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## ECOSYSTEMS – FUNCTIONALITY AND STRUCTURES. ECOSYSTEMIC RELATIONS

### ABSTRACT

Getting people aware – at individual and local level – of the ecosystem benefits and services is a complex phenomenon that starts with the evaluation of the existing natural heritage by the inhabitants and ends with the institutionalization of valorization through the establishment of rural institutions meant to protect the natural capital. In this context, people's getting aware of the relation between local poverty and the underutilization of ecosystem goods and services represents one of the essential aspects of the awareness of the social and economic dimensions of ecosystems.

**Key words:** ecosystem, human habitat, ecosystem services.

**JEL Classification:** Q56, Q57.

### 1. INTRODUCTION

Sustainable rural development presupposes capital optimization-considered as a material and information stock, in order to become an amplified source of ecosystem goods and services flows necessary to increase human welfare<sup>1</sup>. The arguments for which the ecosystem services and goods are essential for the functioning of the rural community economic and social cycle are briefly synthesized in the specialty studies: the rural people depend on agriculture, having a limited access to alternative income sources; the agricultural activities feature a high risk level; labour productivity is low in agriculture; the poor farmers are aware of the value of services, but they are under economic pressure.

### 2. STATE OF KNOWLEDGE

The economic literature focused on the economic value of the goods and services supplied by ecosystems, on the quantification of the economic efficiency

<sup>1</sup> CSERGE (2001): There are 5 forms of capital: material capital (obtained by people), human capital, social capital, critical natural capital (natural goods essential for life that cannot be replaced by the capital obtained by people) and another type of natural capital (renewable natural resources and a few mineral resources that can be fully or partially replaced by the capital obtained by people).

and effectiveness, on the implications on the agricultural market and on the benefits that the communities are able to extract from the ecosystems they belong to<sup>2</sup>.

The recognition of the importance to maintain biodiversity within the normal parameters in the process of life quality stability is the key to the argumentation of Stork (1999)<sup>3</sup> and Dirzo and Raven (2003)<sup>4</sup>. In the same order of ideas, a series of typologies of capital emerge, which is supplied to human communities by biodiversity, of goods and services generated by ecosystems, from the perspective of the possible contribution to welfare<sup>5</sup>.

The causal relationship established between the ecosystem quality, between the quality of goods and services implicitly, and the quality of life of the human communities was approached from the following perspective: economic markets and policies, governance quality, demographic processes, relative and absolute poverty.

The ecosystem degradation can induce severe processes at community level, with direct implications upon population's welfare, starting with the economic dimensions and ending with those referring to health condition (Chivian, 2003)<sup>6</sup>; the ecosystem disequilibrium – induced by the invasion of non specific species or by social irrationality – transforms the natural framework into an unfriendly environment for the people (WEHAB, 2002)<sup>7</sup>. The existing relations between the biodiversity system and the ecosystem operation and the poverty in the rural communities have represented one of the most frequent themes of the economic

<sup>2</sup> Adger, N., Brown, K., Raffaello, Cervigni, Moran, D. (1994), "Towards Estimating Total Economic Value of Forests in Mexico" CSERGE Working Paper GEC-1994-21; Batagoda, B., Turner, R., Tinch, R., and Brown, K. (2000), "Towards Policy Relevant Ecosystem Services and Natural Capital Values" CSERGE Working Paper GEC 2000-06, University of East Anglia and University College London; Bateman, I., J. (1999), "Environmental impact assessment, cost-benefit analysis and the valuation of environmental impacts" in Petts, J. (ed), "Handbook of Environmental Impact Assessment, Volume 1-Environmental Impact Assessment: Process, Methods and Potential", Blackwell Sciences, Oxford.

<sup>3</sup> Stork, N. (1999), "The magnitude of global biodiversity and its decline" in Cracraft, J., and Grifo, F. (eds.), "The Living Planet in Crisis: Biodiversity, Science and Policy", Columbia University Press, New York.

<sup>4</sup> Dirzo, R., and Raven, P. (2003), "Global state of biodiversity and loss", *Annual Review of Environment and Resources*, 28:137–167.

<sup>5</sup> Daily, G., C. (1997), "Introduction: What are Ecosystem Services?" in "Nature's Services: Societal Dependence on Natural Ecosystems" Island Press, Washington, D. C.; De Groot, R., S., Wilson, A., W., and Boumans, R., M., J. (2002), "A typology for the classification, description and valuation of ecosystem functions, goods and services" *Ecological Economics*, 41: 393–408.

<sup>6</sup> Chivian, E. (2003), "Biodiversity: Its Importance to Human Health" Centre for Health and the Global Environment, Harvard Medical School, Cambridge, MA.

