

BABEŞ - BOLYAI UNIVERSITY
FACULTY OF GEOGRAPHY

**Complex rehabilitation of surface mining
(quarries) exploitation
Comparative study Köflach-Austria,
Lausitz-Germany,
Aghireşu-Romania**

Summary of the doctorate thesis

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Key words: surface mining, lake,s environmental damage, natural protection, re-cultivation, rehabilitation planning, rehabilitation process, perspectives, economical costs, ecological costs, touristic aspects

Chapter 1

GENERAL INTRODUCTION

In the world of today, the regions around the globe are focusing enormous pressure to remain competitive. Large funds are invested not only by local authorities but as well on a community, province, national and f.e. European wide level. Most of the regions are already now struggling with their abilities to face these problems on a professional point of view, ending up by realizing unrealistic or non efficient promising projects, bringing the real problems even further deep and large amount of cash has been burned.

People travel more than ever around the world, making “know how” transfer and comparisons of given facts, regional characteristics and realized projects easier than before. Due to my so far moved life, I had the chance to widen my horizon in different cultures, languages, mentalities and economies. This gave me the chance to analyze given situations and look into the right measures to turn a project into a successful and long lasting one.

I believe strongly, that all economic aspects apply to any kind of business, but the basis of success also relates to the present fundament or better said for this thesis relates to the given natural sources and re-sources.

There have been made already many different forms of diploma or doctoral thesis's about analyzing the natural given resources of a region, but so far not many focusing on the result of economical possibilities in regards to the re-cultivation process. Especially in the Romanian region of Aghiresu it can be seen, that more and more studies are taken place analyzing and focusing on the tourism aspects of the area. There has been geological research of the region, touristic and economic analyzes but this thesis is focusing especially on the re-cultivation process helping to develop the analyzed tourism aspects that have been pointed out so far. The very positive and promising area of Aghiresu is at present in a very sensitive situation, where after the closure of the mining activities, the left over mines, have rotten the given and in principal wonderful former surroundings. These surroundings are in need to create them new and work on the needed landscape changes on a natural basis but with a human support.

The re-cultivation process of former mining areas has advanced today by far and the related flooding processes as well as improvements of the water quality level of the surface lakes have technical, chemical and geological wise improved on a very professional level. The area of Aghiresu that has been affected by the mining activities of the past is already now representing an attractive hideaway and retreat area for the local population, showing that there is a given attractiveness of the lakes and open spaces which can be improved by special means and projects to give them a new face to the region but as well over the region boarders.

Like it is the case for western European countries having a mining history, it must be the case for eastern European countries within the EU in the future, to put the re-cultivation process of widely present former mining activities in these countries on a level of national importance and homework. It is not only important to involve the governmental authorities in this process, but as well the local population. Together by involving all parties, the success of the re-cultivation process can be achieved much easier and concepts involving all parties can be realized as well as the usability of the landscape improved. Having all in a boat and involved, the majority of the population will stand behind this project and help to realize a faster legal but as well practical decision process in getting projects turned into reality.

It is the hope, that people and the whole region gets out of these kinds of situations, where projects with touristic aspects could be started in front of their doors.

The aim of this work is to see, if the region of Aghiresu can be turned into a successful touristic area and holiday destination of mayor importance for the whole community, which chances of development are given for the population in the area resulting out of the lake sites, in what ways can the chances of this area be taken and how can the population at the end benefit on a long term basis of the taken measures.

Chapter 2 INTRODUCTION TO THE MINING INDUSTRY

Mining activities have a long history and it has been realized already for a few thousand years. The mining for coal has started in the 9th century in England. Within the varieties of coal, it was the brown coal which developed to the mayor source of energy within the different coal variations and still is with more than 30% of the total energy power for example of Germany today. Coal mining is also one of the biggest polluters as the produce climate unfriendly Cole dioxide (CO₂) while used for energy production. Due to this fact, methods are searched to reduce the dangerous substance but so far only a better efficiency of the power plants using less coal for their production has lead to a slight decrease. At present, brown coal is still one of the mayor sources of energy around the globe, especially in the third world countries. In the industrialized countries of the world, the need for brown coal is declining due to the heavy pollution of the atmosphere. Alternative energy sources like atom, water and wind power plants are developed and built. Today brown coal is used primary for the use of electricity production.

2.2 Surface mining

There are different ways of mining. Surface mining is a special way of gaining the raw material from the ground. It is especially used for the brown coal production and so most relevant for the selected regions of this study. Surface mining is a certain method of mining, which allows gaining coal from the surface without digging deep into the ground and building tunnels. It is used especially for natural resources which are lying close to the surface like turf, gravel or brown coal. The gaining of the resources is realized with especially over dimensional machinery. With surface mining and

especially the huge dimensions of the needed areas goes a dramatic change of the region, as the given surface has to be taken apart sometimes with more the 100m depth. This leads to a massive decline of the natural level of water, which influences the surrounding landscape and population. After finishing the surface mining activities, in general the dug holes will be filled again with the waste of the past years or water (see Fig.) and re-cultivation of the area can take place, either with the development of re-creation areas or farming land. But due to the big influence to the region, surface mining is facing more and more critics and needs to be discussed.



