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# How Do Natura 2000 Areas Intersect with Peoples' Livelihood Strategies in High Nature Value Farmlands in Southern Transylvania?

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**Abstract:** The establishment of the Natura 2000 network in Romania constitutes a turning point for the policy on biodiversity conservation in this country. The presence of human communities in certain Natura 2000 areas determines complex interactions between social and ecological systems, particularly in the case of High Nature Value farmlands that are assigned to this network of protected natural areas. A large part of Romania's biodiversity depends on traditional farming systems that are under pressure from either agricultural intensification or land abandonment, which reflects socio-economic changes that have pushed rural households into developing new livelihood strategies. This paper explores the particular context of traditional rural communities from Southern Transylvania which is a High Nature Value farmland area largely included in the Natura 2000 network. We conducted an empirical analysis that focused on two main issues. The first was applying quantitative methods aimed at identifying the linkages between livelihood capitals and livelihood strategies of people living in Natura 2000 areas. The second was analyzing differences in local development levels which correlate with the share of territorial administrative units belonging to Natura 2000 areas. Our results are based on questionnaire and interview data collected from 40 rural administrative-territorial units within Southern Transylvania as well as on mapping land use changes using Landsat satellite images of 1985, 2003 and 2015. The results indicate that rural communities living in Natura 2000 areas turn to migration as an additional household strategy besides usual on-farm and off-farm activities, leading to rural shrinkage and farmland abandonment.

**Keywords:** livelihood capitals; high nature value farmland; peoples' livelihood strategies

## 1. Introduction

High Nature Value (HNV) farmlands represent a typical coupled social–ecological system [1] that is subject to conservation measures in Europe [2]. The main features of HNV farming systems are low external inputs like synthetic fertilizers, pesticides and herbicides, and the practice of extensive grazing and traditional mowing methods that are beneficial for biodiversity [3]. They are also referred to as biodiverse farmlands, taking into account the strong presence of habitats and species in connection to low-intensity agriculture. The concept of HNV farmland originates from the 1990s, when it was defined by the European Environment Agency and the United Nations Environment Programme as “those areas in Europe where agriculture is a major (usually the dominant) land use and where

agriculture supports, or is associated with, either a high species and habitat diversity or the presence of species of European conservation concern, or both" [4].

HNV farmlands are most often encountered in marginal agricultural areas [5] in Eastern Europe and the Mediterranean countries which concentrate low-intensity farming practices [6–8] and small-scale farms that are characterized by under mechanization and modest market participation [9,10]. The recent literature draws attention to the vulnerability of HNV farmlands, suggesting that those located within the Natura 2000 network are less likely to be transformed through anthropic impacts driven by productive activities [11], however, they are subject to loss of biodiversity and ecosystem services [12–15] due to abandonment of traditional farming activities.

An important research topic related to marginal agricultural areas that intersect with natural protected areas is focused on the social and economic impact on local communities of establishing and maintaining different nature protection levels [16]. Blicharska et al. [17] call for an effective assessment of the environmental and social effectiveness of protected areas at European level. While agriculture restructuring and outmigration have become a common trend for many agricultural areas in Europe, there is insufficient knowledge on the particular state of play of communities living in natural protected areas across Eastern Europe. Acknowledging the social context of protected areas, alongside the ecological prominent features of these sites, could be paving the way for achieving the goals of Natura 2000 network and reap benefits for local communities [18] to attain development sustainability.

The connections between the well-being of local communities and protected areas gained significant attention [19,20] after the publication of the Millennium Ecosystem Assessment, with a growing number of studies aiming to find ways of measuring livelihoods outcomes based on the resources or capitals the people living in protected areas have access to [21,22].

The livelihood perspective contributes to understanding the basis on which people and communities build their well-being and sustainable development [23]. Moreover, scholars point out that pro-environmental actions of local communities depend strongly on the existence of livelihood capitals that reflect the living conditions of people living in protected areas. Livelihoods include the capabilities, assets (material and social resources) and activities required for securing the means of living.

Livelihood strategies are differentiated between households, based on their way of making a living. Following this line of reasoning, Scoones [24] developed a framework of livelihood strategies for agrarian households that includes three main types: (1) increasing the role of agricultural activities by intensification (achieving a higher productivity per unit) or through extensive farming (large land requirements); (2) diversification of non-agricultural activities and the shrinking role of agriculture to produce income; (3) migration, either household members move temporarily or permanently in search of ways of making a living.

The type of strategy that households pursue is determined by the interaction between the human capital (e.g., education, health, ability to labor, and skills), the access to tangible (e.g., natural resources and physical infrastructure) and intangible assets/capitals (e.g., social relations and networks) and the economic activities [25–27].

Natura 2000 in Europe could provide an enabling framework for better connecting human land uses with biodiversity conservation [28] through evidence-based policies and tailored measures that recognize the interconnections between ecology, social and economic challenges at local level [29]. Understanding human needs and challenges of shrinking rural regions is a key approach to delivering biodiversity conservation in protected areas, particularly in the context of coupled social–ecological systems such as HNV farmlands.

To pursue these lines of argumentation, this article presents empirical results on the linkages between the livelihood capitals and livelihood strategies of people living in communities assigned to Natura 2000 sites in the HNV farmlands of Southern Transylvania. While this study focuses on the situational analysis of local development based on the availability of capitals and the empirical research on the sustainable livelihood framework, it could be further improved by assessing the relationship between livelihood strategies, well-being and pro-environmental behavior.

## 2. Materials and Methods

Against this introductory background, in the following subsections, we explain the socio-economic characteristics of the study area which is subject to our empirical research based on household survey and in-depth semi-structured interviews. In the third subsection, we provide a step-by-step presentation of the used data analysis and statistical methods that enabled us to interpret the association between different capitals with livelihood strategies. Additionally, in the last subsection, we fitted a spatial analysis using the Markov change model to visualize the effect of new livelihood strategies, such as outmigration and off-farm activities that break off from traditional farmland activities, on land use/land cover change.

### 2.1. Study Area

Our study area links the extent of Natura 2000 ROSPA0099 “Podișul Hârtibaciului” and ROSCI0227 “Sighișoara-Târnava Mare” in Southern Transylvania, covering an area of 2761 km<sup>2</sup> that overlaps the administrative boundaries of 40 rural administrative territorial-units. The area is characterized by semi-natural open landscapes which are maintained by predominantly low-intensity farming HNV. The farmed habitats support diverse wildlife communities, including populations of threatened raptors such as Lesser Spotted Eagle (*Aquila pomarina*) [30].