<sup>7</sup> WEHAB (2002), "A Framework for Action on Biodiversity and Ecosystem Management", Water, Energy, Health, Agriculture and Biodiversity Working Group Report, contribution to the World Summit on Sustainable Development, Johannesburg, South Africa, 26 August – 4 September, 2002, United Nations, New York.

literature: the immediate, great pressure of the natural ecosystem upon poverty was investigated under the multiple aspects of the economic determination<sup>8</sup>.

The empirical studies were materialized through the (partially universal and consistent) argumentation of the relevant theories (from the economic literature), by their positioning in certain spatial contexts. The multiple relation existing between the ecosystems stability and the zonal characteristics was the subject of certain surveys and studies conducted for solving up the punctual problems; for example, the coral reefs represented the subject of practical research works by which the main aspects of the man-nature system were revealed (Nystrom, M., Folke, C. and Moberg, F., “Coral reef disturbance and resilience in a human-dominated environment” published in *Trends in Ecology and Evolution*, 15/2000).

The important subject of wetlands was the focus of research works by which both the empirical paradigm of the ecosystem relations and the methodological paradigm necessary for the study of this issue were established. The study “The Socio-economics of Wetlands” carried out in 2002 (by the authors Stuij, M.A.M., Baker, C.J., Oosterberg, W.) quantified the contribution that wetlands can bring to human welfare (such as leisure spaces, biodiversity, characterized by socio-cultural values) through the protection of natural habitats.

The empirical studies generally use the classifications of wetlands elaborated by Ramsar (1971, in the paper “Convention on Wetlands of International Importance Especially as Waterfowl Habitat”): marine/coast wetlands (permanent, coral reefs, estuaries etc.), inner wetlands areas (delta, permanent areas of rivers, permanent wetlands of lakes, alpine wetlands, wetlands in tundra etc.) and wetlands created by humans (irrigated areas, excavations, channels and drainage channels, waste water treatment areas, exploitation sites, etc.). The economic significance, the functional performances of the ecosystems dominated by this type of areas was investigated in the African countries. (Turner, R. F., Folke, C., Gren, I. M., and Bateman, I. J. published the results of these studies in the paper “Wetland valuation: three case studies” in Perrings, C. and Maler, K. (Eds.), *Biodiversity Loss: Economic and Ecological Issues*, Cambridge University Press, 1997.

The economic value, both the direct utilization value and the indirect value represented the main methodological subject of the reference paper, “Ecological-economic analysis of wetlands: scientific integration for management and policy” (published in *Ecological Economics*, nr. 35/2000) by Turner, R., K., van den Bergh, J., C., J., M., Söderqvist, T., Barendregt, A., van der Straaten, J., Maltby, E., and Ierland, E., C.

<sup>8</sup> Scherr, S., J. (1999), “Poverty-Environment Interactions in Agriculture: Key Factors and Policy Implications” Paper prepared for the United Nations Development Program (UNDP) and the European Commission (EC) expert workshop on Poverty and the Environment, Brussels, Belgium, January 20–21, 1999, Revised March 1999; Fisher, R. (2000), “Poverty alleviation and forests: experiences from Asia” RECOFTC, Bangkok.

The special relation between the wet ecosystems and the poverty characteristic to human areas was the subject investigated by a multitude of empirical studies: in 1994, Ruitenbeek analyzed the traditional non-commercial forms in the Bintuni Bay mangrove area, Indonesia; in 1999, Turpie investigated the economic benefits generated by the sustainable wetland utilization in Zambia; in 2003, Emerton studied the impact produced by the exploitation of local resources upon the natural ecosystem and poverty.

The quantification of the economic phenomena generated by multiple relations between the natural and the human habitats is one of the essential methodological concerns of the research studies:

- the economic assessment of ecotourism is the subject of concrete studies (carried out in 1996 by Menkhaus, S., and Lober, D. J., in Costa Rica or in 2001 by Seenprachawong in Thailand);
- the economic assessment of water resources (studies carried out by Johnson and Baltodano in Nicaragua in 2004 or by Siedl and Moraes, in Brasil in 2000);
- the economic assessment of the nutrients cycle (studies carried out by Gerrard in Laos in 2004 or studies based on the Camerun model by IUCN);
- the assessment of the saline intrusion cost, example offered by Iftikhar in 2002 in Pakistan's case;
- the economic assessment of the forest ecosystem has a very wide range of methodological approaches, starting with the economic value of the access to the forest resources (1996, Kramer and Shyamsundar made studies in Madagascar for the assessment of non-commercial benefits) and ending with the analysis of the biunivocal relations with the poverty processes (Velded in 2004 – studies under the World Bank aegis).

### 3. MATERIAL AND METHODS

The materials used for the study of the complex relations between the natural and human ecosystems were:

- statistical documents and studies on biodiversity and ecosystems;
- scientific literature on biodiversity and ecosystems;
- statistical materials and studies on the human habitats in the investigated areas;
- regional and local strategies referring to the investigated rural area;
- legislative documents, norms and standard rules referring to the investigated rural area governance.

