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# THE INVOLVEMENT OF THE COMMON AGRICULTURAL POLICY IN THE LIVESTOCK SECTOR AND THE CONTRIBUTION TO THE DEVELOPMENT OF MOUNTAIN RURAL AREAS

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***Abstract***

*Animal husbandry is a traditional activity and an important source of income in the hilly and mountainous areas of Romania, which also supports secular activities in these places. In the context of the EU directives, animal husbandry must be combined with environmental protection actions without losing its importance and traditional elements. The Common Agricultural Policy 2021-2027 through the National Rural Development Programme offers broad support to the livestock sector, but also imposes certain restrictions, as manure from animal husbandry has a negative impact on soil and underground waters through nitrite and nitrate pollution. The article analyses the dynamics of cattle and sheep and goat herds from Romania's mountain area in the period 2015-2021 and the annual amounts of manure that can be obtained from these species. Some methods of using polluting products from animal husbandry are presented, such as using them in biogas plants and obtaining fertilizers from processed manure, which can contribute to the sustainable development of rural areas.*

***Key words*****:** *animal husbandry, Common Agricultural Policy, environmental protection, manure, rural development*

## INTRODUCTION

Livestock farming, a specific activity in the mountain area, has recently faced, in addition to economic problems, the requirements to adapt to environmental standards. Consequently, investment in farm modernization is needed in this sector, which ensure a good manure management [14].

The advantage that Romania has in terms of raising sheep and goats is due to its geographical position, with varied relief (mountains, hilly areas and plains in percentage of approximately 33% each) and large areas of pastures (3.3 million ha) and meadows (1.5 million ha), representing respectively 14% and 7% of the total of 14.6 million ha of agricultural land [19].

Sheep and goats make use of land unsuitable for cereal cultivation and other important categories of plants by grazing. At the same time, they represent an important factor for the preservation of biodiversity, the maintenance of local breeds thus avoids the "genetic erosion" caused by genetic crossings. At the same time, the manure they produce improves soil fertility and ensures plant biodiversity from the spontaneous flora [7].

With Romania's entry into the EU, a new trend appeared in the sheep sector, namely, the transition from raising sheep for milk, live lambs and wool, to the production of meat and milk for the European market [19].

At the same time, the legislative harmonization with the EU community acquis imposed compliance with the "animal welfare" requirements. In Romania this situation is slowly improving [21].

According to statistical data, in 2021, 10,087,439 sheep, 1,826,845 cattle and 1,492,544 goats were raised in Romania [17]. The production of manure obtained from these animals ranked dairy cows first, with 11,508 kg/year, followed by 1-2 years' cattle, with 7,749 kg/year and sheep in last place, with 843 kg/year [10].

Manure from these animals is a source of pollution not to be neglected if not properly managed.

EU farmers have been affected hard by rising input prices, especially in Russia, Ukraine and Belarus, which provided 48.16% of the fertilizers used in the Member States in 2021 [9]. The European Commission considers manure to be the key that would help reduce costs and dependence on non-EU countries [22].

The article analysed how the livestock sector can contribute to the development of rural areas through the new requirements regarding manure management. Treatment and transformation through a process known as Manure Nitrogen Recovery (RENURE), agreed by the EU's Common Agricultural Policies (CAP), as well as use in biogas plants to obtain alternative heat and electricity are ways to harness the main pollutant in rural areas and an important step towards implementing the Zero-Waste concept [25].

## MATERIALS AND METHODS

The purpose of this study was the analysis of how the livestock sector can contribute to the development of rural areas, taking into account the recommendations of the Common Agricultural Policies. The analysed period is 2015-2021. For the elaboration of this paper was used the information available online on the website of the National Institute of Statistics (INS), more precisely the Tempo-Online database. In order to better outline the existing situation on the Romanian animal husbandry sector, a series of indicators were analysed, such as: the number of live animals and the annual amounts of manure that can be obtained from several of the animal species. This information was processed using a quantitative analysis method and presented in the form of tables or graphs. Also, the data available on the Agency for the Financing of Rural Investments (AFIR) website was used, from which information regarding the number of selected funding applications for the Sub-measure 6.1 was extracted. In parallel, the specialty literature was studied, in order to know the current state of the information on the approved topic, in the context of support provided to this sector by the European Commission, through various specific policies.

## RESULTS AND DISCUSSIONS

In Romania, the area included in the Mountain Area (ANC ZM) represents about 30% of the country's area (71,381.48 km$^2$) and covers 27 counties - Figure 1, 2.