### 2.2. Data Collection Methods

Our study contains data analyses based on a mixed method research that combines quantitative and qualitative approaches. A household survey was carried out between 21 May and 29 June 2012 from 40 rural administrative territorial units, within the project “For nature and local communities—the basis for a Natura 2000 integrated management in Hârtibaciu-Târnava Mare-Olt area”. One author of this paper was part of the Gallup Organization team that carried out the questionnaire survey and the poll under the project.

The data collection method for the qualitative research involved in-depth semi-structured interviews. Forty interviews were conducted with town hall representatives, farmers and non-farmers from eight localities in Southern Transylvania (Agnita, Alțâna, Brădeni, Chirpăr, Marpod, Merghindeal, Nocrich and Șoars) to identify livelihood strategies and people’s perception of the nature protection conditions. The in-depth interviews were carried out during the period of 10–23 July 2012.

Both factual data and opinion data were gathered through questionnaire surveys with three types of actors: representatives of local government, local stakeholders and households. The survey sampling included 4000 households, 100 in each rural administrative territorial-unit. The large sample allowed us to carry out the present analyses at locality level.

The following situational analyses are based on the quantitative household questionnaire data as we try to evaluate the contribution of various assets under five capitals (social, physical, natural, economic and human) to securing well-being. We measured the resources/community’s capitals through indices that were constructed based on the factor analysis variable reduction technique. The qualitative data were used in order to exemplify, explore and gain better understanding of certain behaviors that our study focuses on (e.g., relying on certain types of livelihood strategies).

Qualitative data from the semi-structured interviews provided important descriptive background for the local context, as well as first-hand assessments of the policy outcomes in terms of securing livelihood capitals for people living in marginal agricultural areas.

### 2.3. Data Analysis and Statistical Methods Used

Our analysis on the theme of community resources is centered on five types of capital—social, physical, natural, economic and human—each one having been measured through composed, multidimensional indices.

As a first step of the data analysis, we established an operation definition of the five types of capital using the indices presented in Table 1. Part of these indicators are computed using the data collected through the household survey. The database includes 4000 cases which cover 100 households/cases in each one of the 40 administrative territorial units within the study area. Additional primary data sources for calculating the indices included the 2011 Population and Housing Census and the online registers of the National Institute of Statistics.

We processed data in the Statistical Package for the Social Sciences (SPSS 21.0). For each type of capital, a specific index was determined, based on a factorial analysis as a way for data reduction, through principal component analysis. For each type of capital, the resulted indices account for more than 40% explained variation in the data sets (45% explained variation in the human capital data; 46% explained variation in the natural capital data; 40% explained variation in the physical capital data; 51% explained variation in the economic capital data; 50% explained variation in the social capital data). The factorial scoring coefficients were extracted through regression analysis. Following the rescaling of the factor scores, the values covered a range from 0 to 100, which is consistent with the following formula:  $(x - \min) / (\max - \min) * 100$ .

**Table 1.** Metadata on indices related to the community capitals.

Index	Input and Construction
Human capital	<p>Factorial score determined through principal component analysis, using the following indicators:</p> <ul style="list-style-type: none"> <li>- Education-related stock at commune level, mainly the average number of school years graduated by adults living in the commune. Values are calculated based on the sub-samples from each commune.</li> <li>- Share of economically active population aged 15–64 years in the total population of the commune. Reference year 2011, the National Institute of Statistics (NIS) Tempo-Online database.</li> <li>- Population of communes in 2011, converted through logarithm transformation. The source of primary data: the 2011 Population and Housing Census.</li> <li>- Infantile mortality rate during the period of 2002–2011, reflecting the ratio between the number of deaths under 1 year in the total live-births and the reference period. Own calculations based on primary data from the NIS Tempo Online database.</li> <li>- Mortality rate during the period of 2002–2011, reflecting the number of deaths to a specific population in the reference period, expressed in units of deaths per 1000 individuals. Own calculations based on primary data from the NIS Tempo Online database.</li> </ul> <p>The KMO (Kaiser–Mayer–Olkin) measure of sampling adequacy is 0.632, and the first principal component explains 45% of the variation of values in the data set. The scoring range was rescaled from 0 to 100.</p>
Natural capital	<p>Factorial score determined through principal component analysis, using the following indicators:</p> <ul style="list-style-type: none"> <li>- Arable land (ha);</li> <li>- Pastures (ha);</li> <li>- Meadows (ha);</li> <li>- Forests and other forest vegetation (ha);</li> <li>- Land covered with waters (ha);</li> <li>- Livestock (livestock unit—LSU);</li> </ul> <p>Calculated from NIS 2011 database. The KMO (Kaiser–Mayer–Olkin) measure of sampling adequacy is 0.692, and the first principal component explains 46% of the variation of values in the data set. The scoring range was rescaled from 0 to 100.</p>

Table 1. Cont.