The methods used for the identification and quantification of the multiple relations existing between the ecosystem services and rural communities consisted of:

- primary documentation;
- sociological observation of the rural communities, using the in-depth interview; the processing was by ATLAS software;

– the longitudinal and transverse socio-economic analysis of the rural communities on the basis of questionnaires, the main tool being the rural locality fiche (standardized tool designed by the Institute of Agricultural Economics).

#### 4. RESULTS AND DISCUSSIONS

The study of the complex relations between the natural and human structures was carried out in the rural system of Brăila county. We mention that for the case study we used the concept of ecosystem defined as a system formed by the interaction of flora, fauna and microorganisms and between these and their non-living environment<sup>9</sup>.

##### 4.1. Ecosystem typologies

The primary typology of ecosystems comprises:

– **the spontaneous natural ecosystems** – prevailing on the Danube banks, (located on islets); they are also found in the areas cleared of trees for farming purposes or piscicultural (natural or artificial) basins; the main characteristic is the poor vegetation and limited zoocenosis, consisting of species brought by air or water way;

– **the secondary anthropized spontaneous ecosystems** – mainly consisting of forests: *“Such forests were maintained on certain islets, but most of them are covered with hybrid poplar plantations and other fast-growing species, cultivated in rows and without underbrush, the rare and poor grass layer being subject to grazing. These “forests” present an unstable and vulnerable anthropogenous ecosystem, with low biocenotics diversity, subject to periodical natural disasters and pests of all kind”*<sup>10</sup>.

– **the secondary aquatic ecosystems** – *“After dyking the river, over 400,000 ha of ponds, flood land, small streams and runnels disappeared, their place being taken by large land areas, which were intended to be fertile agricultural lands ... in a short time, not more than 4-5 years after dyking, a great part of the land areas obtained through the desiccation of ponds, marshes and streams lost their productivity due to intense salinization, desertification or sloughing processes. ... in the aquatic ecosystems, over 300 taxons of plankton and periphytic algae were identified, 100–200 zooplankton invertebrates, 17 large big groups of benthic invertebrates with hundreds of species, all fish species of fresh water typical for lakes and ponds”*<sup>11</sup>.

<sup>9</sup> Definition formulated in the study *Multilateral: Convention on Biological Diversity* presented in 1993, at the Convention on Biological Diversity, Rio de Janeiro, 1992.

<sup>10</sup> [www.scribub.com/geografie/Danube's Ecosystem 233652222.php](http://www.scribub.com/geografie/Danube's%20Ecosystem%20233652222.php):GSG Moasil Team, Brăila, Romania.

<sup>11</sup> [www.scribub.com/geografie/Danube's Ecosystem 233652222.php](http://www.scribub.com/geografie/Danube's%20Ecosystem%20233652222.php):GSG Moasil Team, Brăila, Romania.

– **the plain ecosystem** (Bărăgan Plain) – characterized by native steppe vegetation, is at present dominated by agricultural crops; 90–95% are anthropized ecosystems. “*At present, the natural steppe vegetation is also found on the slopes of subsidence depressions, in the spaces between agricultural parcels, on the road side, in the areas that are temporarily uncultivated. The basic associations consist of xerophilous grassland with spots of bushes consisting of steppe shrubs*”<sup>12</sup>.

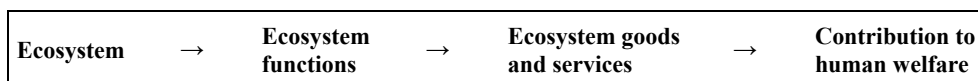
– **the saline ecosystem** is spatially defined by the Salty Lake I and by the lakes Căineni and Movila Miresii; “... *the waters of the lake are intensely salty, characterized by a rich zooplankton and phytoplankton. The therapeutical value is generated by the existence of the massive deposits of therapeutical mud. ... In the Salty Lake (Lacul Sărat) I Brăila, ... the total volume of existing or estimated therapeutical mud is 138404.5 m<sup>3</sup>, and the exploitation volume amounts to 535.62 m<sup>3</sup>. ... the characteristics of the salty lake Căineni are those of a deposit of mineral waters of the type chlorosodium-sulphate-magnesium and sapropelic mud*”<sup>13</sup>.

– **the rockery ecosystem** (Popina Blasova), resulting from the hercinic erosion, has the following composition: “*The vegetation elements are those specific to the pontic steppe and panonic silvosteppe. The steppe was largely upturned and replaced by crop vegetation in 90%. ... Most plants develop their vegetation cycle before the dry periods from the end of summer*”<sup>14</sup>.

#### 4.2. Brăila ecosystems – structures and functions

The ecosystem structures and functionalities generate the support of the rural communities from Brăila, determining fundamental economic and social characteristics.