Fig. 1: Surface mine before and after the flooding; Source: Förderbrückentagebau Reichwalde (2002)

In the last years huge investments have been used to re-nature most of the past left over surface mining pits, where very often there are created new lake areas.

2.3 Below surface mining

The below surface mining is using different kind of tunnel systems (gallery or pits) in mountain areas. There are different methods used in this kind of mining. The biggest ones are called “chamber construction”.

2.4 The buyers of coal production

Brown coal is used primary for production of energy but is facing a heavy competition from other more effective sources. Also its way of production is very cost effective in comparison to other energy sources. The main buyers in Europe are the energy producing businesses as well as the heavy industry in third world countries, where still the heavy industry used coal for its production facing little governmental obligations in regards to Co2 and better economical conditions due to financial obligations and social services.

Chapter 3

RELATED ASPECTS IN REGARDS OF THE MINING ACTIVITIES OF THE THREE AREAS

3.1 Environmental Damage

All in all surface mining is the biggest reason for landscape changes in Europe, creating areas similar to the moon surface, where resettlement of whole villages is realized to gain further space for mining. Also huge mass of death material is left over from the mining process which needs to be placed somewhere, either by creating dumps or giving it to the flowing waters. At the end all

environmental damage resulting out of this processes are depended on the way of mining and its machinery used, the kind of resource as well as the given geologic conditions. In the long run will be effected loads of different areas including the surface, ground water as well as the topography of the region with a much longer duration than the actual mining time.

Chapter 4 RE-CULTIVATION

The re-cultivation and rehabilitation of surface mining especially in regards to the brown coal developed has not only an ecologic and geologic change but also an important social, ecological and economical factor within a region. The major aim of the rehabilitation and re-cultivation of an area is to create a future usable mining area and its related surface in regards of the interest to the public. During the process of rehabilitation there are many different problems which need to be addressed and solved in order to guarantee a secure and long lasting use including the major problem of flooding the mines as part of the re-cultivation, where the level of ground water is declining which leads to an strong impact on the regional water supply for households and industry but also former wet land areas stay dry due to this process. Beside water or ground that needs to be addressed in regards to problems of the appearance of the re-cultivation of surface mines, also geological problems and the dismantling of old related fabrics, rail systems, pipelines and its environmental protected recycling process, service installations and other materials have to be realized, affecting whole villages which have been partly or fully revitalized. The financial and technical means to achieve these changes according the regulations are very high and costly. The areas have to be re-cultivated in that way, that the future planning can be put into practice and that access can be granted to the public without any security risk. But due to the heavy changes due to the mining processes in the past, the areas can at the end never be 100% re-cultivated as stated in the regulations. Only due to the self regulation of the nature time will bring back again a natural relation over hundred or more years.

The Lausitz lakes are still a very young example of a re-cultivation project developed on a tourism basis with an aim of driving a high potential touristic flow into the region.

Looking at the overall project (see Fig.2) in detail, there can be seen, what amount of land was re-cultivated by water as a result of the heavy mining industry and how long such a guided process takes, until the last lake has been flooded and the project can be finalized.

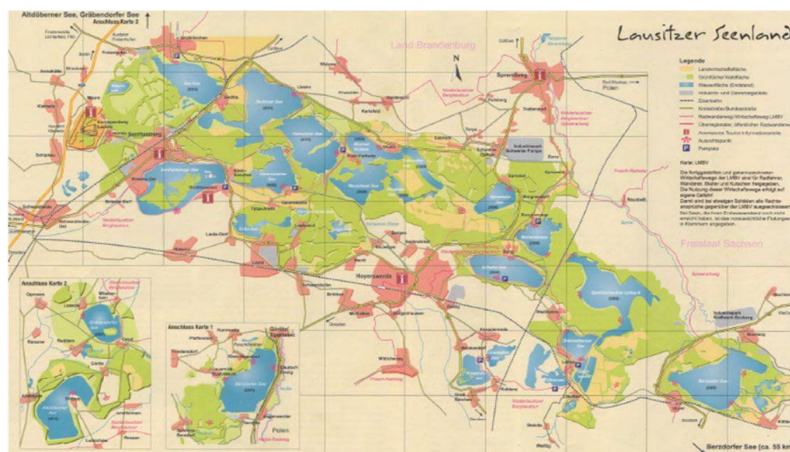


Fig. 2: The Lausitz lakes; Source: Ferienjournal; Tourismusverband Niederlausitz e.V. (2006)

Also in the region on Köflach in Austria, which is much smaller than the one of Lausitz, also there can be found at least two successful projects of re-cultivation of the former brown coal surface mining land.



Fig. 3: Golf Club Erzherzog Johann – Maria Lankowitz; Source: http://www.golf-marialankowitz.at/mhg_03DE/default.asp (12.05.08)

4.1 Mining industries and their rehabilitation problems

The major aim of the re-cultivation is regulated in legal mining regulations, for example in § 4 Abs. 4 BBERG of the German mining regulations which states, that the regular re-cultivation and re usability of a mining area and its related surface are of interest to the public. These regulations result out of the “general mining act” in the 19th century.

