The Analysis of Local Communities Flood Adaptation Strategies using Traditional and Participative Research Methods. Case Study: The Danube Valley between Giurgiu and Gostinu

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SUMMARY

The research focuses on three interconnected areas of study in terms of the context of adaptation and the temporal and spatial scales (Figure 1), which differ depending on the research methods used.

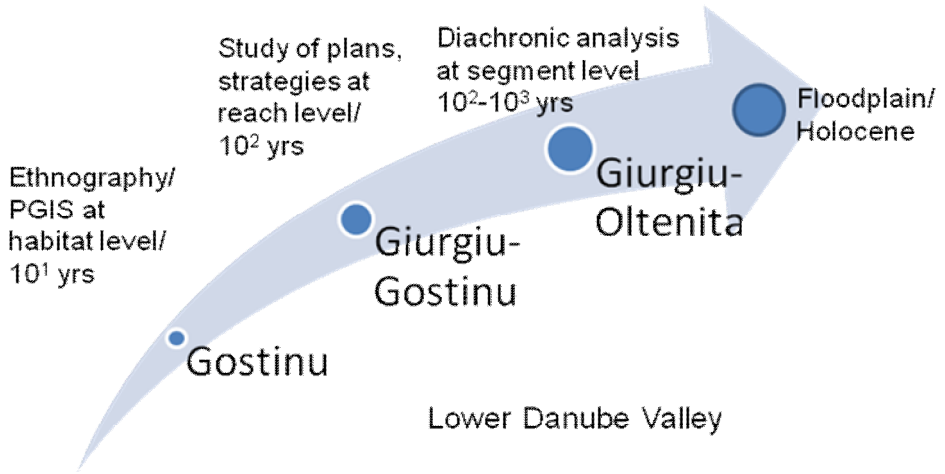

Figure 1: Spatial and temporal interconnection between the three nested study areas

The diachronic analysis considers a wider area - the Danube Valley between Giurgiu and Oltenița (Figure 2), selected primarily because hydro-geomorphologically this is a naturally distinct unit and secondly due to its socio-economic evolution as determined by specific historical and geographical characteristics. These characteristics have influenced the move of Wallachia's capital from Targoviste to Bucharest, transformed Giurgiu into a port for Bucharest and created distinct connections between Giurgiu and the settlements located in the northern area, on the Burnaz High Plain: Daia, Baneasa, Pietrele, Greaca, Cłscioarele and Chirnogi due to their relation with the Kaza of Giurgiu, a former Ottoman administrative unit with judicial role, which comprised the study area for approximately 400 years.