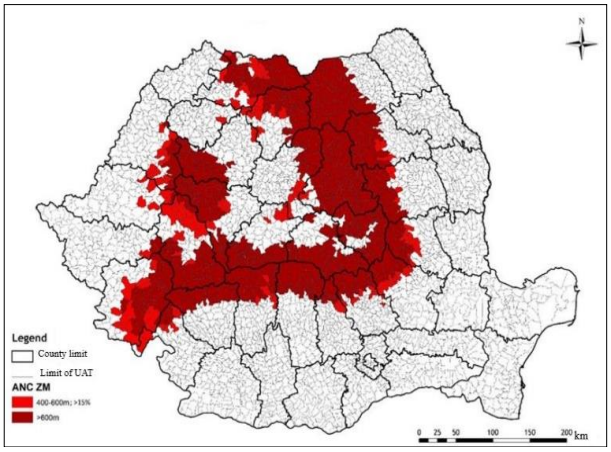


Fig. 1 Administrative-territorial units (UAT) included in the mountain area (ANC ZM) starting with 2023, Source: [14].

The locals in this area represent almost 15% of the Romanian population. At the level of 2016, the rural population of the mountainous area constituted 52.47% of the total population of the mountainous area, while the rural population of Romania represented 44.94% of the total population of the country [24].

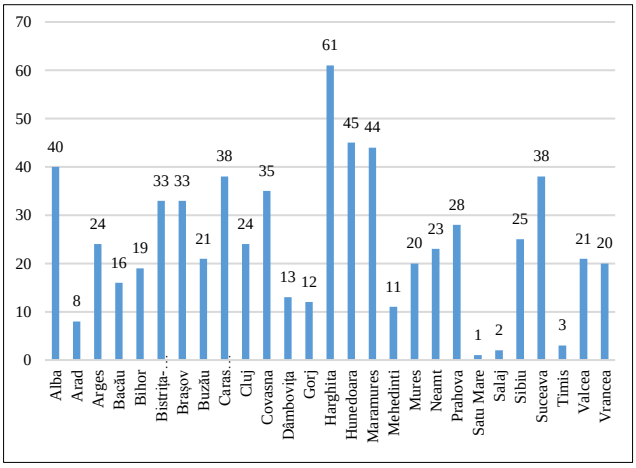


Fig. 2. Number of UATs in the Mountain Area
Source: our representation after [1].

It also includes 658 Administrative-Territorial Units (UAT) - Figure 2 - with an agricultural area of 1,828,845 ha [18].
As it can be seen, there are counties with a large number of UATs located in the mountainous area (Harghita, Hunedoara, Maramures), but also counties with only a few localities (Satu Mare, Salaj, Timis).
Livestock farming (especially cattle, sheep and goats) is an activity practiced in Romania since ancient times, especially in the mountain area, where it is the main occupation of the locals.
The breeds encountered here are bred in subsistence and semi-subsistence farms, which require low maintenance costs [19].
At the same time, these farms have less access to sources of funding and are less able to adapt to high performance technologies due to a lack of own funds [11].

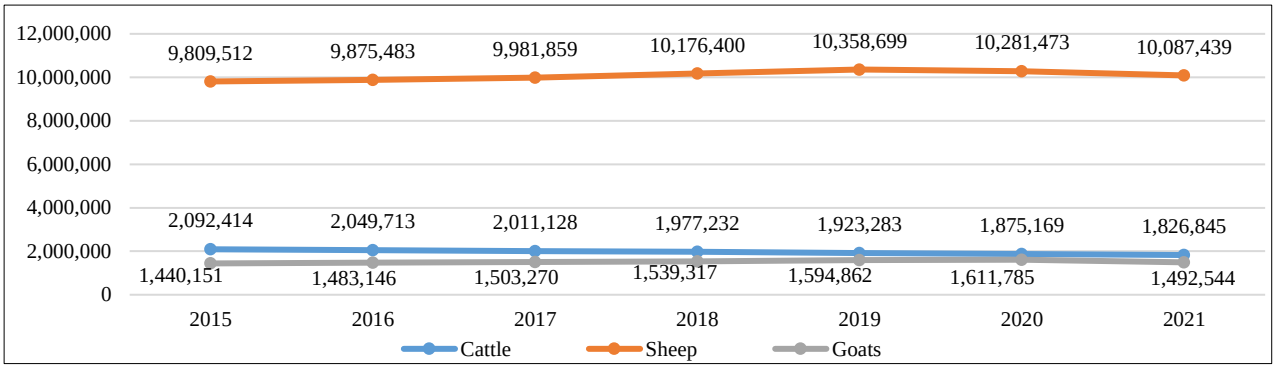


Fig. 3. Livestock dynamics of cattle, sheep and goats in Romania, from the mountain area, in the period 2015-2021
Source: our representation after [17].