These regulations focus especially on the water, ground and natural protection. Water has problems in regards to its quality as the mines give iron hydroxide and sulphuric acid to the water, reducing the 6-9 pH level needed according the EU swimming water regulations for safe water sport activities as a result of an iron sulphide alteration. The so called “Sour lakes” are also not allowed to use for fishing or as water reservoirs. Special problems here in regards to the quality of water are the souring by Pyritoxidation, eutrophication (see Fig. 4) with too many nutrients (Phosphor) with river water during the flooding process. As well a contamination is given by micro pollutants (heavy metals, etc) and salinization of deep waters.

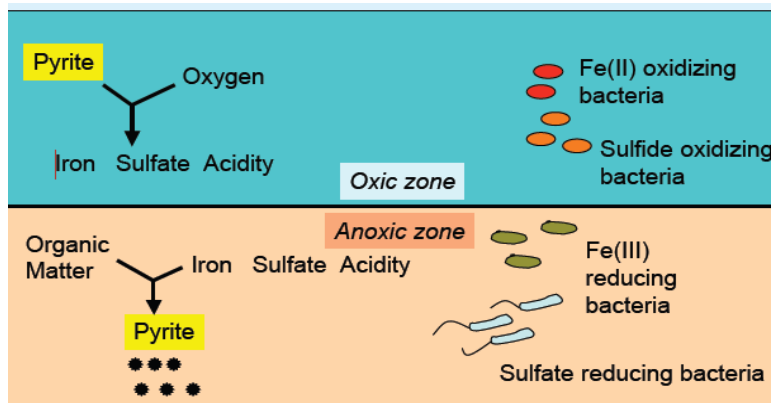


Fig.4: Microbial oxidation and formation of pyrites; Source: UFZ-Umweltforschungszentrum, Leipzig-Halle, 2009

Overall it can be seen (see Fig.), that the concentration and acidity in sour surface mine lakes are 2-3 times bigger the level of rain acidic lakes.

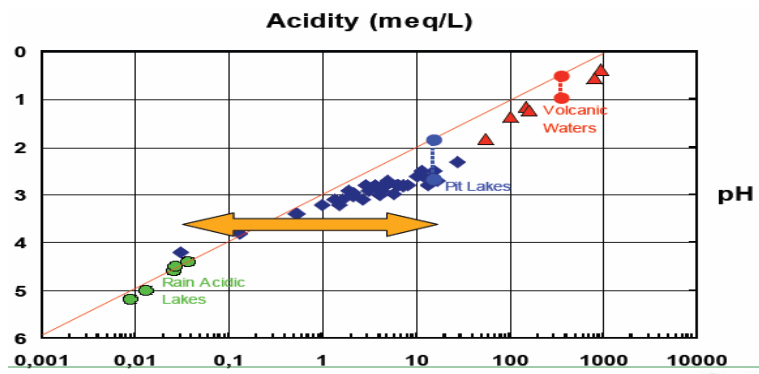


Fig.5: Level of acidity of different types of sour lakes; Source: UFZ-Umweltforschungszentrum, Leipzig-Halle, 2009

Further flooding of these waters is not permitted either, as it would be affecting all other involved waters like f.e. rivers. This process can be reduced due to external flooding out of rivers into the mines instead of ground water running out of them. It can be seen also as the biggest challenge in regards to the left over's of the rehabilitation restructuring of brown coal re-cultivation, to get into a status of self regulation of the existing water balance. If this status cannot be achieved by natural internal or external water sources, then only chemical additional processes can reach to this status.

Further the mining regulation focus on the ground. Most of the land around the former surface mines has been heaped up and is not of natural growth. These effects the quality of the ground in regards to the materials holding the ground together. As these grounds are not that solid like natural grounds, it has to be taken into account for any further use. The surface is for that reason not ready for any agricultural use any other like housing, etc but methods to improve the surface stability are undergoing. Another related problem are the landslides at the lake borders which bring high risks. These risks are also not changed due to natural means over the years and prevent also any public use. Different methods of securing the grounds are tested and implemented to avoid these risks.

4.2 Phases of the rehabilitation process

Before the beginning of the rehabilitation planning of closed or still active surface mines have to be fulfilled three facts: The allowance of the local mining authority has to be given; the planning has to be in accordance with the goals and basic declarations of the official country planning as well as the legal aspects and it has to be given the general permission by the control agency for land rehabilitation planning. In regards to the technical, ecological and economical most efficient rehabilitation possibility are taking place evaluations of independent official scientific bodies and engineer offices.

4.3 Costs of the re-cultivation process

The costs for re-cultivation have to be in relation or better said in proportionality but the mining regulations also leave it open to state, from when proportionality is given.

4.4 Employment possibilities

The process of rehabilitation and re-cultivation of surface mines are also a big factor to economy in regards to the employment possibilities. It is the aim to make most of the former workers return into the working process of rehabilitation of their past working places

4.5. Environmental aspects

Looking at the combination of substratum, ground, vegetation, Fauna and Flora and climate, it can be drawn an exact picture of an area, explaining its development from past to present in all means and related matters. Taking all these important factors into account, it can explain the reason for structural happenings, the quality of certain areas as well as influencing parameters.