The rural community benefits come from the modality in which the ecological values get combined with the economic ones, in which the physical, biological processes are intermingled with those specific to human activities and the natural habitat and human habitat complete each other.



Source: “The Economic, Social and Ecological Value of Ecosystem Services: A Literature Review”, London, 2005: A2-11.

Figure 1. Ecosystem – human welfare relation.

<sup>12</sup> [www.cjbraila.ro/Raport de mediu PATJ Braila-Final-2011.PDF](http://www.cjbraila.ro/Raport%20de%20mediu%20PATJ%20Braila-Final-2011.PDF) – “Environmental report for the Territory Ammendment Plan of County Braila Halcrow, România, 2011: 41.

<sup>13</sup> [www.cjbraila.ro/Raport de mediu PATJ Braila-Final-2011.PDF](http://www.cjbraila.ro/Raport%20de%20mediu%20PATJ%20Braila-Final-2011.PDF) – “Environmental plan for the Plan of Territorry Ammendment”, Halcrow, România, 2011: 60.

<sup>14</sup> <http://primariafrecatei-braila.ro/fckfiles/File/PAAR.PDF> – “Natural, economic and social characteristics of the Frecatei commune”, p: 6.

The spatialization of the relations between human welfare and the ecosystems existing in Brăila area was reconsidered only for those rural communities in which biodiversity was fractured in order to annihilate the drought-induced risks; these areas were selected in order to demonstrate the multiple inter-influencing relations.

The main features of the investigated area are the following: **a plain ecosystem considered as an agro-ecosystem** taking into account the very high share of agricultural areas in total area: 81.3%; these add to the fact that 75% of the agricultural land is found in the 1<sup>st</sup> and 2<sup>nd</sup> fertility classes. Furthermore, 200,000 hectares are organized into modern farms on which modern techniques and technologies are used; **the coverage area** is ample because most rural communities in the county Brăila are part of this ecosystem. Depending on the modification of the ecosystem, one can detach the areas in which both the direct factors (mainly land transformation, change of the river flow and water prelevation, introduction of pressure upon species, abusive use of fertilizers, crop harvest and livestock production, climate variability and change), and the indirect factors (mainly the socio-political ones/governance and the legal-scientific framework and technology – agricultural techniques) brought their substantial contribution to redefining the human development starting from the change of the plain ecosystem into an agro-systemic one and the deep transformation of the natural – human ecosystem implicitly.

If we detach a rural area with high ecological and social homogeneity we can **localize the rural subsystem defined by the rural localities Cazasu, Siliștea, Vădeni, Tudor Vladimirescu**. The eco-ecological analysis focused on this area reveals the relation between the ecosystem services and the development level of the rural communities as well as the existing relations between the ecosystem functionality and the human welfare. The ecological characteristics are defining for the communities with a medium natural risk level (Table 1).

*Table 1*  
Environment characteristics

	<b>Cazasu</b>	<b>Siliștea</b>	<b>Vădeni</b>	<b>Tudor Vladimirescu</b>
Periodical moisture surplus in soil				
Soil erosion				
Landslides				
Frequent drought	Yes	Yes	Yes	Yes
Small and very small humus reserve in soil	Yes			
Acidity/alcalinity		Yes	Yes	Yes
Chemical pollution of soil due to human activities	Very low drinking water pollution	Serious drinking water pollution	Low drinking water and soil pollution	Serious drinking water pollution

*Source:* Data from the Commune fiche, applied in 2011, 2012.

*The rural area of Brăila Terrace, consisting of the 4 investigated communities* comprises 13 villages; the average number of villages per commune is of 3.2; the population of this rural area totals 11,169 inhabitants. The density, specific to the region it belongs to, has quite low values, ranging from 0.15 inhabitants/ha (commune Siliştea) to 1.2 inhabitants/ha (commune Cazasu).

**The demographic capital** is defined by the balanced structure by genders, the share of the female population is 50.2%, as well as by the severe demographic phenomena: the birth rate in the rural area is 13.9‰. The natural population increase can be noticed only in the rural community Siliştea (+5.9‰) in the remaining communities having negative values, ranging from –19.5‰, in the commune Tudor Vladimirescu to –1.2‰, in the commune Cazasu.

The particularity of the occupational pattern resides in the occupational disequilibrium, generated by the prevalence of employment in the agricultural sector. The excessive contraction of job supply supports this pattern, which became specific for the rural Brăila area. The excessive great shares of the population employed in agriculture describe the excessive economic and social dependence on this activity, also indicating the maximum risk degree that the respective rural communities are facing. A preponderantly mono-occupational structure is materialized into increased vulnerability to any type of natural, social and economic risk (Table 2).

Table 2  
Problems of the investigated rural communities

Commune	Problems of the community
Siliştea	Temporal subsidy gaps – lack of timing between the periods when these are necessary and the time when they are received
Vădeni	Lack of funds for commune modernization
Tudor Vladimirescu	Lack of jobs
Cazasu	Rural poverty

Source: Commune fiches applied in the period June 2011, March 2012.