Figure 3 shows the dynamics of cattle, sheep and goats in Romania, in the mountain area, in the period 2015-2021.
It is noted that the total number of cattle heads decreased by 12.7% in the analysed period, while for sheep and goats there was a slight increase by 2.83% and 3.64%, respectively. At the same time, it can be noticed that the Covid-19 pandemic had a negative impact on the livestock by about 10%.
Among the animal species raised in the analysed region, sheep predominated, being followed, at a distance, by cattle and then by goats.
The dynamics of the cattle herds from the 27 counties included in the mountain area, in the period 2015-2021 is found in Figure 4.
The share of cattle raised in the mountain area increased from 73.2% in 2015 to 75.5% in 2021. From the point of view of the territorial distribution, is necessary to mention that only 7 counties recorded an increase in the number of heads, of which can be noted Covasna, Sibiu and Bihor, by over 15%.
Suceava County remained the leader, but for the analysed period was reported a 25% decrease in cattle herds.

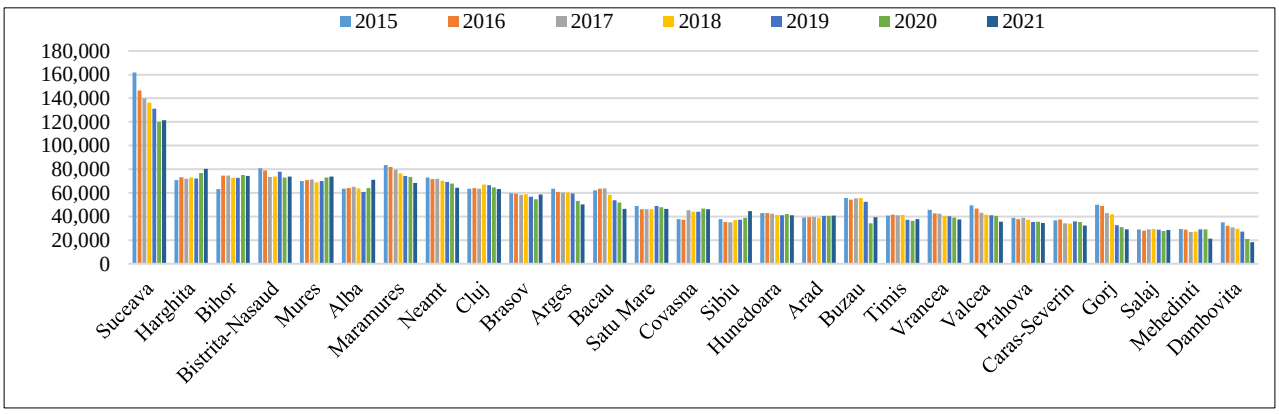


Fig. 4. Dynamics of cattle herds in the mountain area, in the period 2015-2021
Source: our representation after [17].

Despite the trend of increasing the number of sheep heads at the country level, the share of those raised in the mountain area, of the country's total, decreased from 71.8% in 2015 to 66.7% in 2021.

In 2021, the livestock grew in 13 counties, the most significant increases being recorded in Bihor – 37.6%, Alba – 29.25% and Bacau – 23.1% (Figure 5).