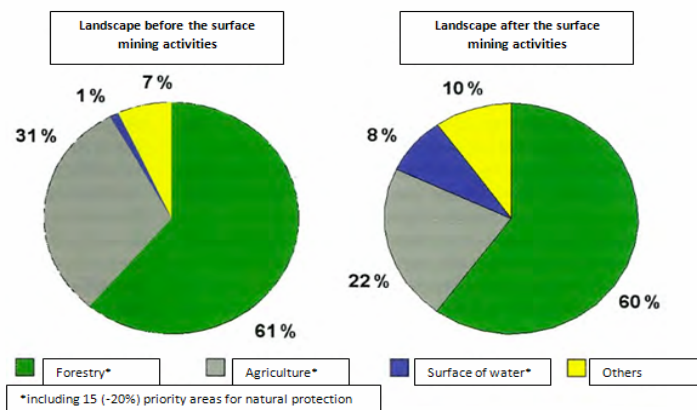


Fig.6: Comparison of landscape before and after the surface mine activities Source: LMBV (2003)

Chapter 5 ANALYZE OF THE RELEVANT STUDY AREAS

5.1 The areas of Köflach, Lausitz and Aghiresu

The three relevant areas in comparison of this thesis are all located across central and east Europe, within Germany, Austria and Romania, who all form part of the European Union (see Fig. 7).



Fig.7: European map indicating the three areas of Lausitz, Köflach and Aghiresu, Speedpool (2010)

The city of Köflach is the biggest in the county of Voitsberg in the Austrian province of Styria. The former brown coal mining community Köflach-Voitsberg has a population of 10.600 inhabitants (2007) and a size of 20,38 km². The region of the Lausitz is consisting of two totally different areas, the Upper and the Lower Lausitz, has a total size of 11.000m² and has approximately 1,4 million inhabitants. In total 13 different communities form part of the region which is divided into two provinces of Germany, being Sachsen with the bigger part and Brandenburg. The locality of Aghiresu has a total area of 105,79 km², 7.156 inhabitants and is situated in the Someșan Plateau, which is a definitive geographic sub-structure of the Transylvanian Depression.

All of these three areas have long mining histories in brown coal surface mining, which Köflach and Aghiresu have stopped their production in the meantime, whereas Lausitz is still in a growing production stage. Also Aghiresu is still mining its kaolin sand deposits at present.

Looking at the population statistics it can be seen, that since the mining activities have been stopped or reduced, a strong population decrease has taken place. Old people are left, the young ones have gone mainly to the bigger centers of the community. Also the unemployment rate is with app. 9% significantly higher than in other areas. Most of the former mining industry has undergone a change towards the service industry with offering now around 50% of the total working environment.

In regards to the geology of these areas, all are representing relevant deposits, incl. Aghiresu with kaolin and quartz; Lausitz with kaolin, clay and crystal and Köflach with quartz, calcite, crystal and dolomite. The climate is very similar with average temperatures of 8°C in Aghiresu, 8,3°C in Köflach and 8,6°C in Lausitz. In regards to the average rainfall Köflach has the highest depression with 840mm, Lausitz has 648mm and Aghiresu the lowest with 633mm.

Looking at the hydrologic aspects, all are having several hydrologic basins, whereas the ones in Aghiresu are not relevant for the lakes district (excl. the Bagara lakes). All areas also offer a wide variety of fauna including a good mix of fox, deer, etc., whereas in regards to flora, Lausitz is facing the problem of monocultures of only spures and pines compared to a mix of oak trees, chestnut, beech trees, etc in Köflach and Aghiresu.

Infrastructural wise, all areas offer a very well connected road and rail system - mainly based and resulting out of the former mining transportation ways. Whereas Köflach and Lausitz have an perfect developed infrastructure, Aghiresu is suffering of very bad conditions of its systems. Coming to the tourism activities of all three areas, all are targeting the recreation, the cultural, rural and the sports tourism. Köflach is offering in these regards a good but very limited structure for regional tourism; Lausitz is underway to be one of the biggest tourism projects on a national wide level with their lakes district ever, but suffers from a national recognition as a tourist destination as well as from a lack of skilled labor for the dimension of this project. Aghiresu is considered by regional tourists only, using

for example the balneal resort of Leghia or the lakes district for camping and water sports with no given infrastructure.

Chapter 6

REHABILITATION PROCESS FOR THE AGHIRESU COMMUNITY

In regards to the rehabilitation process for the promising Aghiresu region it is important to create a long lasting, economical feasible and profitable project, which helps the region to develop and to act as a new impulse for the future.

The Aghiresu region is already nowadays a well known and visited region for the surrounding villages within the province with a large potential not only due to its rich fauna and flora but as well due to its given natural resources including the marvelous surroundings. It is important to create further attractions and activities within the rehabilitation process by using the optimal and rich natural given resources in accordance and combination with the given present infrastructure, the economical possibilities as well as the development of a tourism environment.