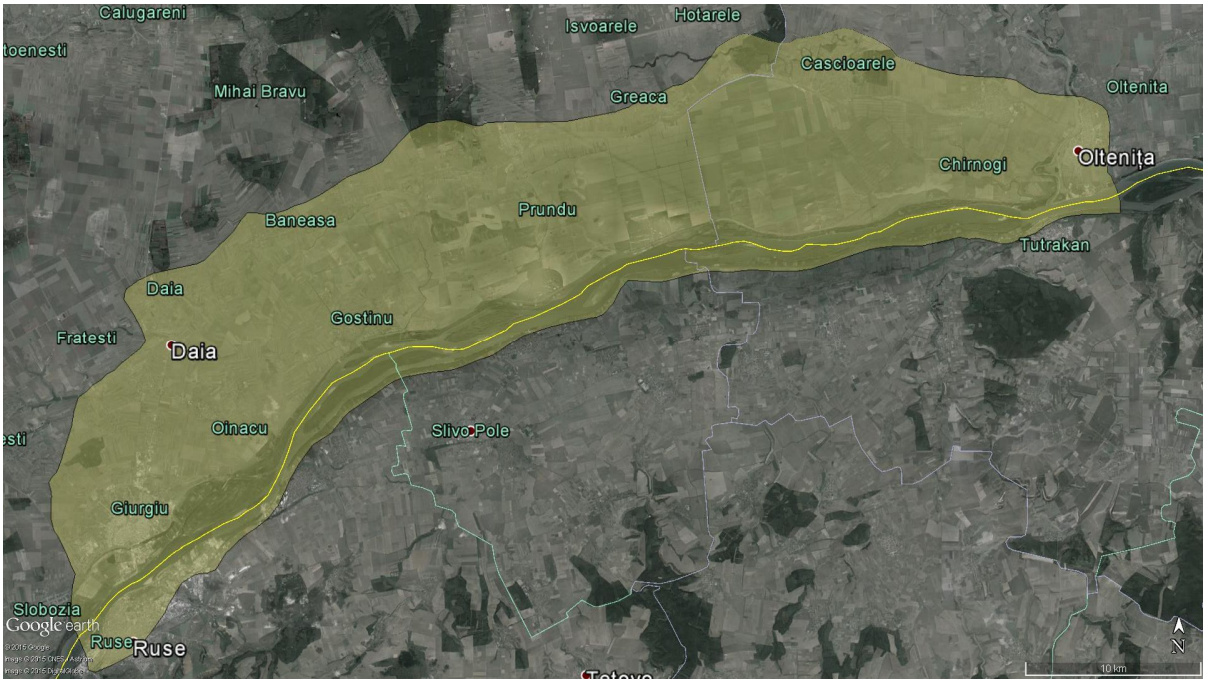

Figure 2: Diachronic analysis study area- Danube Valley between Giurgiu and Oltenița

The analysis of the adaptation plans and strategies was applied to the area between Giurgiu and Gostinu, including three administrative units located in the Danube basin, which have the highest exposure to flooding in the Giurgiu county: the Municipality of Giurgiu and the Villages of Oinacu and Gostinu.

The PGIS participative mapping and the ethnographic method, which involve a situational and contextual approach at micro-scale have been used in Gostinu Village.

The study aimed to achieve the following specific objectives:

1. To identify current and past ways of interaction between the inhabitants of the Danube floodplain and their local environment and the factors that contributed towards adjustment, adaptation or mal-adaptation;
2. To estimate the impact of structural methods of protection against floods and infiltrations and the bureaucracy associated with implementing these structural works in the Danube floodplain area between Giurgiu and Gostinu;
3. To apply a detailed case study in the village of Gostinu in Giurgiu county, using diachronic analysis, ethnographic methods and Participatory Geographical Information Systems (PGIS) to identify factors that influence adaptation to flooding and infiltrations;
4. To identify the characteristics of local communities and the vision of community members, regarding floods and infiltrations and explore reactions to plans to renaturate the Danube floodplain, taking into account that the beaches, river islands and the floodplain forests from the Gostinu study area are part of the Natura 2000 Network (ROSPA0090 and ROSCI0088);
5. To analyse flood protection policies and strategies at local, regional, national and international level and estimate their impact in the study area.

The aim of the research is to combine traditional approaches to the study of adaptation to floods based on academic research with transdisciplinary approaches using ethnography as a qualitative method that gives insights into the situational adjustment or adaptation (determined by local conditions) and Participative GIS (PGIS) which is based on 'contextual' non-academic knowledge identified by the analyzed group and based on its collective memory.

The paper is structured into eight chapters; the first two chapters are theoretical, while the 3rd, 4th, 5th, 6th and 7th chapters present and analyse academic and non-academic data and knowledge about the study areas, collected during the doctoral study. The last chapter is focused on conclusions.

The first chapter argues that geographers have a long tradition of generating new directions of study in the natural sciences, suggesting how they need to be studied. Geography is still considered a liaising science (but surprisingly not by geographers themselves, but by those working in other fields), which is expected to provide answers concerning nature and its natural hazards. In this regard, this chapter presents the analytical model entitled 'Hierarchical Patch Dynamic' (HPD), which is applicable to riverine ecosystems, such as the Danube, and developed to address the complexity specific to hazards and the lack of integration of research between the natural sciences and that of the social sciences.