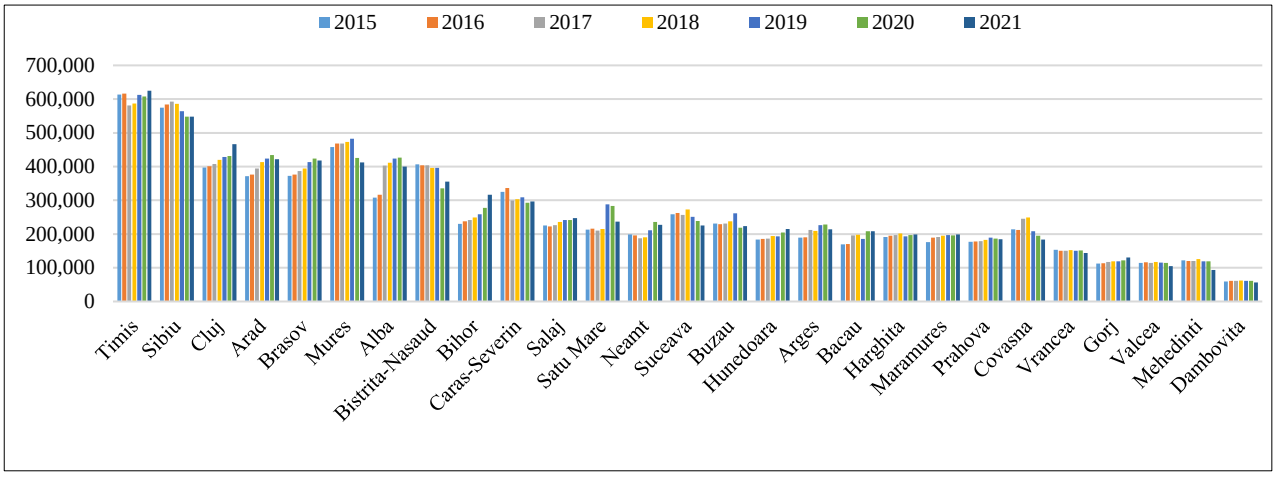


Fig. 5. Dynamics of sheep flocks in the mountain area, in the period 2015-2021
Source: our representation after [17].

The largest decrease was observed in Mehedinti and Covasna counties, with 24.25% and respectively 14.1%, Timiș and Sibiu counties, found in the first places, held about 20% of the total sheep in the country, keeping a quasi-constant trend in the analysed period. Compared to 1990, the number of sheep decreased, from 14,061,864 in 1990 to 10,087,439 in 2021, i.e. by 29.26% [5]. In the case of goats, can be noticed a situation similar to that of sheep, that is, the share of livestock in the mountain area relative to the country's total decreased from 49.1% in 2015 to 47.02% in 2021. The highest percentage of growth was recorded in Alba County (118.93%), followed by Sălaj (39.31%) – Figure 6.

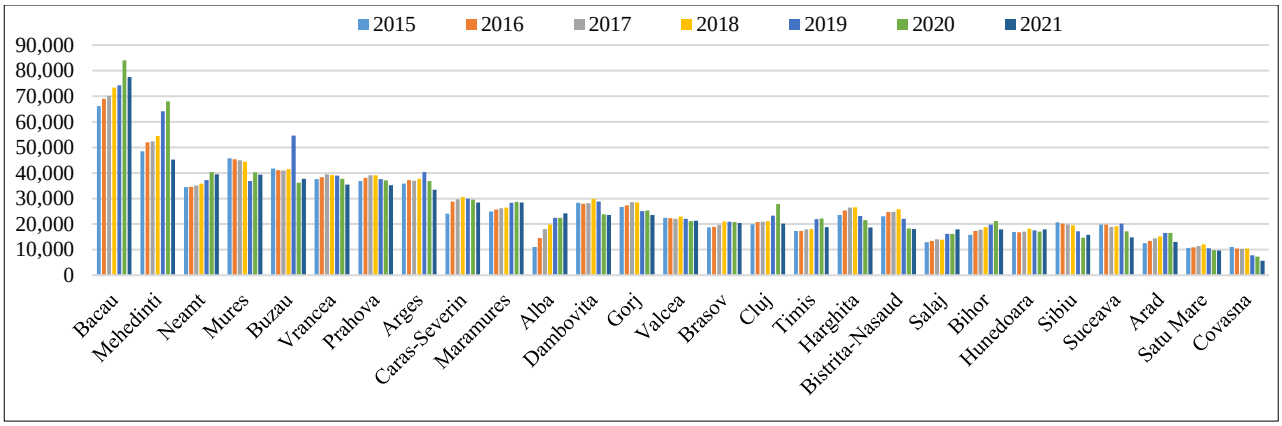


Fig. 6. Dynamics of goat herds in the mountain area, in the period 2015-2021
Source: our representation after [17].

At the opposite pole is Covasna, where the decrease was about 50%, and for the counties of Sibiu and Suceava the decreases were about 25%. Bacău County was the leader, with 11% of all Romanian goats.

Compared to 1990, the number of goats increased, from 1,004,810 in 1990 to 1,492,544 (48.54%) [5].

The annual quantities of manure (solid or semi-solid consistency) that can be obtained from some of the animal species studied are shown in Table 1.

Table 1. Manure production (kg/year)

| Species | Production of manure kg/year | Nutrients (kg) |
|---|---|---|
| dairy cows | 11,508 | 81 kg N<br>15 kg $P_2O_5$<br>54 kg $K_2O$ |
| cattle 1-2 years | 7,749 | 5 kg N<br>20 kg $P_2O_5$<br>43 kg $K_2O$ |
| infant calves 0.3 -1 year | 4,930 | 35 kg N<br>5 kg $P_2O_5$<br>26 kg $K_2O$ |
| sheep | 843 | 7 kg N<br>1 kg $P_2O_5$<br>5 kg $K_2O$ |

Source: [10].