The possible projects must give the region a certain character and an added value with a clear focus on the touristic aspects and the feeling of a holiday experience in between a wonderful surrounding, offering exceptional possibilities, making it worth to travel to the area and to spend money within it. Also it must strengthen the historic heritage to be integrated into the overall project development.

6.1 Possibilities

After analyzing the large positive but as well negative given factors of the area around the “Blue Lagoon” within the Aghiresu area, the best possibilities can be achieved within a touristic project, which drives not only the potential of the geological aspects of the area but as well involves the inhabitants, builds up the local infrastructure and facilities constantly and brings a positive image, which is nowadays more important than ever for further projects and investments to be granted. The touristic premises in regards to the poor infrastructure within the community of Aghiresu are especially the reason for limited development. The very positive given touristic potential, including elements offered by the natural landscape like relief, climate, water net, vegetation, etc.; has an important role in touristic activities development and diversification of the community and so outcome the necessity to set up some classification criteria for touristic attractions.

6.2 The touristic aspects and next steps

At present, Aghiresu does not take part in the touristic potential of overall Romania. The service industry is heavy underrepresented in the region. The region on Aghiresu is not an establish travel location and the cities and surrounding attractions only play a regional matter. Even though the lakes project will be a success, it is in an uneven comparison to the re cultivation costs and employment will mostly only be a seasonal one. The main factor for success will be, if the region of Aghiresu will be recognized on a national level as a touristic area and perceive a stronger positive

image, as local spending will not be enough to develop this industry and if no local economy is there, no money will be available to be spent.

Laguna Albastră Lake (Blue Lagoon Lake) and the surrounding other 8 lakes represent the most important natural spot of the Aghiresu community. The microdepression is almost 500m long and over 200m wide resulting into an approximate surface of 100000 m². The lake's dimensions excluding the gulf, that is almost separate, are as follow:

- the surface of the water: 22000 m²
- the water volume: 50000 m³
- the length: 255 m
- the width: 132 m
- the maximum depth: 7 m

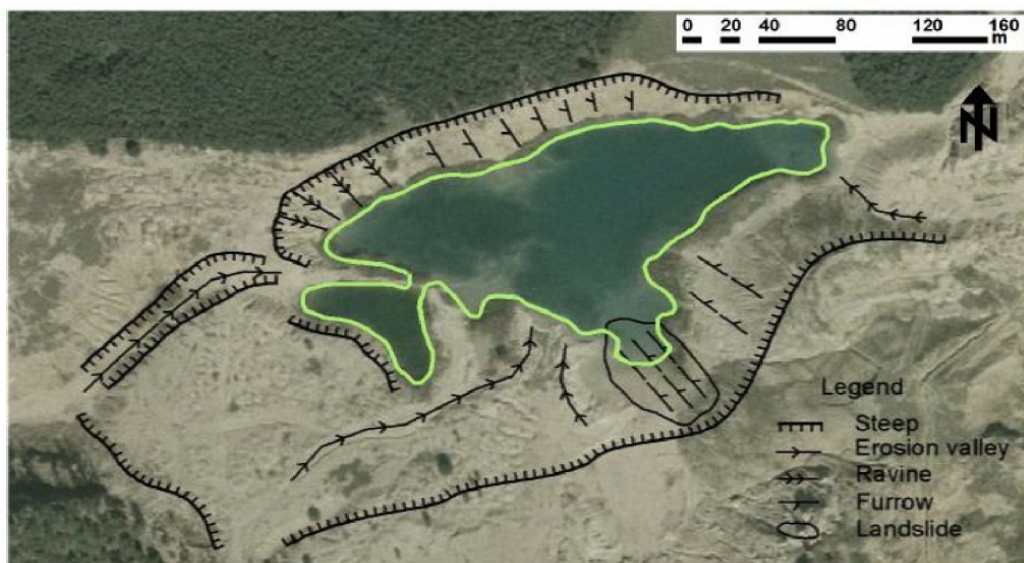


Fig.8; Morphometric map of the Blue Lagoon lake; Source: The lakes structure of the Blue Lagoon, 2009

The morphometric parameters of the Aghiresu lakes show their characteristics, being among the largest aquatic units of this area.

Tab.1: Morphometric parameters of the lakes from Aghiresu

Lake	Area (m ²)	Length (m)	Width (m)		Depth (m)		Perimeter (m)	Sinuosity coef	Volume (m ³)
			Mean	Max	Mean	Max			
Blue Lagoon	21719	266	81	154	2,3	10,0	823	1,58	50000
Lake 1E	4961	128	39	51	2,0	5,6	325	1,30	10025
Lake 2E	15278	247	62	97	2,9	6,3	739	1,69	44647
Lake 3E	13363	203	66	107	1,5	3,7	600	1,46	20645