The theories of the Danube Valley formation are in dispute to date and there is no study on the evolution of the entire lower valley on either the Romanian or Bulgarian sides. To address this issue the paper presents both Romanian and Bulgarian geomorphologic maps of the Danube Valley segment between Giurgiu/Russe and Oltenita/Tutrakan and a map of the Holocene paleolake that once existed between Giurgiu and Calarasi, on the Romanian and Bulgarian banks of the river. The former Pietrele and Greaca lakes located in the study area and drained in the '60s, were remnants of this paleolake.

The information presented in this chapter advances the hypothesis that the Giurgiu - Oltenita segment of Danube Valley evolved under intense human pressure for an extended period of time and has certain morphodynamic tendencies dictated by a past that is not well known, however it is of considerable importance for the successful identification of possible ways to adapt to flooding by diversifying and increasing the use of the Danube's ecosystem services.

The second chapter presents the conceptual framework, complex and comprehensive methods and indicators on risk, vulnerability and adaptation, which were developed at a national and international level under the assumption that the 'risk society' is considered a characteristic of contemporary post-industrial societies (Beck, 1989, 1992).

A new development in this chapter is to introduce data from archives and papers written on vulnerability and adaptation during the totalitarian period, when on the one hand adaptation was imposed through five-year plans and on the other hand vulnerability was not then accepted as a concept or term in Romanian scientific circles.

This chapter importantly highlights a diversification of methods for estimation of risk and vulnerability, which become particularly essential after 2003 when Romanian researchers began developing valuable quantitative methods to estimate the extent of possible natural hazards, usually developed in isolation by researchers in the field of natural science, without attempts at integrating social sciences research.

Chapter 3, looks at structural methods, which reveal associations between the contexts in which water management structural works were developed, meaning that there were 'hydropolitics' (Wittfogel, 1954) at play in antiquity that have since been replicated by modern western societies in Europe and North America ('The Hydraulic West'). In socialist Romania, the 'hydropolitics' were used as a leverage to coerce the landed peasantry to accept collectivisation and as a tool to control the majority of the rural population.

Studying the evolution of structural works, such as the system of levees, canals, irrigation and drainage stations built in the floodplain, it is becoming increasingly clear that the most significant problems created are longitudinal and transversal river disconnection, high maintenance costs and their overall inefficiency. They have evolved simultaneously with drastic land use changes such as deforestation, advancement of inhabited areas, intensive and extensive agriculture, only structural methods have been designed without taking into account possible changes and reactions of the river and its floodplains.

At the Giurgiu - Oltenita river segment level, the study shows that the levees are not as well-built as authorities claim, further compounded by the lack of consideration for local river dynamics, the embedment of the river course and the drawing up of the levees without taking into account the shape of the Danube river bends, all of which can cause major losses in the area. Since their construction, the area adjacent to the levees and those areas once covered by the Pietrele and Greaca lakes (ranging in height from 12.5 m to 18 m) are now exposed to flooding and infiltrations. The occurrence of a possible breach at the maximum erosion point, km 475 of the Danube, could drastically affect Gostinu Village, where houses are no longer being built on man-made mounds of earth as in previous times, the so called traditional 'talpa' houses. Furthermore, many new dwellings have an average height of16 m, which lives them exposed to floods.

Chapter 4 includes the results of the diachronic analysis, which combined information provided by maps and cartographic documents, statistics, bibliographical sources with information from archives (Giurgiu County, local and regional institutions) and highlighted how untamed nature with its geographical characteristics and the political, social, cultural and environmental conditions have led to a Danubian local context of vulnerability and adaptation to floods**.**

Moreover, the chapter illustrates how the local inhabitants first tamed nature, then forcibly turned it to serve the needs as dictated by a range of imposed controls (fiscal, legislative, etc.) at the level of the Kaza (Ottoman administrative unit), principality (Wallachia) and even at global level. Based on the data collected and the analyzed cartographic documents, certain thresholds with obvious impacts on the lives of residents were identified. These thresholds then determined changes and major adjustments to the newly created historic-geographical conditions, each of which time period is further defines by the pressure of leverages that the power / state institutions / bureaucracy imposed on the local communities, which over the long-term led to adaptation or maladaptation.