In traditional agricultural practices, manure is used to fertilize crops and is applied directly to the land. But exceeding the optimal allowable amounts creates a surplus of nutrients that becomes harmful, especially because of nitrates.

Manure emits nitrogen-containing gases into the atmosphere, such as: ammonia, nitrogen oxides, nitrous oxide (which has a strong greenhouse effect). Poor manure management can lead to the loss of 50% of nitrogen and diminish the fertilizing effect of the obtained compost [15].

Because 80% of the animals are raised in individual households that are not conditioned by obtaining the environmental permit and do not have manure storage facilities, they are a risk factor for point pollution of water and for increasing the level of greenhouse gas emissions [14].

Poultry breeding is also a traditional activity in rural area, they are raised in large numbers, both in individual households and at the country level in livestock farms. Experiments to make the most efficient use of animal manure are in full development, and poultry manure is also included in this category [13, 16].

Studies show that manure is one of the raw materials from farms, which can be used for the operation of compost production complexes and biogas plants. For the purpose of determining the appropriate size of the biogas plant, account must be taken of the number of heads of animals and the type of raw material available.

Thus, in Table 2 it is presented the correlation between the number of cattle on the farm, the resulting amount of manure/day, the production of electricity and heat obtained and the estimated value of the required investment.

Table 2. Production of electricity and heat obtained from cattle farms

| No. of cattle heads | Manure (kg/day) | KWh cal | KWh el | Total | Occupied area (ha) | Total estimated cost (1,000 Euro) |
|---|---|---|---|---|---|---|
| 500 | 34 | 87 | 173 | 260 | 0.4 | 1,276 |
| 829 | 56.37 | 162 | 330 | 492 | 0.4 | 1,328 |
| 1,000 | 68 | 202 | 346 | 548 | 0.8 | 1,883 |
| 1,500 | 102 | 318 | 518 | 836 | 0.8 | 1,953 |
| 2,000 | 136 | 434 | 691 | 1,125 | 1.8 | 2,480 |

Source: [23].

For the production of biogas, in addition to the biogas production facility, the farmer needs animal droppings, vegetable biomass and waste resulting from agro-food activities.

The most recommended crops for obtaining biomass are: silage corn, sugar beet and fodder grasses.

Biogas obtained from manure has many advantages ecological, such as a much more bearable smell (which leads to the acceptance of animal farms, which receive complaints in this regard), reduction of emissions of methane, $CO_2$, particles and nitrous oxide, sanitation of liquid manure and a better capacity of nitrogen fertilization contained in the treated manure (i.e., less nitrogen is needed to achieve the same fertilization effect) [8].

In addition to biogas, following the anaerobic fermentation process, a good quality fertilizer is obtained, which contributes to maintaining soil fertility without the need for excessive use of chemical fertilizers [20].

Another way to use manure is to use it to produce organic fertilizers and fertilizers. RENURE products are a substitute for chemical fertilizers. RENURE, 'Nitrogen recovered from manure', is defined as any substance containing nitrogen, wholly or partly derived from manure by processing [12] (Figure 7).

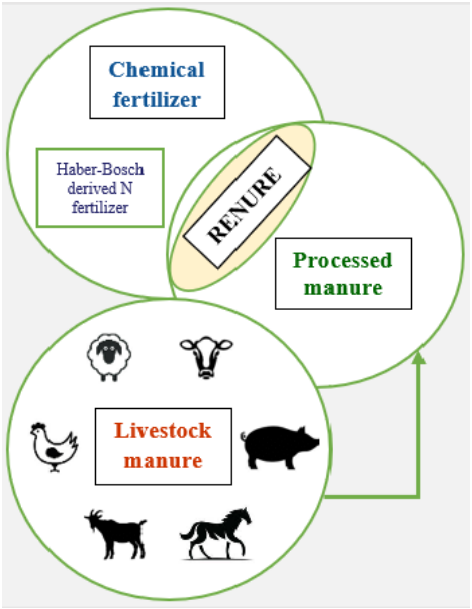


Fig. 7. Graphical representation of the product RENURE
Source: our representation after [12].