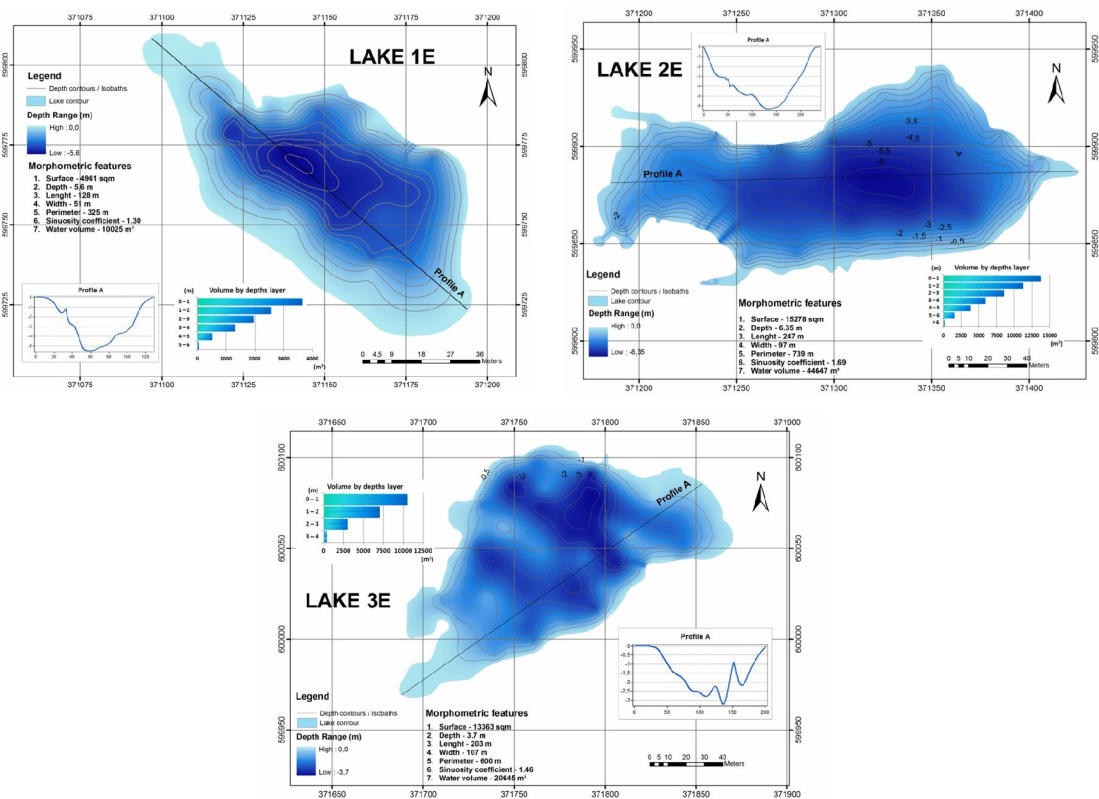


Fig. 9: Parameters of lake 1E, 2E, 3E; Source all: Pandi G., Bătiņaș R., Vigh M., 2010

Also analyzes of the lakes in regards especially to the following six variations incl. temperature stating a difference of 2,9-5,6°C, turbidity with no significant variations, electric conductivity from depth to surface with 30 US/cm and 2m +/- 4m because of its charging with salt, dissolved oxygen with low quantities and maximum values at the surface and hydrogen ions with very small amounts only, have been taking place. Not to be forgotten are the pH values, which lay at 6.06 - 5.65pH in summer and are much higher in winter. A comparison from summer to winter (SW08/09) has also been made, showing slightly higher temperatures due to a hot summer, no change on electric conductivity and hydrogen ions but a large variation in regards to dissolved oxygen.

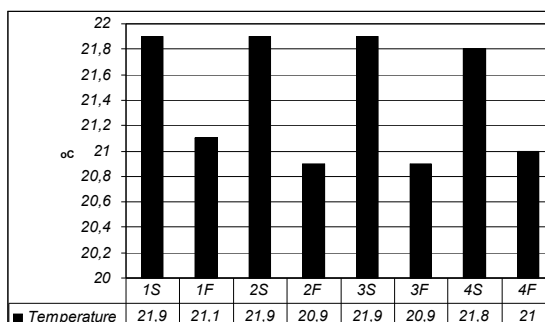
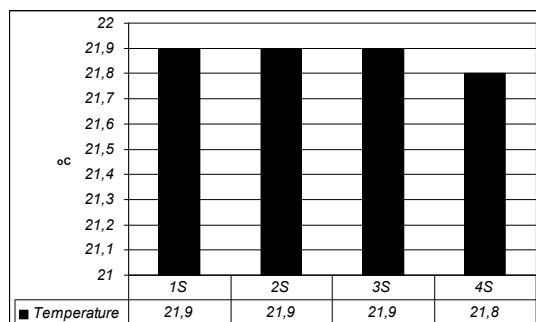


Fig. 10: The variation of the temperature in the hot season, at the surface and on the vertical; Source: The impact of mining upon the features of the Blue Lagoon Lake in the Aghireșu area, Source: Pandi G. at all (2009)