While at the statistical analysis level we can identify the problems emerged from the lack of jobs (non-diversification of job supply), at the level of social analysis much more complex problems were established. In the formal leaders' opinion, vulnerability stems from the lack of funds, poverty, incorrect implementation of agricultural policies.

The defining **social capital** for the investigated rural communities is characterized by:

1. **social relationships** with positive effects (information dissemination, knowledge and information exchange, internalization of the interests of the group the rural players are part of) and negative effects (their sticking to the traditionality matrix results in the emergence of an “*anti novatory*” behaviour and the low internalization of values in relation to the natural environment preservation). The first category of the social relations is based on the organization of water users into



formalized entities (there are 6 irrigation water users' organizations) and on the establishment of producers' associations ("Association of sheep and cattle raisers" in the locality Siliștea). The social relations with negative effects are determined by: minimum rural poverty generated by a specific participatory pattern. The professional producers' organizations are early nuclei of institutionalized capital, these being found in the rural communities where entrepreneurs exist and in which the life quality has a high level. The farmers' organizations are characterized by the relative decoupling phenomenon, with a clear-cut separation between the formal structures and the effective operation.

2. **"the confidence radius"** – assessing the contribution of social relations to sustainable development, enabling the opening of the rural community to the exterior, together with the stability of relations. In general, the rural associative forms that have established formalized relationships, for example, the irrigation water users' organizations, have had an essential contribution to the opening of rural communities towards the extra-rural institutions.

**The economic characteristics** are generated by the prevalence of the agricultural activities with low entrepreneurship representativeness and the low diversification of non-agricultural activities. The investigated areas have been subject to the anthropic impact, the natural vegetation being replaced by agricultural crops, which "stopped the natural process of humus bioaccumulation and contributed to the decrease of humus reserve in soil implicitly"<sup>15</sup>. The very high share of arable land – ranging from 84.71% (commune Vădeni) to 95.96% (commune Siliștea) determines the agrarian profile of the investigated sub-system and occupational structures focusing on agriculture (Table 3).

*Table 3*  
Structure of agricultural areas, %

	<b>Cazasu</b>	<b>Siliștea</b>	<b>Vădeni</b>	<b>Tudor Vladimirescu</b>
Arable	94.80	95.96	84.71	87.5
Pastures	1.60	3.04	1.93	11.87
Orchards	3.60	0.92	0.33	
Vineyards		0.08	13.03	0.54

*Source:* Study conducted by OJSPA Brăila, for the communes Cazasu and Siliștea, in conformity with the MAFF Order no. 223/2002, 2006: 5; for the commune Vădeni, data from documents of OJSPA Brăila, 1996; for the commune Tudor Vladimirescu, data from the Locality Fiche, DJS Brăila, 2010: 17–18.

The soil quality permitted the development of agricultural activities and the consolidation of an extensive economic system: "The soils on the territory of the commune Cazasu were grouped into 5 quality classes. The classification took into consideration all the weather and soil factors characteristic to each homogeneous

<sup>15</sup> Study conducted by OJSPA Brăila, in conformity with MAFF Order no. 223/2002 of MAFF, 2006: 5.

territory: annual average temperature, annual average rainfall, depth of phreatic water, gleization, salination, alkalization, horizon A texture, total porosity in the restrictive horizon, calcium carbonate content, the reaction in the first 20 cm, the humus reserve on 0–50 cm, useful edaphic volume. The soils on the territory of commune Cazasu, Brăila county, were formed in the conditions of a plain relief (2313.51 ha – 100% of the territory area) on parental materials consisting of loessial deposits, in the conditions of a dry continental temperate climate, characterized by high annual average temperature (11°C) and low annual average rainfall (460.5 mm)<sup>16</sup>. The soil formation in the area of commune Siliștea “took place in the conditions of a dry climate, with cold winters and hot summers, with torrential rains at large intervals. The potential evapo-transpiration exceeds the rainfall value, resulting in a humidity deficit that affects the crops and favours soil salinization in the areas where the phreatic water is found at a small depth”<sup>17</sup>.

The agricultural areas belonging to the commune Vădeni are of medium quality: most arable areas are in the 3<sup>rd</sup> quality class. The arable land in the commune Tudor Vladimirescu has a wide range of soil quality; the land in the 2<sup>nd</sup> quality class has the highest share. The benefits that agriculture extracts from the supply services (food-crops) of the eco-system that the 4 rural localities are part of are quite contradictory due to the existence of the irrigation system. The irrigation system of Brăila Terrace results in breaking up the ecosystem equilibrium on one hand, and the optimization of agricultural production on the other hand (Table 4).

The economic diversity (Table 5) is the result of the ecosystem supply service conjugated with the existence of a rural business environment depending on the proximity to the urban centers (Cazasu located at 5.7 km from Brăila and Vădeni at 15.9 km from Galați).