Following the model of biogas plants, it will be possible to build communal platforms for collecting manure, which will later be processed to obtain RENURE, which will provide jobs and will contribute to improving the demographic aspect of the rural space, especially in the mountain area.
This will ensure the availability and accessibility of the key input (fertilizer) amid disruptions caused by natural disasters, climate change and geopolitical instability.
Within the National Rural Development Program (PNDR) 2014-2020, financial support was granted for the projects implemented in the mountain area and for the preservation of autochthonous animal breeds, there are even special sessions for submitting funding requests for this area.
Through the requirements imposed on farmers, these projects directly or indirectly contributed to the reduction of nitrate pollution [18].
The EU considers young farmers a key element in the development of the agricultural sector and supports generational renewal through tools the common agricultural policy, such as direct payments and financial assistance through Sub-measure 6.1 "Support for the installation of young farmers" [4].
Table 3 presents the projects that were financed within the PNDR 2014-2020, in the counties that are part of the mountain area, under this Sub-measure.

Table 3. Distribution of the number of projects at the level of each county in the Mountain Area

| County | Mountain Area | | | Mixt | |
|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | 2020 |
| Alba | 17 | 21 | 25 | 0 | 25 |
| Arad | 3 | 10 | 10 | 12 | 19 |
| Arges | 10 | 22 | 12 | 0 | 3 |
| Bacau | 4 | 5 | 7 | 0 | 2 |
| Bihor | 30 | 74 | 125 | 52 | 48 |
| Bistrita-Nasaud | 88 | 229 | 206 | 3 | 31 |
| Brasov | 11 | 12 | 13 | 0 | 2 |
| Buzau | 2 | 4 | 5 | 1 | 3 |
| Caras-Severin | 50 | 74 | 77 | 10 | 13 |
| Covasna | 17 | 22 | 45 | 7 | 0 |
| Cluj | 37 | 63 | 74 | 25 | 38 |
| Dambovita | 4 | 19 | 15 | 13 | 80 |
| Gorj | 34 | 28 | 24 | 0 | 7 |
| Harghita | 0 | 2 | 3 | 0 | 3 |
| Hunedoara | 38 | 128 | 116 | 3 | 3 |
| Maramures | 7 | 21 | 49 | 2 | 8 |
| Mehedinti | 5 | 6 | 8 | 0 | 1 |
| Mures | 0 | 0 | 3 | 0 | 13 |
| Neamt | 0 | 1 | 2 | 0 | 1 |
| Prahova | 0 | 0 | 1 | 0 | 0 |
| Salaj | 0 | 0 | 1 | 2 | 8 |
| Satu-Mare | 0 | 0 | 0 | 1 | 10 |
| Sibiu | 1 | 3 | 1 | 1 | 4 |
| Suceava | 0 | 10 | 6 | 4 | 6 |
| Timis | 0 | 3 | 2 | 35 | 54 |
| Valcea | 9 | 8 | 3 | 0 | 3 |
| Vrancea | 1 | 3 | 5 | 2 | 6 |

Source: [6] based on data provided by [3].

Analysed Sub-measure had as the self-evaluation criterion “Principle of indigenous breeds/varieties”, for which a maximum of 5 points were awarded and which worked as follows: a percentage score was given out of the 5 points depending on the percentage which was represented by the SO (standard output) value for native breeds/varieties from the total SO related to the dominant sector (livestock sector or vegetable).
Also, the implementation of the new projects

meant the introduction of advanced animal husbandry technologies, which required compliance with hygiene standards and ecological measures required at the EU level.

An important aspect was the obligation that, in order to obtain the financing of the PNDR 2014-2020, the investment projects in animal husbandry had to have a manure platform available.

Next, the sessions of the PNDR 2014-2020 opened under sub-measure 6.1, which contributed to the preservation of traditional activities in the mountain area, will be presented:

*Session 2015:* had separate fund allocations for the mountain area and non-mountain area. Funding applications for the mountain area started to be submitted only from stage 3, because in the first two stages no projects with a score above the monthly quality threshold were submitted.

*Session 2016:* had separate funding allocations for mountain area and non-mountain area just like 2015. Money for upland was requested in 6 stages. At the end of the session, although the entire amount was requested, not all of the commitment was allocated, largely due to ineligible projects submitted according to the allocation, but not funded.

*Session 2017:* for the mountain area there were a number of 3 stages with selected projects, due to the request for funds for this area in the first two months after the opening of the continuous project submission session.

*The 2018 session*: was characterized by the abandonment of the separate allocation for the mountain area, with projects competing according to the selection score for the same amount of money, regardless of the area. This fact is due to the small amount of money allocated, only 11 million euro, compared to 2017 where the amount of 176 million euro was allocated, of which 138 million euro for the non-mountainous area and 38 million euro for the mountainous area.