The maladaptation (IPCC, 2014) may increase inhabitants' vulnerability and the exposure to floods at different physical locations or economic sectors. In the study area, there seems to be a maladaptation

regarding current agricultural practices, which are no longer compatible with the present situation because land ownership has changed. During the communist regime, land belonged solely to the state, and the intensive farming practiced on the immature floodplain soil was maintained by an energy inefficient system of drainage and irrigation, which functioned with very high 'environmental costs'. At present, most landowners hold less than 5 hectares of land and are unable to meet the actual cost of drainage or irrigation. In terms of present agricultural practices, the adaptation of local communities appears to have become blocked. To an outside observer, the reasons appear illogical, however this chapter goes on to argue that the reasons are in fact entirely logical and can be fully understood only after an examination of data obtained from the in depth analysis of diachronic maps, compared to research results from various other authors, monographs, and data available in the county and local archives.

In contrast, the transport sector has been one of the main decisive factors that has brought positive change and allowed populations to adapt. The relocation of the Wallachian capital from Targoviste to Bucharest (1659) was due to the increased usage of the Giurgiu highway at the expense of the Sibiu highway. This was because the Giurgiu citadel was at the crossroad between Wallachia, the Austro-Hungarian Empire and the Ottoman territories, the Raia and Kaza, that were situated along the Danube and and the citadel was used as a harbour for Bucharest up until the opening of the Giurgiu-Bucharest railway, in 1850. The Giurgiu harbour, the river transport and its associated activities have played and continue to play a major pro-adaptive role throughout the area of study.

The main power agents/institutional actors, which forced local communities to adjust to their requirements, expanding the agricultural land to the detriment of the natural floodplains, lakes, forests and other flooded areas, rapidly becoming owners in their own right of all unflooded agricultural land, then forcing the most vulnerable to work the newly acquired land. These power agents were a) The Ottoman Empire through the Danubian territories they ruled, which were called Raia and Kaza; b) The nobility (boyars) and the churches/monasteries from Wallachia; c) The state institutions from the pre-communist modern period; and d) The Communist Party during the totalitarian period. Bibliographic sources and data from archived show how these agents/ actors have gradually seized land originally own and worked as common land (Stahl, 1969), by pastoral forest communities, 'bivolari' (trackers who used carts pulled by oxen), custom/border guards, fishermen, shepherds practicing 'trashumanta' and the nomadic Roma people (Petcut 2007). These processes of change took place simultaneously with those highlighted by rural land use maps and data obtained by methods using Geographic Information Systems (GIS), allowing measurements of land-use reform over a period of time.

In particular, the Ottoman period serves as an example in terms of both, the variety and diversify of their ways of adaptation, specifically in the Danube floodplain when economic activity intensified and the number of settlements on both sides of the Danube banks was growing significantly (Constantinescu, NA 1911). The paper mentions authors presenting Ottoman structural methods of flood protection (Walsh 1812, Boldescu 1912, Cernovodeanu 1969, Beatie, 2010) as being built based on a thorough knowledge of local hydrology and directly connected to the ways the land was being used.

The way in which local residents constructed their houses in the study area and the food provided by the ecosystem services are evidence of a sustainable pro-adaptive behaviour, which formerly characterised the local communities. The three types of houses described in this chapter - the subterranean type (bordei), the 'maza' type and the 'talpa' type made of 'paiantŁ' (a type of cob house), which in 2014 represented 74% of the material used to build houses in Gostinu Village (as indicated by a quantitative questionnaire) are examples for other Danubian communities to follow, in order to reintroduce the employment of sustainable materials and methods. The construction of such houses would then encourage ecosystem services regeneration and recreate the specific landscape described by many authors mentioned in this chapter.