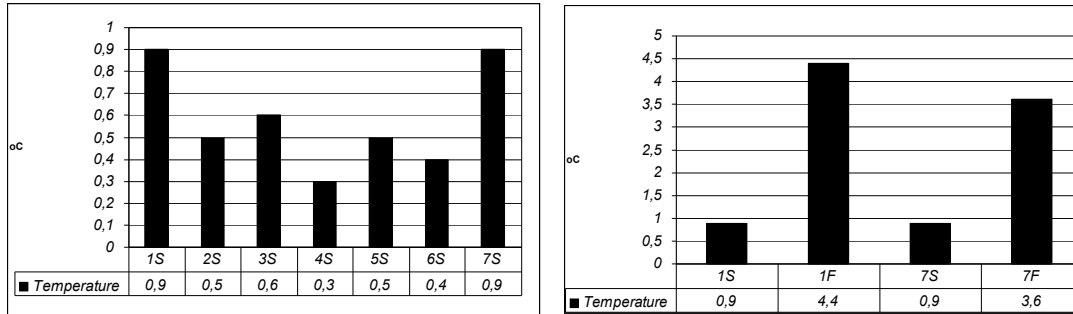


Fig. 11: The variation of the temperature in the cold season, at the surface and on the vertical; Source: The impact of mining upon the features of the Blue Lagoon Lake in the Aghireșu area, Source: Pandi G. at all (2009)

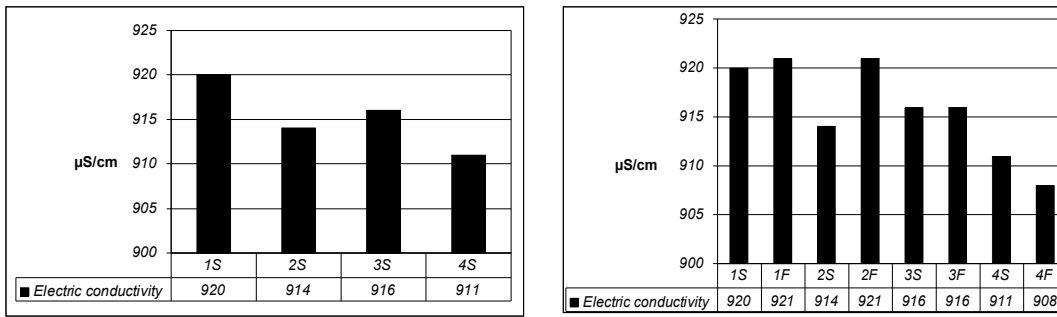


Fig. 12: The variation of the electric conductivity in the hot season, at the surface and on the vertical; Source: The impact of mining upon the features of the Blue Lagoon Lake in the Aghireșu area, Source: Pandi G. at all (2009)

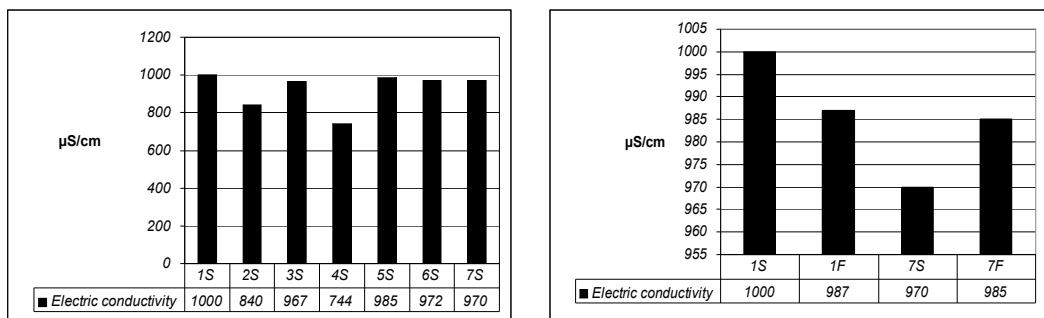


Fig. 13: The variation of the electric conductivity during the cold season, at the surface and on the vertical Source: The impact of mining upon the features of the Blue Lagoon Lake in the Aghireșu area, Source: Pandi G. at all (2009)

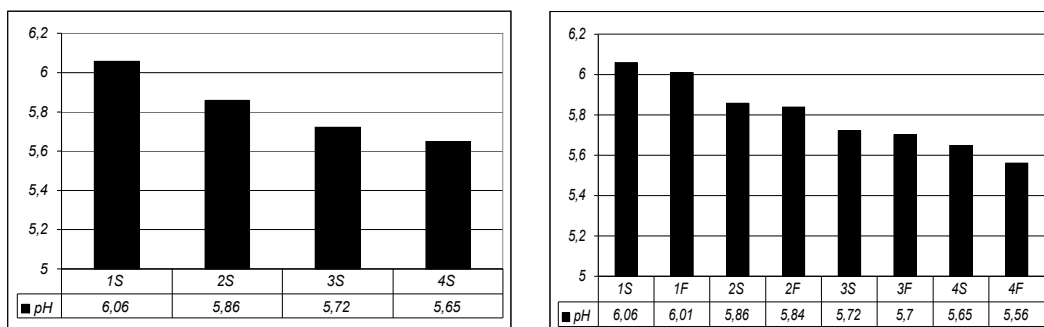


Fig. 14: The evolution of the pH during the hot season, at the surface and on the vertical
 Source: The impact of mining upon the features of the Blue Lagoon Lake in the Aghireșu area, Source: Pandi G. at all (2009)