The occupational structures (Table 6), under institutionalized forms, are those specific to rural communities on the way to their economic and social emancipation; the relevant shares of the employees from industry are generated by the flow of commuters oriented towards the two urban poles, Galați and Brăila.

The demographic and socio-economic structures have generated the modality to connect to the natural ecosystem and the utilization level of the goods and services specific to it (Table 7).

The way of understanding the natural ecosystem, the degree of intervention upon the natural habitat and the whole tissue built up in time between the two players – rural community-ecosystem – determined the ecosystem contribution minimalization. The ecosystem is the support of the basic activities (feeding, heating) and of the fundamental processes (pollination); the contribution of the other services is low, being determined by the relative absorption degree of the rural communities.

<sup>16</sup> Study conducted by OJSPA Brăila, for the commune Cazasu, in conformity with MAFF Order no. 223/2002, 2006: 6–7.

<sup>17</sup> Study conducted by OJSPA Brăila, for the commune Siliștea, in conformity with MAFF Order no. 223/2002, 2006: 6.

*Table 4*  
Dynamics of main crops and agricultural productions

	Cazasu		Siliștea		Vădeni		Tudor Vladimirescu	
	2008	2010	2008	2010	2008	2010	2008	2010
Area under wheat								
Irrigated-ha.	890	711	1,670	1,335	1,520	1,214	1,040	829
non-irrigated-ha.	1,317	1,485	7,855	8,366	9,613	9,519	4,879	5,114
Wheat production								
Irrigated-tons	920	866	2,701	1,354	1,613	1,575	683	836
non-irrigated-tons	1,418	1,821	5,616	6,397	4,824	3,213	1,796	2,954
Area under rapeseed								
Irrigated-ha.	30	100	100	68	428	801	120	371
Non-irrigated-ha.	84	140	280	380	480	317	260	199
Rapeseed production								
Irrigated-tons	46	270	230	176	748	1,155	193	428
non-irrigated-tons	100	285	551	624	1324	2,060	691	1,213
Area under maize								
Irrigated-ha.	350	93	280	380	428	801	120	371
non-irrigated-ha.	495	100	350	390	480	317	260	199
Maize production								
Irrigated-tons	617	497	1,314	4,830	1,324	2,060	691	1,213
non-irrigated-tons	693	435	2,277	4,976	1,374	4,486	2,374	6,474
Area under sunflower								
Irrigated-ha.	100	120	300	143	300	200	220	100
non-irrigated-ha.	100	231	1397	872	1,181	2,405	820	999
Sunflower production								
Irrigated-tons	201	288	810	400	811	560	354	250
non-irrigated-tons	160	370	2,230	1,588	1,830	4,406	1,002	1,726

Source: Data supplied by DARD Brăila, 2011.

*Table 5*  
The economic diversity

	Cazasu	Siliștea	Vădeni	Tudor Vladimirescu	TOTAL
Local industry firms – no.	7	1	5	1	14
Agriculture, food industry firms – no.	4	9	13	7	33
Firms – related services for agriculture – no.		2	3		5
Tourism firms – no.	1			2	3
Commercial firms – no.	24	6	16	4	50
Transport, construction firms – no	11	2	4		17
Other firms – no.	15	2	9	2	28
TOTAL – no.	62	22	50	16	150

Source: [www.listafirme.ro/braila](http://www.listafirme.ro/braila)

Table 6  
Occupational diversity \*, %

	Cazasu	Silișteea	Vădeni	Tudor Vladimirescu
Agriculture	11.2	15.6	19.7	31.8
Industry	56.3	75.1	49.2	
Constructions	5.1	0.5	0.3	
Trade, mechanical repairs	17.8	9.2	13.0	8.8
Transport and storage	3.7	0.5	2.4	
Hotels and restaurants	5.1	0.5	1.2	1.7
Public utilities, ecology **		1.1	0.1	

\* It was calculated on the basis of shares of the number of employees only for certain non-agricultural sectors.

\*\* Water distribution, sanitation, waste management, decontamination activities.

Source: Own calculations on the basis of data from the Locality Fiche, DJS Brăila, 2010.

Table 7  
The ecosystem – rural community relation

Ecosystem services	Supply				Modelling/control		Cultural and valoric contribution	
	food	fibres	fresh water	wild foods	pollination	water regularization	aesthetic	ecosystem leisure time
Cazasu	crops, animals	wood fibres		captured animals	pollination	feeding underground waters	religious	
Silișteea	crops, animals	wood fibres	ground waters	captured animals		feeding ground waters	religious	
Vădeni	crops, animals	wood fibres				feeding underground waters	religious	
Tudor Vladimirescu	crops, animals	wood fibres				feeding underground waters	religious	Natural

Source: Processing of data from the Commune Fiche, 2011, 2012 and in-depth interviews applied to rural people.