During the socialist period, local communities were forced to abruptly abandon a way of life that had been characterized by diverse ways of adaptation, in a closely coupled human-environment, at the centre of which was the individual in search of opportunities that nature provided for its benefit in a flexible way of

life to a completely different way of life. This new way of life was based on agriculture practiced in CAPs (cooperative farms), IASs (state agriculture enterprises) and agricultural research stations such as ICITID Baneasa (former United Nations-FAO in the '60s) or based on employment in the industry sector requiring commute to the nearby urban areas such as Giurgiu and Bucharest. This type of development transformed the Gostinu and Oiancu villages from rural areas, which were relatively independent from institutions into peri-urban areas dependent on a large number of institutions and bureaucracy.

Chapter 5 comprises the ethnographic analysis, which shows that the period of communism, dominated by intensive agriculture and maintained by physically powerful structural works, which disconnected the natural floodplain from its river flow, did not however destroy the interconnection of Gostinu area villagers with the Danube. The local population maintain a perceived strong connection to the river, which appears as a recurring theme in the ethnographic interviews. The purpose of this chapter was to present the preliminary results of the ethnographic research in the Gostinu village.

The ethnographic method employed for this paper is that defined by the Anglo-Saxon school of thought, based on a combination of qualitative methods that involve studying without a priori hypotheses and predetermination of what will be seen on the ground and exploring and testing assumptions that emerge as a result of work on the ground. Ethnographic analysis was conducted up to the point of saturation regarding the 'modalities of adaptations' theme and used a sample of 56 informants, identified using a snowball sample method and a semi-structured interview.

The ethnography highlights that the Gostinu community members are characterized primarily by a shared collective memory, a 'repository' of knowledge in the memory of the community about the natural floodplain environment before the construction of the un-submergible levees after 1963, the year of the last major 'zapor' (a flood due to ice obstacles in the river-course). Other relevant elements emerging as recurring themes in the collective memory are: the local custom of repairing or building houses as group work ('claca'), fishing practices, working on nearby construction sites, the construction and maintenance of levees, the drainage and irrigation system, the intensive farming which begun with the establishment of the cooperative farm (CAP), the collapse of the irrigation and drainage system in the '90s, the influx of poorer inhabitants from the Moldova region, the phenomenon of soil patchiness allied to the variety of soil types, infiltration, excessive humidity, 'the principle of communicating vessels' and interconnectivity with nature - 'El Danubius' is personified and is seen as an 'agent' (Giddens, 1988). As people are 'agents' acting on nature, nature has her agency as 'El Danubius'. To the contrary, the river is not perceived by the local population as an object / phenomenon for control by humans (Steinberg, 2000).

The focus groups held with women were the most valuable for providing information on their daily life connected to various ways of adaptation, based mainly on the uses of the Danube ecosystem, such as: a) sources of food (shells, recipes, asparagus and plants growing on the bottom of ponds when water was retreating), which disappeared with the drainage of the lakes and ponds; b) isolation due to precarious transport and communication; c) the lack of a bakery in the village until 1963; d) the existence of ponds in the middle of the village until the '80s (near the Village Hall, Folanu, Gropana, Galdau, Maracinoasa) confirmed by other sources and maps, which determined some type of adaptive behaviours; e) that women were left with the task of working for the CAP in order to have access to land (lot ajutator) necessary for the survival of the family, while men were working in the building industry, at larger IAS farms, at the Baneasa ICITID Station, or held jobs in Bucharest or the town of Giurgiu; f) the gradual disappearance of fish and shellfish, the main food source for housewives formerly found in ponds, channels and natural canals.

The semi-structured interviews showed that institutionalization created the dramatic transformation of the Gostinu village area into a 'hybrid' (Escobar, 1999) environment, but also caused the transformation of the villagers from predominantly fisherman to farmers. The evolution of Gostinu village was determined by the existence of an over-riding dominant political and institutional framework (pre-socialist, socialist, post-socialist and transition), which has evolved in a way not seen as distinctly in any other part of the floodplain.

The local ethnology is reach in symbols that reinforce the hypothesis of interconnectivity between man and its environment and the existence of rituals aimed at protecting and strengthening the community, protecting the most vulnerable (children under 12) by symbols that are found as recurring themes especially in patterns/techniques used for everyday clothes, functional household objects, quilts, carpets, reed woven objects and wooden carvings decorating the 'talpa' traditional house. Locals inhabitants have values that show a pro-adaptive behaviour and local knowledge, folklore and symbols have guided their life as a whole for the period up to 1989.