Index	Input and Construction
Physical capital	<p>Factorial score determined through principal component analysis, using the following indicators:</p> <ul style="list-style-type: none"> <li>- Average living floor;</li> <li>- % households with access to a public sewer network;</li> <li>- % households with electricity;</li> <li>- % households with gas supply;</li> <li>- % households with running water;</li> <li>- % households with indoor flushing water;</li> <li>- % households with computer ownership;</li> <li>- % households with mobile phone ownership;</li> <li>- % households with landline telephones;</li> <li>- % households with cable TV;</li> <li>- % households with internet connection;</li> <li>- % households in the commune with car ownership;</li> <li>- Area covered by ways of communication, % of non-agricultural land;</li> <li>- Distance from the center village to the closest town that exceeds 30km.</li> </ul> <p>Values obtained based on the sub-samples from each commune, except the area covered by ways of communication obtained from the NIS 2011 Tempo-Online database. The KMO (Kaiser–Mayer–Olkin) measure of sampling adequacy is 0.722, and the first principal component explains 40% of the variation of values in the data set. The scoring range was rescaled from 0 to 100.</p>
Economic capital	<p>Factorial score determined through principal component analysis, using the following indicators:</p> <ul style="list-style-type: none"> <li>- Local authorities' total gross income in 2011 per population converted through logarithm transformation (data from the Romanian Government);</li> <li>- Mean income per member of household—determined on the survey data;</li> <li>- Number of households with an income per member lower than 60% of the mean value of each commune;</li> <li>- % households that indicated wages as the main income source of the household.</li> </ul> <p>The KMO (Kaiser–Mayer–Olkin) measure of sampling adequacy is 0.596, and the first principal component explains 51% of the variation of values in the data set. The scoring range was rescaled from 0 to 100.</p>
Social capital	<p>Factorial score determined through principal component analysis, using the following indicators:</p> <ul style="list-style-type: none"> <li>- % households that mentioned to local authorities the common problems that need to be solved;</li> <li>- % households with members active in various associations;</li> <li>- % households that took part in public debates on current issues;</li> <li>- ethnic diversity—the population belonging to ethnic minorities in the total Romanian population (own calculation based on the 2011 Population and Housing Census);</li> <li>- religious diversity—the population belonging to a religious minority in the total Orthodox population (own calculation based on the 2011 Population and Housing Census).</li> </ul> <p>The KMO (Kaiser–Mayer–Olkin) measure of sampling adequacy is 0.576, and the first principal component explains 50% of the variation of values in the data set. The scoring range was rescaled from 0 to 100.</p>
Local Development Index	<p>An index calculated as the mean value of the scores determined for the five types of capital: human, natural, physical, social and economic.</p>

The final step in analyzing the local livelihood capitals was to compute the Local Development Index as the mean value of the scores determined for the five types of capital: human, natural, physical, social and economic. The variation of the Local Development Index is similar to that observed in the factorial scores that were combined for its calculation, also covering a range from 0 to 100. The Local Development Index is a summary measure of how communities fare with regard to access to resources/capitals. The index enables state-of-play comparisons between the development of communities with territories assigned to the Natura 2000 network and those that are located outside the protected natural sites.

Additionally, we used the literature on the Sustainable Livelihood Framework [31] to associate the types of resources/capital of the people living in our study area with the livelihood strategies that rural households undertake, taking into account the context within which people pursue their livelihoods, including the external factors on which they do not exert any control or they only have limited control [32]. Previous studies [33,34] indicate that the most common strategies of rural households at international level are based on on-farm activities using natural resources, off-farms activities, migration and remittances, retirement and social payments, as well as intensification or diversification of household activities.

To explain the composition of the livelihood strategies for communities living in HNV farmlands in Southern Transylvania, we started by splitting the strategies we identified in our household survey database into several types that reflect the categories of income sources: waged work, on-farm independent activities, off-farm independent activities, earnings from migration, social payments, occasional activities/daily-basis labor and retirement payments. An overall score of the intensity of livelihood strategies was produced by combining the distribution of household member across income sources and the structure of the household income in terms of share of income by sources contributing to its construction. Using the percentage of income by sources that contribute to composing the household income, we determined, through principal component analysis, the factorial scores representing the intensity of each type of livelihood strategy. The seven factorial scores were calculated at household level and used as input for the K-means cluster analysis to split the household into six categories. Each category is determined by the main livelihood strategy.

The analysis focused on two levels—the community (or the administrative territorial-unit) and the households. We developed synthetic indices reflecting capitals/resources that are accessible to communities, as well as the identification and description of livelihood strategies employed by households. The livelihood capital indices reflect the living conditions of local communities based on capital accounting. In order to take full account of the linkages between nature protection areas and the livelihoods of people living inside these areas, the results presented in this article take into account a comparison between three types of communities that were defined based on the percentage of the entire administrative territorial-unit that is included in Natura 2000 sites.

#### *2.4. Land Use Change Analysis*

To obtain an overall picture of the region's land use change pattern related to farmland abandonment, we developed a digital change detection approach based on the visual assessment of Landsat MSS and ETM+ images from 29 July 1985, 20 May 2003 and 8 July 2015. Following image processing, we computed a normalized vegetation index (NDVI) that was used as input in determining land use changes [35] based on the Markov change model. Satellite imagery processing is a common approach for modelling and monitoring land use/land cover change in agricultural landscapes [36–38]. The added value of this viewpoint is that it provides a comprehensive outlook of causes and consequences of land use change [39].

### 3. Results

#### 3.1. Community Livelihood Resources/Capitals

Concerning the administrative territorial units in the study area, the analyses indicate significant disparities between the types of capital that communities have access to, depending on their percentage of administrative territory under nature protection. Consequently, the most resourceful communities in terms of human, natural and economic capital are those with a low percentage of administrative unit under Natura 2000 management, while the communities with more than 75% surface included in natural protected areas are placed at the opposite end. The latter represent impoverished communities in terms of human and economic capital.

If fact, determining a mean value of all the capitals used in this study, mainly a Local Development Index, we observed that communities which are poor in respect of capitals are also those with high shares of Natura 2000 areas. The index was mapped (Figure 1) to show the spatial variation across administrative territorial units in Southern Transylvania.

