosion and for marketing of seed and seed potatoes of those landraces and varieties; and
2. Commission Directive 2009/145/EC of 26 November 2009 providing for certain derogations, for acceptance of vegetable landraces and varieties which have been traditionally grown in particular localities and regions and are threatened by genetic erosion and of vegetable varieties with no intrinsic value for commercial crop production but developed for growing under particular conditions and for marketing of seed of those landraces and varieties.

In terms of capacity building the list of reasoning refers to the national regulatory framework on the subject and for administration as well as the European regulatory framework on the subject of the Local Decision to prove that it is respecting and is in line with the EU legal framework [51].

The text of the Local Decision recognizes into the provisions of 10 articles that are including among others the heritage value for the following items:

1. The list of crop plant species grown in Moșna commune according to the AGR 2A form (the current form for collecting data related to agriculture products and land) [62–64]
2. The list of cultivated plant species cultivated for more than 50 years [62–64]
3. The list of local populations cultivated for more than 100 years
4. The list of ancient animal breeds
5. The list of families owning local varieties with heritage value
6. The list of traditional home-gardens

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The text of this decision stated that *future development strategy for agriculture will take into account the conservation and sustainable use of local varieties and ancient breeds of animals as well as the promotion of families that own such resources.*

The Local Council Decision was approved by the Commune Council in 29.11.2019.

We mention that it was the first decision on this subject taken at the local level in Romania. The promotion of pride at the local level related to agriculture which is among their daily life activities may support rural communities to further ensure food security for the future and to increase their resilience. Such an approach was needed to be exercised in our country as Romania do not have yet a national strategy adopted for the conservation and sustainable use of plant genetic resources for food and agriculture under the Plant Treaty [51,62].

Such an approach may further support capacity building at the authority's level in charge with the conservation of genetic resources as a basis for new breeding programs all over the country. The Multilateral System may provide access for biotechnology laboratories working on different plant species on a broader genetic pool including from on farm conservation [104]. Thus, including morphogenetic processes studies such as that of somatic embryogenesis may benefit from the revealing at the national level of landraces lists [105,106].

5. Conclusions

A major role in a household's life has traditional home-gardens preservation as a specific land-use pattern inside the household for supporting the needs of their family for Moșna commune in Romania. Thus, today about 26% of the current household land use is covered by home-gardens and 20.17% households are still preserving the original Saxon land use. In these properties a mix of traditional and modern agricultural practices are applied from seed selection system, preservation, cultivation and further use. 20 landraces have already been recognized as being of heritage value at the local level. These Saxon origin households may provide to us a *historical reference and traditional land use cover* to understand better what a resilient rural community is and it would perfectly responding to current policies for supporting circular economy and low costs of energy under the Green Deal and a fast connectivity to Breeders through Multilateral System based on Seeds Gene Bancks.

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