Contemporary ethnographic research on human-environment relations regarding flooding in the Lower Danube is noticeably scarce. This chapter aims to explore the 'hybridization' (Escobar 1999) of the floodplain by exploring the human-nature-technology connections and to what extent the local floodplain inhabitants have adapted, adjusted or even regressed as a result of the excessive use of technology.

The conclusion of this chapter shows the numerous advantages in using mixed qualitative-quantitative methods and geography-anthropology interdisciplinary approaches, which complement each other to produce a fuller image of the dynamic evolution of an area, dynamism due to natural, cultural, institutional, social and economic transformations.

The purpose of the 6th chapter was to present the PGIS research field (Participative Geographical Information Systems), a domain linking GIS with the critical geography thinking and based on the implementation of participatory research methods. PGIS mapping was augmented with data obtained through ethnographic interviews, field research and participant observation.

Research has shown that using transdisciplinary methods has considerable potential to bring very valuable information in one place and only information relevant to the communities studied, which collaborated in the research process. The PGIS has been used to: 1) Re-create the flood of 1963, 2) Identify the areas of water infiltration and the documentation of the 'communicating vessels principle'; and 3) Use geo-tagged photos with embedded GPS information to record the characteristics or changes in the ROSPA0090 - Ostrovul Long Gostinu - part of the Nature 2000 Network with help from local residents.

The role of PGIS was to increase the capacity of locals to visualize and understand spatial information about their community, which might help them find appropriate ways of adapting to infiltration affecting 30% of the arable land of the village. The PGIS process has brought together different generations, experts and non-experts to facilitate an exchange of information and learning about former adaptations, about past mistakes that should be avoided in the future and in this way create a collective spatial data-base and enrich the collective memory of Gostinu's inhabitants.

Chapter 7 gives evidence that flood risk has been effectively managed in the past, even though this was not achieved by using integrated and coordinated methods in an institutionalized manner as in the present period. Numerous archive documents prove the existence of adaptation strategies for flood risk management and show that as the Danube floodplain develops, the destruction caused by floods increases. Pre-communist communities accepted floods as part of the cycle of nature, just as they perceived their entire existence was dependent on such natural phenomena.

Adaptation strategies were present in three basic forms: (a) implementation of structural methods using the technology available at the time, taking into account the financial feasibility of such protection measures, given that absolute protection cannot be obtained due to prohibitive costs; (B) living with floods; and (c) options for withdrawal or relocation from areas more exposed to less exposed to flood areas, aimed at correcting a incorrect type of adaptation for the floodplain and its future development.

All three types of strategies have been used at one time or another in the Danube floodplain. Among the first measures of structural protection were those built by the Ottomans in the XV-XVIII centuries in the cities of Vidin and the first dyke for the protection of Giurgiu town, built in the nineteenth century.

The plans and strategies for adaptation referred to in this study have been presented chronologically and analyzed based on the context of time, starting with 1830, the beginning of the modern age in the area under study and ending with the most recent plans or strategies for flood protection developed as a result of

the implementation of the Flood Directive no. 2007/60 / EC transposed at national level by the 'National Strategy for flood risk management for the medium to long term 2010-2035'.

The study exemplifies situations which reflect the implementation of strategies and plans at European, national, watershed and at local village level. Thus, ethnographic interviews show that the drainage system inside the Malu-Rosu-Gostinu Baneasa agricultural precinct is not functioning properly, the water level is excessively high in some channels, even during periods of low Danube water levels, which were observed and recorded in September 2014. Photos 1a and 1b below show the Moarta Canal at its maximum water level (3.9 m on the water meter), which normally would initiate the phase III of the actions for flood emergency situations. The reasons for this are: a) The drainage pumps are no longer employed unless paid for by the users of the surrounding land; and b) The larger part of the invisible (below ground) infrastructure - underground pipes / sippers - which collect water from the land into the collector canals such as Moarta Canal has suffer from being silted, obstructed or even destroyed (Moraru and Savin, 2011). Despite the fact that the water level of 3,9 m should lead to the implementation of specific measures to reduce the water level in the canal, the responsible institutions take no action, compounded by the fact, farmers in the area receive no compensation for losses due to excess moisture and infiltrations in their arable land.