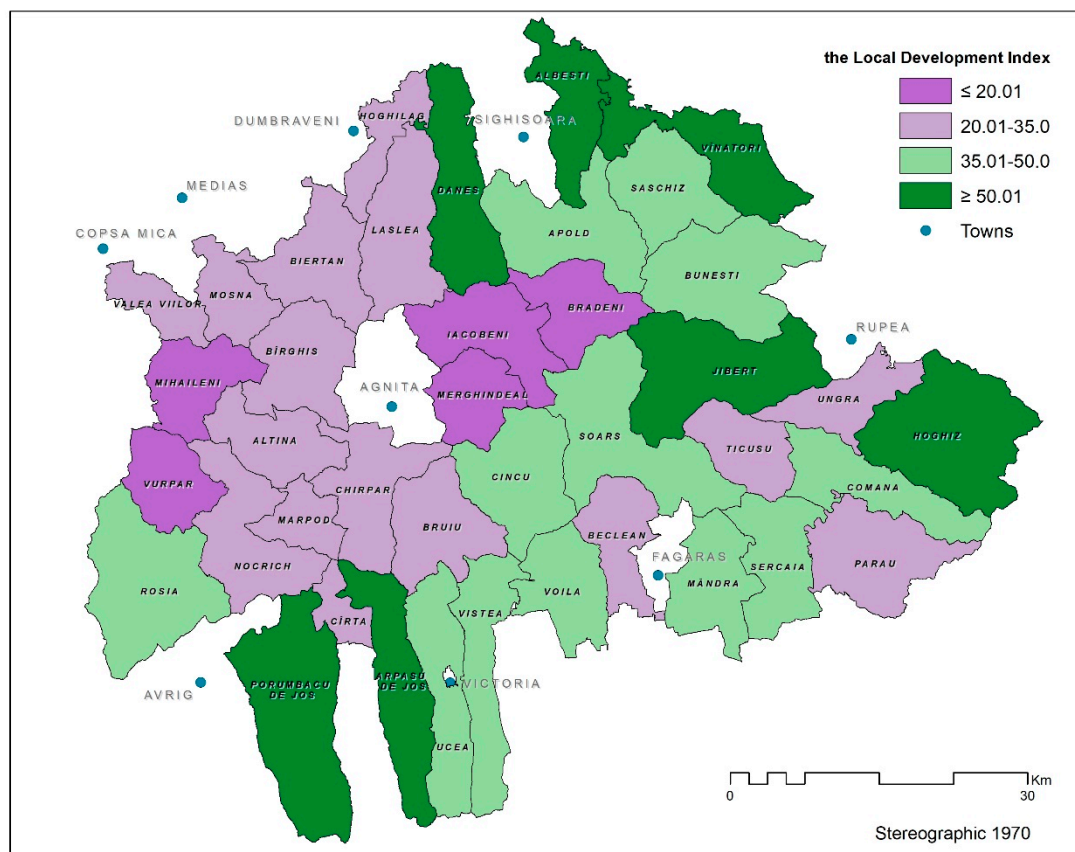


Figure 1. The distribution of the Local Development Index.

Additionally, a direct connection is noticeable between the share of administrative units overlapping natural protected areas (Figure 2) and the Local Development Index, which could be studied in-depth in future analyses focusing on the relationship between poverty and the circumstance of being part of a protected natural area.

Compared to localities in which the administrative area partially overlaps some nature protections sites (Table 2), the communities which are almost entirely included in a protected area are also less populated, and the inhabitants are less educated, with lower income levels and a precarious household infrastructure, despite the fact that they benefit from a similar or even higher-quality natural capital (the land and its use, the livestock, etc.).

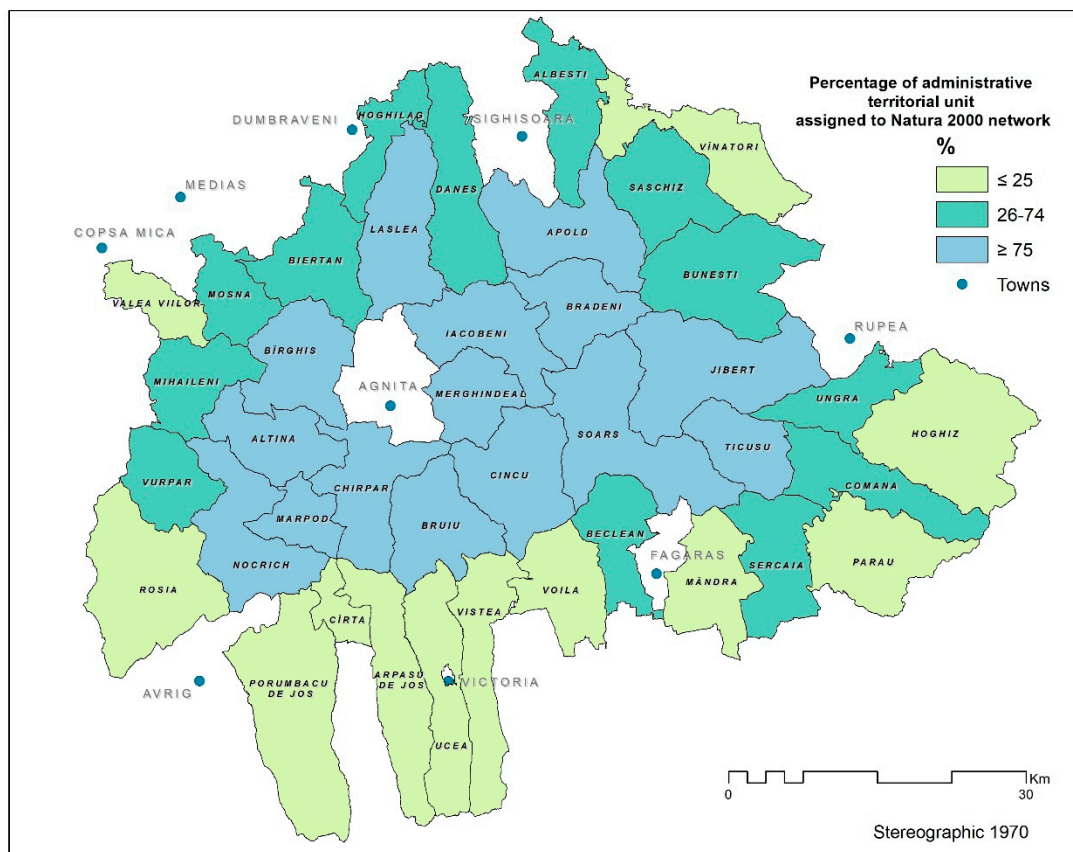


Figure 2. Percentage of rural administrative territorial units assigned to Natura 2000 sites.

Table 2. The profile of communities living in protected areas compared to the available resources.

Percentage of Administrative Unit under Nature Protection	No. of Units	Local Development Index	Human Capital	Natural Capital	Economic Capital	Social Capital	Physical Capital	% Persons Receiving Guaranteed Minimum Incomes
≤25%	12	46.3	46.0	48.0	46.3	36.0	55.0	5.5
26–74%	13	34.9	35.7	32.3	30.9	35.5	40.0	5.1
≥75%	15	30.5	26.8	41.7	13.6	39.3	31.3	12.4
Total	40	36.7	35.5	40.5	29.0	37.1	41.3	7.8

Villages included in this category are more isolated, the infrastructure is poorly developed, and, consequently, the population’s access to the labor market or the product market is utterly diminished. It is worth mentioning that in these communities, the share of socially assisted persons (receiving social allowances) is more than double compared to the other types of communities.