In this **relational context (natural ecosystem→rural community)** the support for the rural welfare is minimally obtained through:

– generation of basic matters for an agreeable life (adequate subsistence matters, food, shelter) through the **supply service** and regularization of ground waters, and biological fundamental processes (pollination) and through the **modelling/control/ regulation service**;

– the materialization of a minimal level of satisfying the health condition is realized only for the existence and quality of ground waters and through **the supply and control/modelling service**;

– the materialization of the good social relations (social cohesion, capacity to help others, mutual respect) is mainly supported through the **cultural contribution service** (aesthetic – religious values);

– the generation of the personal security conditions is supported by all the 3 ecosystem services, under minimal parameters: through the **supply service** (adequate subsistence matters, food, shelter), **through the modelling/control/regulation service** (ground water regularization and fundamental biological-pollination processes) and through the **cultural contribution service** (aesthetic-religious values);

– the freedom of action and choice is low because there is a minimal capacity to control the personal situation with the help of the three fundamental services (on one hand their support is diminished and on the other hand the latent and manifest behaviours have low intensity degrees).

A possible sociological explanation would consist in: the dimensions lacking valoric depth of the *internalization process* through which the external data are analyzed, become internal data and represent the basis of the individual's adaptation; in this way, a process of ecological uncertainty increase takes place at individual level; a superficial *learning process* (based on special relations with the natural and human habitats depending on the character of situations/persons and not on their achievements), generating manifest behaviours subject to certain unwritten laws and not to certain norms.

The drought phenomenon in which the modelling/control/regulation service does not have any role on the human habitat; this is perceived either as a divine fact or as a consequence of the irrigation system destruction. The specific mentality focuses on religious causes and associations<sup>18</sup>: “*When it was drought, this was real, and we used to pray to God ... it was a request, they used to bring a saint from a monastery in the proximity, the priests used to come, they used to read here and maybe, after a day or two ... those clouds were coming ... and even now, please, forgive me, we are praying to God to give rain from above ... from above, that is all, last year, on Saint Elijah's Day, which is a great day for us, it rained.*” (C.T. farmer, Cazasu).

*When God wishes, this is it, for instance, you've seen, this autumn, it was a terrible drought, a whole month it didn't rain, nothing ... People were going to the field, with water barrels, with big icons, they were going to the field and the priest was reading, used to drop water on the ground; and after that clouds gathered and rain would fall ... Today they take out only the icons from the church, we are going to the fields with them, Holy Virgin, and Jesus Christ, 2, 3 icons, ... the priest reads, when it is drought, when it isn't, he won't read; it is quite strange, once after the service it started to rain, you know, it was a bad weather outside, you know, it was interesting, well, that would be all ...*” (R.S. farmer, Siliştea).

<sup>18</sup> In-depth interviews applied in 2011, 2012 in the communes Siliştea and Cazasu; ATLAS processing.

The precarious condition of the irrigation canals means turning back to a passive behaviour: *They destroyed, dear madam [low voice, upset], they took the flagstones, ... the engines that were working, they stole them shamelessly [low voice], they stole, [high voice, accusingly] they stole the motor pumps from the cooperative farm, these ones that used to pump out water, were in every station; there was a station here, 2,3 stations that pumped water, they stole from there, too [Was there anybody working in the stations?] they were workers, state employees ... everything was destroyed, you could even say that there was not any cabin there, it is nothing there now [slightly amused]. People do not irrigate anymore, now they are waiting to receive funds from the government, with these bigger ones, there is more hope, but with those small ones, they must spend all, because they took the small flagstones to use them for themselves ... I also took 3 or 4 myself, what could I say, if I found them there I put them in my chart and I used them ... they were destroyed madam, they were stolen.* (C.T. farmer, Cazasu).

While 20% of the explanations are of religious nature, 60% belong to the association between this phenomenon and other related processes (poverty, spatiality, temporality); the most frequent is built upon the food vulnerability: *“When it was drought we did not have what to eat, if it was drought we had less wheat ... you worked for nothing and did not save anything. Only one year it was drought and there was no maize to be harvested ... In '57 it was drought. Lucky of us with the cows that had enough milk, we were making porridge, we were making doughs, we were making this kind and were eating.. ... hunger was the worst thing and this is the cruelest memory.”* (R.S. farmer, Siliştea).

In the typology of associative answers, the spatial-temporal ones prevail, as a kind of vulnerability translating: *“... what shall I tell you, this is the story, the great drought was in the year 1946, 1947, these two years, that was the great drought that people felt, yes, all people, but not quite all, in Oltenia it rained, the grains were harvested, we used to go there and buy grains, and brought them here; this is the story of drought here in Muntenia.”* (C.T. farmer, Cazasu).