Photo 1. a) The Moarta Canal and the water meter b) The water reaches its maximum level at 3.9 m

In response to increased losses due to flooding at national and European level, there is pressure on the Romanian state to reduce governmental costs in assuring total protection for flood risk, including the responsibility for repairing the structural system of flood defences built during the communist era, which is still operating with outdated high energy consuming technology.

Once becoming a member of the European Union Romanian authorities have been under pressure to designate areas for water retention such as ponds, swamps and lakes and to renaturate parts of the Danube Green Corridor. For these reasons civil society, international organizations such as WWF, local NGOs (e.g. Living Danube) and some government authorities would appreciate the implementation of non-structural measures for flood mitigation rather than excessive reliance on structural measures and a greater accountability on the part of the private sector for losses due to flooding.

The 7th chapter highlights that most Romanians consider as unjust the transfer from state to individual responsibility for losses due to flooding because: (1) The phenomenon of flooding has increased due to the implementation of structural protection systems in all countries of the Danube basin; (2) The habitats of the corridor no longer produce ecosystem services (fish, shells, reeds, clay, sand and other materials needed for building the traditional 'talpa' houses, etc.) and (3) The aging of rural Danube population in the study area and the fact that Giurgiu county is among the counties with the highest poverty index (Sandu, 2011).

Chapter 8 presents the conclusions in full showing that the capacity of adaptation and the adaptability have a multitude of meanings and take place in an independent manner, directly or indirectly as a result of policies / strategies or plans. The paper attempts to argue the hypothesis that emerges as a result of the research methods used - a rural area such as Gostinu has a high potential capacity to adapt in a way in which

people achieve a decent standard of life while 'living with floods'. Rural areas such as Gostinu may be considered social systems interacting and relying on an ecologic substratum, whose survival depends, among others on its interrelations with the indigenous natural resource system. The environment and its natural resources depend on the actions of the local population. Consequently, the Gostinu rural area may be considered a socio-ecological system and the areas such as Gostinu that still benefit from the services provided by the Danube ecosystem are centrally vital to the regeneration of these services.

Furthermore this chapter presents general factors that encourage specific adaptive interconnected lifestyles. which are coupled to the environment: 1) the habit of living with changes and uncertain situations; (2) the promotion of diverse ways of adaptation and resilience; (3) the importance of collective memory and combining different types of knowledge; (4) creating opportunities for self-reliance, self-organisation and taking responsibility in reconnecting with nature through a way of life based on regenerating ecosystem services, which in the past kept the local Gostinu villagers deeply interconnected with their environment.

The approach in this paper was intended to highlight the existence of a Danubian contextual framework regarding vulnerability and adaptation. Reconstitution and understanding social communities based on data recorded chronologically can be viewed from several angles, but this study has chosen to focus on identifying dynamic elements, such as the activities of studied communities influenced by both natural and human factors with access to knowledge or power, political pressures, the influence of bureaucracy, the evolution of vulnerable groups and communities over time, with the major factors that have led to adjustment and adaptation at national, regional and local levels. The hypotheses that emerge are valid for the Danubian context of the communities under study, without a major potential for generalization.

The paper finally concludes that the issue of adaptation is highly sensitive due to the methods of adaptation being heterogeneous and that there is always an initial resistance against them and confusion because 'communities hesitate between adaptation dictated by the past and what is prefigured in the future' (Heller, 2000, p 9). Also because the institutions, which are created to assist people in adapting do not bring adaptation independently, adaptation is formed in an inconsistent way being influenced by connections created at contextual level, under the influence of socio-economic conditions and local cultural conditions favouring certain adaptive behaviours and attitudes.