### 3.2. Household Livelihood Strategies

Rural households usually maintain several types of income sources and/or livelihoods, ranging from agricultural outcome that is consumed within the farm household, to wages, incomes from independent activities in agriculture or non-agricultural sectors, money income or in-kind income from occasional jobs, up to transfer payments from the public budget (unemployment and retirement benefits, agri-environment payments). The questionnaire survey data used in the analyses include records at the level of every household related to the occupation of household members, income sources and actual income from various types of sources. In line with the combination of these income sources, we grouped the households through a cluster analysis, thus producing six categories of livelihood strategies.



- Livelihood strategies centered on farming—all households included in this category obtained money income from farming (commercializing the agricultural output). Still, almost 45% of these households obtained incomes through retirement payments, and almost a quarter of them had at least one employed family member. Considering the entire analyzed sample, only 7% of the households fall into this category (Table 3).

Table 3. Livelihood strategies related to the community profile.

Percentage of Administrative Unit under Nature Protection	Livelihood Strategy Centered on:						Total
	Farming	Off-Farm Activities	Paid Activities	Occasional Activities/Daily Basis Labor	Migration	Retirement	
≤25%	4%	1%	36%	8%	2%	49%	100%
26–74%	7%	2%	32%	10%	4%	45%	100%
≥75%	10%	2%	28%	13%	3%	44%	100%
Total	7%	2%	32%	10%	3%	46%	100%

According to interviewees, farming conditions allow the cultivation of grain, corn and potatoes, while dairy products are delivered to dairy processing companies or directly to urbanities through local markets or social networks. However, the low percentage of households included in this category indicate that the continuity of traditional farming practices is a constraint rather than a deliberate choice in securing livelihoods. Therefore, local communities are not seeking the benefits of protecting natural resources for livelihood security purposes, a fact emphasized by farmers themselves:

“[ ... ] unfortunately, things aren’t going as planned. Grasslands are kept only because farmers receive payments. When they won’t receive payments for grasslands anymore, they’ll bring in heavy tractors and do whatever they want”

(statement s24, farmer from Bunești village);

“[ ... ] besides agri-environment payments, people should receive supplementary subventions that will encourage them to preserve the resources”

(statement s27, entrepreneur from Laslea village);

“[ ... ] now we’re fighting to get incentives to preserve local biodiversity but these incentives don’t ... they fail in reaching the expected outcomes and 20 years ago farmers didn’t need incentives to mow the meadows”

(statement s21, farmer from Bunești village).

- Among livelihood strategies centered on independent activities in non-agricultural areas—these include households that run small businesses in other fields than farming, being one of the most heterogeneous categories from the perspective of income source combination—two-thirds manage to obtain incomes from wages and/or retirement payments. Respondents look to supplement the household income from agri-tourism. This is the most seldom encountered category, counting for 2% of the entire household sample, despite the effort of local conservation trusts in promoting the diversification of rural economies at the same time as maintaining low-intensity farming practices.
- Livelihood strategies centered on off-farm paid employment—all households included in this category had at least one member employed in economic activities. In addition, 41% of these household also obtain incomes from retirement payments. Taking into account the whole sample, this category groups almost a third of the household sample. Since most farming activities are time sensitive and seasonal, these households focus on agriculture for 6–8 months, with the remaining time being spent working off-farm or in nearby cities. Household members that have access to employment opportunities often migrate to provide services as wage labor.

- Livelihood strategies centered on occasional labor/daily basis labor—this category groups households that obtain incomes through daily basis labor in agriculture or other areas of activity. In this category, we also identify the largest share of households that receive social allowances from local authorities (21%). Almost one out of six households included in this category also procure income from retirement payments. This category counts for 10% of the entire household sample.
- Livelihood strategies centered on working in other countries—these households consist of members that had migrated to work in another country, yet they represented only 3% of the analyzed households. Retirement payments and/or wages represent a particular income source for almost 40% of these categories, and 10% obtained money from farming activities or running business in other area of activity.
- Livelihood strategies centered on securing the income from retirement payments—these are specific to those households composed only of elders, yet they also include multigenerational households. Almost 90% of existing cases indicate that retirement allowances constitute the only source of income for these households.

The analysis of livelihood strategies points to some differences between those households that are part of communities with more than 75% of administrative territory under Natura 2000 regulation which largely depend on farming and occasional labor/daily basis labor strategies, while strategies centered on paid employment are much less present in the case of these households. The qualitative data from the semi-structured interview also indicate that low-input farming activities are rather a constraint in this case, being the only livelihood option for a population characterized by a lower level of education, poor access to the labor market, and increased isolation from urban centers. Interviewed farmers explained that they cannot cover the high costs for fertilizers and pesticides to be used as input for increasing crop production. In this case, rural households do not have the means to invest in more intensive production methods and rely on traditional farming activities with low external input.

“[ . . . ] the chemicals are less spread [ . . . ] Few people afford to apply herbicides; and how much herbicides can they use? Usually they grow corn on a small plot, and most of them use the land for grazing and mowing. Now it is different from the past, when whole hectares were exploited, now the air is clean and healthy”

(statement s20, farmer from Alțâna village).

Subsistence farming that is characterized by agriculture output consumption within the household covers a high share of the households that pursue a livelihood strategy centered on securing incomes from retirement payments (83%), paid employment, occasion labor or remittances (almost 75% of the analyzed households). Looking at the previous labor migration experience (Table 4), we notice that households from localities that are more than 90% overlapping a Natura 2000 site comprise larger shares of returnee and present migrants, a fact indicating that the younger generation from these rural communities is more focused on seeking opportunities in foreign countries through migration than turning to on-farm activities as a livelihood strategy.