**The relation between the ecosystem and the rural communities can be assessed in terms of sustainability as the sum of the capital goods is constant,** in the conditions in which the direct factors (the change of the local agricultural land utilization modality, the utilization modality of the local agricultural land areas, the pressure upon the species) and the indirect ones (populations distribution, the governance and the legal framework, new agricultural techniques) contributed to reaching an eco-economic equilibrium. As a complementary approach, **the rural communities – ecosystem relation** is generated by the structure and functionality of a set of independent factors. The direct factors that have a strong impact upon the ecosystem from Brăila are the following:

a) *the change of the local land utilization modality, soil occupation configuration and the change of agricultural techniques*; for example, the soil occupation

scheme (Table 8) is the consequence of the traditional pattern of emergence and development of rural localities in Câmpia Bărăganului (Bărăgan Plain), in which the modernization process took place, with the change of the people's quality of life;

b) *modification of the river flow and water prelevation*;

c) *introduction of pressure upon species*: "...the vegetation was subject to anthropic changes, which determined the setting in of the segetal vegetation. The segetal vegetation depending on the type of crop (row crops or non-row crops) is represented by early spring weeds with long vegetation period (wild oats, swine grass, charlock), perennial weeds (couch grass, cane, tunnyfish, sesame, bindweed) and aquatic weeds (reed, bulrush)"<sup>19</sup>;

d) *the disposal of polluting substances and the abusive use of chemical fertilizers*;

e) *the harvest of crops and the animal production*: if we exemplify by punctual analyses, for the communes Vădeni and Tudor Vladimirescu, we can demonstrate the influence of this factor upon the ecosystem. "For the calculation of the nitrogen balance it is considered that the organic fertilizers on the population's households are applied on an area that does not exceed by more than 2.5 km the limits of the built-in village area. From the point of view of the limits imposed by the average flows of ground water bodies located under the area of the commune, the maximum number of LLU admitted in the spreading area of organic fertilizers is 3.6 LLU/ha"<sup>20</sup>.

f) *climate variability and change*.

Table 8  
Soil occupation pattern

	Cazasu	Siliștea	Vădeni	Tudor Vladimirescu
Dwelling area sq.m	54,944	29,984	54,897	37,734
Length of water supply network – km	21.1	15.2	33.6	25.4
Length of gas supply network – km	13.8	3.9	28.7	–
Agricultural area in total area – %	90.3	87.2	72.3	86.4
Non-agricultural land area in total area – %	9.6	12.7	27.6	13.5
Area under buildings – %	3.3	1.8	5.2	2.3
Area occupied with means of communication and railroads – %	2.3	2.2	2.2	2.1
Building authorizations issued for residential buildings – sq.m	5,781	1,231	2,074	589

Source: Data from the Locality Fiche, Cazasu, Siliștea, Vădeni and Tudor Vladimirescu, DSJ Brăila, 2010.

<sup>19</sup> Study made by OJSPA Brăila, for the communes Cazasu and Siliștea, in conformity with Order no. 223/2002 of MAAP, 2006: 4–5.

<sup>20</sup> Source: [www.icpa.ro/comune\\_vulnerabile/Braila/report\\_Braila-Vădeni](http://www.icpa.ro/comune_vulnerabile/Braila/report_Braila-Vădeni).

The indirect factors with multiple actions upon the ecosystem structure and functionality are concentrated on:

- a) *populations distribution* – there is a moderate pressure of the anthropic factor upon the ecosystem in the investigated area;
- b) *the governance and legal framework*.

## 5. CONCLUSIONS

**In the relational (natural ecosystem→rural community) context**, the support for the rural welfare is minimally achieved by: generation of basic matters for an agreeable life (adequate subsistence matters, food, shelter) by the service of supply and regularization of ground waters, and fundamental biological processes (pollination) through the modelling/control/regulation service; the materialization of a minimal level of health condition satisfaction is achieved through the service of supply and control/modelling; the materialization of good social relations is supported mainly through the cultural contribution service; the generation of personal security conditions is supported by all the 3 ecosystem services: the supply service, the modelling/control/regulation service and the cultural contribution service; the freedom of action and of choice is low because there is a minimal capacity to control the personal situation by the help of the three fundamental services (on one hand their support is diminished and on the other hand, the latent and manifest behaviours have low intensity degrees).

The relation between ecosystem and rural communities can be assessed in sustainability terms because the sum of the capital goods is constant, in the conditions in which the direct factors (the change of the local agricultural land utilization, the pressure upon the species) and the indirect factors (populations' distribution, the governance and legal framework, new agricultural techniques) have contributed to reaching an economic equilibrium.

In the context of the **rural communities → ecosystem relation**, the direct factors that had a very strong impact upon the Brăila ecosystem are the following: the change of local land utilization, soil occupation configuration and the crop harvest and animal production; these added to the disposal of polluting substances and the pressure upon species. The indirect factor with a very strong impact consists of the governance types and legal framework.

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