*Session 2020:* the first session to have a distinct allocation for the diaspora, parallel to the national allocation. Unfortunately, no project for the diaspora was declared eligible this session. The main reason argued by the evaluators in the "Eligibility criteria not met" section is the lack of the official document with an apostille according to „The Hague Convention" with which the applicant had to prove the holding of a job in the EU space [2].

With a few exceptions, can be noticed increases in the number of projects submitted both in the sessions dedicated to the mountain area 2015-2017 and in those opened at national level (mixed).

It can be observed that in the sessions with distinct submission for the mountain area, usually, there were several projects submitted for this area.

In addition to the benefits for the environment and for human nutrition, PNDR 2014-2020 projects have led to the development of family businesses, to the increase of entrepreneurs' incomes and to the economic growth of the mountain area.

## CONCLUSIONS

The mountainous area is distinguished from the other regions, primarily by natural disadvantages (climate and altitude) and structural disadvantages, such as: dispersal of households within a locality, large distances from administrative centres, lack or insufficiently developed infrastructure, isolation from communication routes.

At the same time, residents face the following problems: lower incomes, reduced possibilities to access financial resources, lack of qualified human resources and high costs for the implementation of modern technologies.

Analysing the data taken from INS, it can be concluded that over 2/3 of the sheep and ¾ of the cattle are found in the mountain area. The amount of manure per capita obtained, as well as the new Community requirements for environmental protection, have changed the preferences of livestock farmers in terms of livestock structure. Thus, there was a decrease in the number of cattle and an increase in the number of sheep and goats.

Better exploitation of the products available in the rural area will lead to sustainable development. Manure is a product that has been misused but can be used to obtain green

energy and fertilizers to EU standards.

Depending on the location and distances to nearby farms, it may be proposed to develop a manure collection cluster with or without biogas production facilities in the area of interest.

In most cases specific to the mountain area, at least 2 conditions must be met:

• Cooperation of farmers to ensure the necessary number of animals to overcome the balance point (breakeven) of the investment;

• The facility to enter the electricity/heat market and RENURE products.

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## REFERENCES

[1]Agency for the Financing of Rural Investments (AFIR), 2023, Anexa 3, Lista UAT din Zonele Montane / Annex 3, UAT List of Mountain Zones, www.afir.info, accessed on 02.08.2023.

[2]Agency for the Financing of Rural Investments (AFIR), 2023, Ghidul solicitantului - submăsura 6.1 / Applicant's Guide - Sub-measure 6.1, www.afir.info, Accessed on 02.08.2023.

[3]Agency for the Financing of Rural Investments (AFIR), 2023, Rapoarte și liste - Rapoarte de selecție / Reports and lists - Selection reports, www.afir.info, Accessed on 02.08.2023.

[4]Badan (Voicila), D.N., Fintineru, G. 2022, Young farmers - A fundamental factor in the development of the agricultural sector. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", Vol. 2292), 73-80.

[5]Chiurciu, I.A, Cofas, E., 2020, Technical-economic analysis of sheep and goat herds in Romania. Agrarian Economy and Rural Development – Realities and Perspectives for Romania. International Symposium, 11th Edition, The Research Institute for Agricultural Economy and Rural Development (ICEADR), Bucharest, 110-117.

[6]Chiurciu, I.A, Varutoiu, M.I., 2021, Absorption of funds allocated by sub-measure 6.1, National Rural Development Programme 2014-2020, in Romania. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", Vol. 21(4), 133-142.

[7]European Commission, Directorate-General for Agriculture and Rural Development, 2023, Enhancing agricultural biodiversity, https://agriculture.ec.europa.eu/sustainability/environmental-sustainability/biodiversity_en, Accessed on 15.08.2023.

[8]European Parliament, 2008, Report on sustainable agriculture and biogas: a need for review of EU legislation, Report - A6-0034/2008, https://www.europarl.europa.eu/doceo/document/A-6-2008-0034_EN.html, Accessed on 10.08.2023.

[9]Fertilizers Europe, 2022, Fertilizer Industry Facts & Figures, https://www.fertilizerseurope.com/wp-content/uploads/2022/09/Industry-Facts-and-Figures-2022.pdf, Accessed on 10.08.2023.

[10]Gazeta de Agricultură / Agriculture Gazette, 2013, Gunoiul de grajd ca sursa de poluare / Manure as a source of pollution, https://www.gazetadeagricultura.info/eco-bio/566-protectia-mediului/14398-gunoiul-de-grajd-ca-sursa-de-poluare.html, Accessed on 10.08.2023.