**Table 4.** Households with labor migration experience located in protected natural areas.

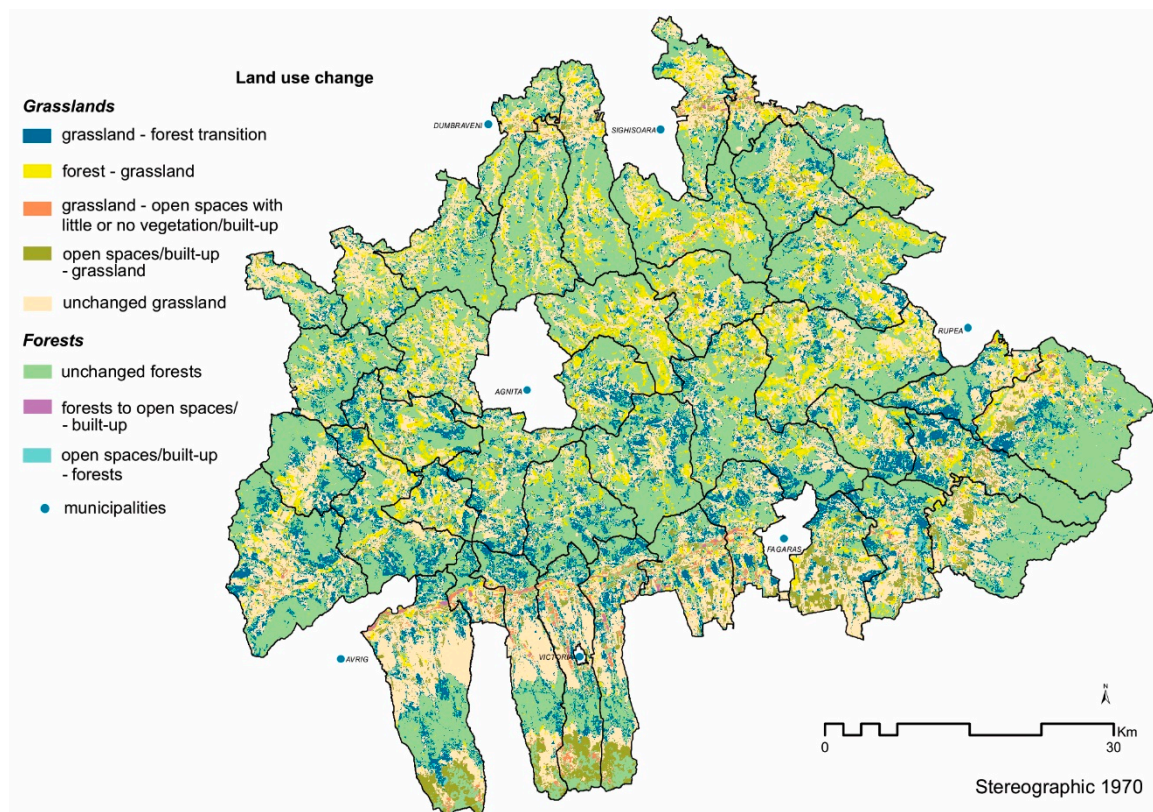
Percentage of Administrative Unit under Nature Protection	Households with Labor Migration Experience			Total
	No	Returnee Migrants	Present Migrants	
≤25%	86%	11%	3%	100%
26–74%	79%	15%	6%	100%
≥75%	75%	19%	7%	100%
Total	80%	15%	5%	100%

### 3.3. Land Use Changes in HNV Farmland

Livelihood strategies could be analyzed in connection with agricultural land use change. Mapping land use change, we sought to understand the spatial consequences of the low share of actively managed farmland in the range of livelihood strategies of people living in the HNV farmland of Southern Transylvania. According to the last Agricultural Census, 37.5% of the total population living in the area is occupied in the agricultural sector [40]. However, out of the livelihood strategies identified, only 7% focus primarily on farming activities and 32% rely on off-farm paid employment outside the farming season (Table 3).

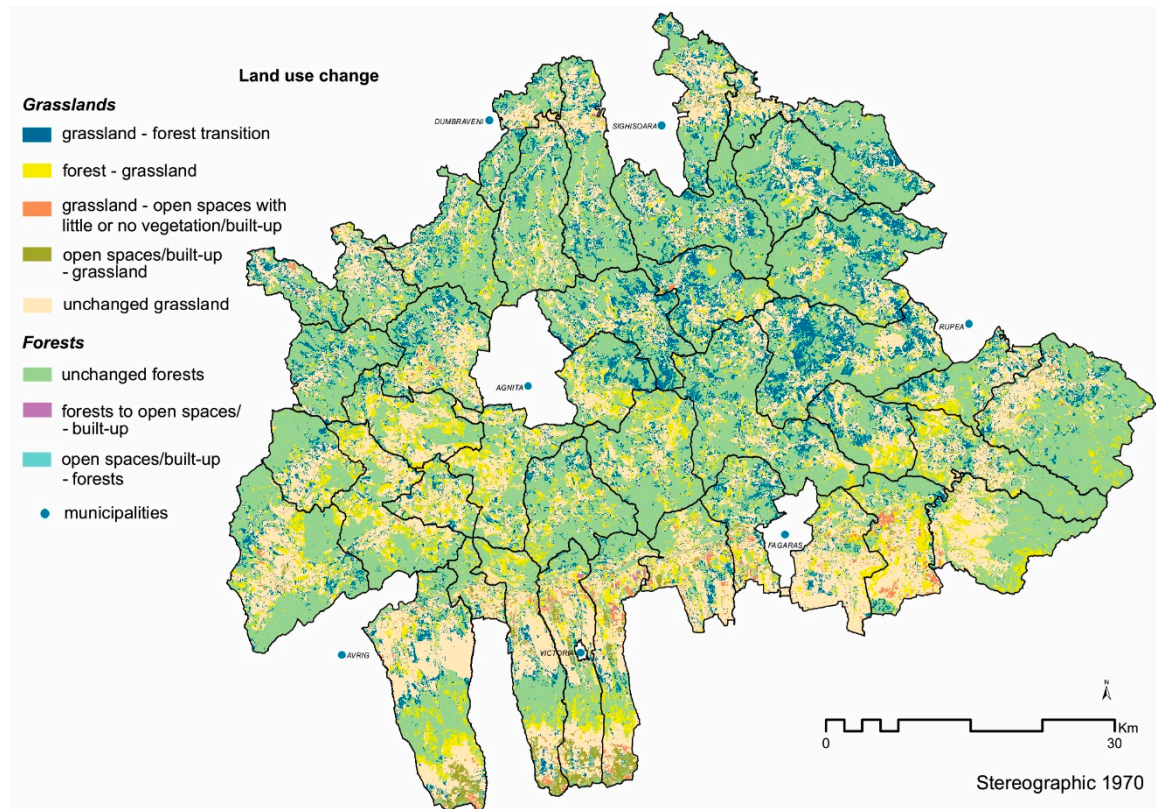
We looked at the agricultural land use change process that consists in farmland abandonment and the transition of grasslands into forest cover that occurred in two time-steps: (1) between 1985 and 2003, which could be considered the period of post-socialism, and (2) between 2003 and 2015, corresponding to the accession to the European Union and, subsequently, to the Common Agricultural Policy and the first cycle of multiannual financing.

The abandonment of agricultural activities was considered in association with decreasing traditional semi-natural grassland management. Even though there is an overall increase in the semi-natural grasslands throughout the entire studied area, there are some spatial differences marked by the fact that until 2003 more than 36% of the grassland changed extensively into forest vegetation in areas like Biertan, Laslea or Saschiz (Figure 3).



**Figure 3.** Land use changes during the period of 1985–2003 determined by using Landsat data.

The process lowers to 23% grassland transition into forests during the period of 2003–2015, being clustered in Apold and Saschiz (Figure 4).



**Figure 4.** Land use changes during the period of 2003–2015 determined by using Landsat data.

The results are confirmed by interviewees who explained that agriculture played a key role in preserving these semi-natural open landscapes, but with the aging population and considerable outmigration to urban areas, scrub has been advancing into grasslands or even into abandoned arable lands.

“[ . . . ] the local government has many problems to deal with since there are many areas that were covered by grassland or crop fields in the past but which are now covered with forests, and I’m not talking about high value forests, these areas are encroached with thorny bushes and useless scrub”

(statement s12, veterinary from Apold village). A total of 18.7% of the total grasslands from 1985 had been converted to forests by 2003, a period during which many young people left the countryside for more appealing livelihood options in urban areas, while the rate lowered to 13.3% by 2015.

#### 4. Discussion

Through this study, we aimed at understanding the social and economic characteristics of communities living in proximity of protected natural areas, the availability of resources/capitals, and ability of securing livelihoods. These are likely drivers of (1) the community compliance with the regulations of the Natura 2000 network, and (2) the sustainability of protected natural areas when ecosystems are dependent on traditional management of farmlands. The objective is to argue the need for better linkages between rural development and conservation policies that integrate a place-based perspective and adequately incorporate social science understandings of livelihoods. This integrated approach could enhance the well-being of local communities and preserve ecosystems dependent on traditional agriculture activities.

Our analysis identified six types of livelihood strategies following the possible combination of livelihood capitals. The livelihood strategy approach is grounded on the assumption that a low

resourceful/capital base will also predict the lower development of communities. The map of the Local Development Index and the statistical data confirm that people living in protected natural areas are more prone to poverty incidence, particularly explained by the unsatisfying levels of physical capital (lack of accessibility and isolation from public utility networks), human capital (low levels of education) and economic capital (insufficient income), despite the higher-quality natural capital. The strong incidence of underdevelopment in administrative territorial-units assigned to Natura 2000 sites is associated with an unfavorable resource/capital base that is reflected in declining rural communities through migration and agricultural land abandonment.

The use of local development indices based on livelihood resources/capitals is not new, but it was less applied to protected natural areas. These results could be transferred into the broader discussion on rural shrinkage and the underlying causes of underdevelopment despite high value natural assets and provision of ecosystem services. The dissimilarity between the natural capital of HNV farmlands included in the Natural 2000 network and the unsuccess at reaping the benefits of this capital through livelihood strategies is indisputable when looking at the failure of policies to tackle rural depopulation and land abandonment.

The research results indicate that a conservation program built on the ecological components of protected natural areas without fully understanding and integrating the social context is not enough to achieve biodiversity conservation objectives. As in the case of HNV farmlands where biodiversity levels depend on the continuity of traditional farming activities, it becomes clear that human well-being outcomes, which are generated by ways of constructing livelihood strategies, should be better understood. This perspective suggests that there is a need for rethinking policy silo narratives and start integrating biodiversity conservation and rural development policies. This comes in line with other studies on depopulation in rural areas which show that a way forward is to build evidence- and place-based integrated policies to find innovative solutions to adapting both ecological and social systems to the shrinkage of marginal rural areas [41–43].

The case of HNV farmland in Southern Transylvania indicates that the diversification of livelihood strategies is the most suitable way of alleviating rural shrinkage and upholding local sustainability. This suggest a mix of measures enabling farmers to act as both food producers and ecosystem services providers through governance interventions to improve the structure and total amount of livelihood capitals.

Accession to EU has prompted Romania to push for fast conservation reform through the expansion of Natura 2000 network, with complex implications for small-scale farm holds included in these nature protection areas, as our comparative model indicates. While the research indicates a link between the predictor based on the extent of administrative unit that is included in a natural protected area and the share of households with labor migration experience, the nature of that association remains context specific. Notably, farming still plays an important role in the composition of livelihood strategies in the case of communities living on protected lands, in view of the existing agricultural outcome that is consumed within the farm household and incomes from independent activities in agriculture.

Moreover, in the context of EU's attempts to limit overproduction and support traditional farming through rural development policies, the idea that small-scale farming is a solution to preserve high nature value farmland has been built on assumptions and contradictions on the sustainability of making this type of farming over-reliant on the continuity of subsidies. Even though the opportunity for biodiversity conservation has expanded since 2008, when the region became a Site of Community Importance within the framework of the EU Habitats Directive, the species-rich habitats are still threatened by rural outmigration resulting in farmland abandonment, land use change [44] and declining HNV farmland management (under-grazing and insufficient mowing), which come at the expense of farmland biodiversity [45], the advancement in scrub encroachment [46] and prevalence of invasive plants such as *Solidago canadensis*. Mapping land use changes in the study area points out the conversion from grasslands to forests, particularly in those administrative territorial-units that are largely intersecting Natura 2000 sites and which are more prone to farmland abandonment, which is

determined by lower opportunities for local development based on endogenous capitals in comparison to the performance of surrounding rural communities.

At this state of our understanding, livelihood strategies are relevant for this type of analysis because they differentiate households according to the ways of making a living. In regard to the immediate resources that communities have access to, particularly the human capital as well as the economic and natural capitals, they all determine which strategy will be selected. In terms of capitals, those communities characterized by an extensive inclusion in natural protected areas (more than 90% of the administrative territorial-units) are poorer from the perspective of natural and economic capitals. Additionally, households that are part of these communities turn mostly to farming activities for subsistence; consequently, expectations related to economic activity diversification (especially ecotourism/rural tourism) and to sustainable local development, against the background of under-education, are less probable to be fulfilled exclusively on the grounds of existing internal resources. Seasonality is the main factor directly influencing the vulnerability of rural households, and this can be mitigated through migration.