[11]Grodea, M., 2018, The sheep and goat farming sector in Romania - A new development perspective. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", Vol. 1893), 151-158.

[12]Huygens, D., Orveillon, G., Lugato, E., Tavazzi, S., Comero, S., Jones, A., Gawlik, B., Saveyn, H., 2020, Technical proposals for the safe use of processed manure above the threshold established for Nitrate Vulnerable Zones by the Nitrates Directive (91/676/EEC), EUR30363 EN. Publications Office of the European Union, Luxembourg, doi:10.2760/373351, JRC121636.

[13]Lăzăroiu, G., Negreanu, G.P., Pîșă, I., Grigoriu, R.M., Ciupageanu, D.A., 2021, Experimental researches on poultry manure combustion in co-combustion with biomass. E3S Web Conf., 286 02013, 10th International Conference on Thermal Equipments, Renewable Energy and Rural Development (TE-RE-RD 2021), Section Renewable Energy, https://doi.org/10.1051/e3sconf/202128602013.

[14]Ministerul Agriculturii și Dezvoltării Rurale / Ministry of Agriculture and Rural Development, Planul PAC 2023-2027 pentru România / CAP Plan 2023-2027 for Romania, https://www.madr.ro/docs/dezvoltare-rurala/2022/Plan-National-Strategic-PAC-2023-2027_v1.2.pdf, Accessed on 05.05.2023.

[15]Ministerul Mediului, Apelor și Pădurilor / Ministry of the Environment, Waters and Forests, Manipularea neconformă a gunoiului de grajd poluează și aerul! / Improper handling of manure also pollutes the air!, https://apanoastra.ro/manipularea-neconforma-a-gunoiului-de-grajd-polueaza-si-aerul, Accessed on 06.08.2023.

[16]Mitroi, R., Stoian, O., Covaliu, C.I., Manea, D., 2021, Pollutants resulting from intensive poultry farming activities and their impact on the environment. E3S Web Conf., 286 03018, 10th International Conference on Thermal Equipments, Renewable Energy and Rural Development (TE-RE-RD 2021), Section Rural Development, https://doi.org/10.1051/e3sconf/202128603018.
[17]National Institute of Statistics (INS), Tempo online, Statistical database, www.insse.ro, Accessed on 03.12.2022.
[18]National Rural Development Program (PNDR) for period 2014 - 2020, version 12, https://www.madr.ro/docs/dezvoltare-rurala/2021/Program-National-de-Dezvoltare-Rurala-2014-2020-v12.pdf, Accessed on 12.12.2022.
[19]Popescu, A., 2017, Analysis of sheep and goats' livestock and milk and meat production in Romania, 2007-2016. Scientific Papers. Series "Management, Economic Engineering in Agriculture and rural development", Vol. 17(4), 267-280.
[20]Revista Ferma / Farm magazine, 2011, Ferma ca sursă de energie / The farm as a source of energy, https://revista-ferma.ro/ferma-ca-sursa-de-energie/, Accessed on 29.11.2022.
[21]Maerescu, C.M., Țuțui, D., Chereji, A.I., 2019, Leading by example: The animal welfare in the EU. Past evolutions, current trends. Case study: Romania. Annals of the University of Oradea, Fascicle: Ecotoxicology, Animal Husbandry and Food Science and Technology, Vol. XVIII/A 2019, http://protmed.uoradea.ro/facultate/publicatii/ecotox_zooteh_ind_alim/2019A/Animal/Maerescu.pdf. Accessed on 29.11.2022.
[22]Struna, H., 2022, Commission, EU countries agree on importance of manure-made fertilisers. Euractiv, https://www.euractiv.com/section/agriculture-food/news/commission-eu-countries-agree-on-importance-of-manure-made-fertilisers/, Accessed on 29.11.2022.
[23]SC Trinergi Grup SRL Bucharest, 2012, Studiu de fezabilitate - Instalatie productie biogas / Feasibility study - Biogas production facility, www.ener-supply.eu/en/results/ES_BIOMASS_FS_ERDF5_ENERO_Ialomita.pdf, Accessed on 20.11.2022.
[24]Ungureanu, D., 2017, Dezvoltarea durabilă a zonei montane din România. Realități și perspective / The sustainable development of the mountainous area in Romania. Realities and perspectives, https://www.turismulresponsabil.ro/wp-content/uploads/2017/01/2.-Danut-Ungureanu-Zona-montana.pdf, Accessed on 18.05.2023.
[25]Zero Waste Europe, 2023, About zero waste. https://zerowasteeurope.eu/, Accessed on 06.08.2023.