In terms of migration patterns, starting with the 1990s, the process of rural depopulation determined land abandonment, a phenomenon that accelerated throughout Central and Eastern Europe [31,32]. Labor mobility and external migration allowed rural households to explore new livelihood strategies, but these affected local ecological conditions through farmland abandonment and encroachment [33]. The present-day existence of small-scale farms, which represents 50.7% of the total agricultural holdings in this area, is deeply embedded in the social and economic context of Eastern European countries, being a product of collapsing collectivized agriculture units after the fall of the socialist regime [9].

The absence of insurance markets in case of risk-prone agricultural production is also associated with migration as a diversification strategy employed by households in order to reduce their vulnerability. Migration involves labor mobility which is closely connected to experience, skill level, education and health status of the migrant, these resources being generically referred to as human capital. Moreover, it also plays several roles in creating “virtuous circles” of capital accumulation [26].

The reflection of migration on earnings and remittances received by the households in the sending region is of utmost importance in preserving and increasing the capital level they benefit from, namely, savings (economic capital), land properties and/or livestock (natural capital), production assets and technology (physical capital), and child education (human capital). Furthermore, migration increases the household’s social capital, turning into a cumulative process. To this end, earnings or remittances from migrants play a crucial role in initiating such cumulative process if we take into account the constraints with which rural households are particularly confronted when trying to access the financial markets. Remittances often uphold investments in agricultural activities [47].

In terms of uncertainties and shortcomings of this study, while the applied method aimed at combining an extensive questionnaire survey with qualitative semi-structure interviews, it lacks a more participatory point of view in establishing linkages between livelihood capitals and strategies. This drawback could be addressed in the future through the integration of sample surveys and participatory ways of understanding in-depth the livelihood strategies.

In addition, the situational analysis was carried out on data collected in 2012 through the household survey, representing a snapshot of the livelihood capitals that people living in HNV farmlands under the nature protection regime relied on. Considering that this was a one-off household survey, data used in this analysis do not cover the changes to the rural development national measures under the Common Agricultural Programme 2014–2020 or more recent socio-economic transformations of the rural areas in Romania.

The main shortcoming of the livelihood-based approach is that it relies mostly on calculating livelihood capitals and identifying associated strategies; therefore, the empirical research could be further developed to explore the relationship between livelihood capital and pro-environmental

behavior. In this case, the livelihood capital analysis could contribute to predicting pro-environmental behavior of communities living in Natura 2000 areas.

## 5. Conclusions

The approach of livelihood capital and livelihood strategies could represent an important viewpoint to integrating social considerations into research and policymaking in the field of protected natural areas. The paper provides a consistent framework for assessing sustainable local development in complex coupled socio-ecological systems assigned to Natura 2000 sites. At this point, the livelihood strategies of communities living inside Natura 2000 sites do not reap the economic benefits of nature protection. Other studies [42,43] highlighted the fact that natural resources like landscapes and biodiversity offer potential for rural development, but there is still a knowledge gap in how to produce economic return for the local communities.

The analysis framework of this study ensures an applied approach to linking livelihood capital and livelihood strategies, offering pointers to the consequences of households relying mostly on migration and off-farm activities to ensure livelihoods on rural decline and to the policy implications of this situation. Overall, our results suggest that traditional farming activities face a sharp decline. In this context, households intensify the use of alternative livelihood strategies. In this regard, our study suggests that other livelihood strategies can result from the combination of activities, specifically the diversification of land use practices or combining on-farm and off-farm activities. All these strategies might require resources that households lack (more farmland, money for agricultural inputs or for starting an off-farm activity, etc.), therefore resulting in migration as the most efficient livelihood strategy.

This conclusion supports those arguing that sectoral policymakers and relevant stakeholders must work together in designing nature conservation and rural development policies based on in-depth livelihood planning [5,6,48,49]. In this context, rural development policies should not rely only on a compensation strategy that includes payments to farmers for managing agricultural ecosystem services. The larger issue of rural shrinkage should be addressed through a cross-sectoral lens that must integrate ways for farmers living in Natura 2000 sites to provide ecosystem services and for enabling local sustainable development.

The empirical analysis of livelihoods capital strategy linkages and mapping of local development inside and outside Natura 2000 sites could be integrated into future research for better understanding the impact of rural development–nature conservation policies on communities that intersect with protected natural areas. Data availability still represents an important drawback to a wider and more applied assessment of livelihood strategies by ensuring comparisons across time scale and more spatial granularity of statistical data to complement household survey data.

Follow-up research could also address the challenge of developing cross-disciplinary social–ecological approaches of assessing the interconnections between rural communities and protected natural areas. Additionally, the approach of livelihood capital strategies could be fine-tuned by taking on board the value of ecosystem services of HNV farmlands such as food production or pollination that support the livelihoods of farming communities. Taking into account that surrounding urban populations depend on services provided by ecosystems in traditionally managed pasturelands, livelihood policies should capture the value of farmers as providers of ecosystem services through specific payments, considering that rural areas are not sufficiently rewarded for their role.

The vulnerability of rural livelihoods should be better addressed by future research. In this view, in addition to assessing which livelihood capitals and strategies are most vulnerable, particular attention should be paid to the role of European Union farm-to-fork and bioeconomy strategies in identifying new possibilities for rural areas for the future and crafting solutions for adapting social–ecological systems to rural shrinkage.

We further argue that policies addressing rural communities inside protected natural areas should seek to balance the economic orientation of the role played by farmers between food producers or

environmental service providers. Consequently, rural development policies could focus on increasing the connection of local and regional markets of products, especially by strengthening rural–urban linkages to downstream farm products to urban consumers by leveraging farm-to-fork demand and improved distribution networks. A sound interconnection between the urban demand for farm products and the rural offer could increase employment opportunities through small rural entrepreneurship. The benefits of farming revitalization could contribute to slowing down migration, at least in the case of young people who could be integrated in this growth scenario both as workforce and as entrepreneurs.

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