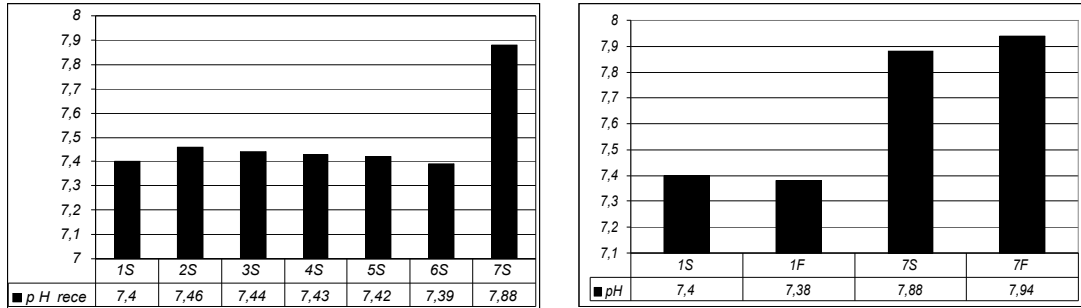


Fig. 15: The evolution of the pH in the cold season, at the surface and on the vertical;
 Source: The impact of mining upon the features of the Blue Lagoon Lake in the Aghireșu area, Source: Pandi G. at all (2009)

6.3 Possible realistic tourism projects compared to Lausitz and Köflach

One of the projects with the most potential for the community to take advantage from was already taken into consideration by the local authorities and it is about the Laguna Albastră Lake arrangement, lakes which appeared due to sterile dumps excavating and which in the summer time are already now overpopulated by the neighboring tourists, especially on weekends although they have no improvement since many years. Due to its placement near the wood has a very high landscape potential. Bringing investors would help at this area developing from a touristic point of view. Looking at other similar projects in Germany and Austria, there can be taken advantage out of the processed like it is the case for the Lausitz area and the lake side project as well as the Köflach area.

The best positive example in comparison for the Aghiresu lakes district is for sure as described earlier already by far the golf club Maria Lankowitz (see Fig 3), one of the top golf courts in Europe but as well its active park Piberstein, where a former surface mine was flooded for sportive use comparable with the process in the region of Lausitz.

Chapter 7 SWOT ANALYZE OF AGHIRESU AND A COMPARISON OF THE THREE AREAS

Looking at the three different areas and its development in comparison, it can be seen that it has been very difficult to find alternative sources compensating the role of the mining industry in the related amount of employment and financial income sources. A direct SWOT comparison of the three areas Lausitz, Köflach and Aghiresu, focusing on common strength and weaknesses in the different relevant areas, also points out clearly all given facts. Focusing there on the main points, the clear strengths of Aghiresu compared to the other two areas are significant quantities of kaolin, a high natural potential, a high qualification level of given industry, trade and agriculture. The clear weaknesses of Aghiresu are the low density of rain, aging population and young migration, bad road network, no local & foreign investors, low education and quality, industrial pollution and no ecologic

facilities. The clear opportunities are programs of country and EU development and financial programs, Laguna Albastră as well as cultural and historical assets, ecologic education and protection of fauna and flora. Last but not least are the clear threats of an decrease of active population, consideration of other areas first, no investor interest, illegal work increase, lack of communication and increased risk of soil erosion.

Chapter 8 CONCLUSION

After having compared the three areas in all relevant fields, it can be reflected, that the area of Lausitz and the realized projects of re-cultivation are completely different from the Köflach and Aghiresu area. There are almost no fields in Lausitz that can be compared or used for the progress of the re-cultivation process in Aghiresu, neither from the infrastructure, nor from the dimensions of the project. Further to that, also are the limited availability of funds to realize such a project.

In contrary, Aghiresu can take huge advantage of the changes that have been taken place in Köflach, where similar conditions in a whole apply. Also there changes have happened and projects where realized attracting local and regional tourism. Simple and budget friendly structures have been put in place step by step allowing a constant growth to what it is now.

For the promising area of Aghiresu, many major points have to be solved in a first stage, to make the huge potential of this area not only in regards to the diversity of fauna and flora, which is now being protected by environmental laws of the authorities, but also due to the strong natural touristic potential grow. To reach this, first of all the most important and principal step must be the improvement of the accessibility of the whole area taking especially the existing bad road network into consideration. Taking advantage of the very high density of connections of the area by road and rail is vital in order to bring the economy, investors', tourists, etc into the region. Without this approach, no further project can be put into reality or further works can be established.

Once this has been achieved, not only special projects have to be started to bring back young and qualified labor force into the area, which have migrated to the urban surroundings due to unemployment and a lack of perspectives within the community of Aghiresu, but as well rise at the same time the given educational levels and skills in regards to the reflected project fields consisting of a highly trained professional quality tourism and service industry as well as the present industry concerning trade and agriculture.

To achieve this, large financial resources have to be raised, by either local or national programs, foreign investments or direct investments from the European Union into their infrastructural and regional development programs. These programs will also help to establish an environmental friendly waste industry, which will lead to less pollution of the area by avoiding for example further dumping into the Nadas river.

Generally there are many more possibilities of taking advantage of the local and regional areas. It must be taken into consideration that the resources presence in the underground determined

community development, resources ensuring further the basis for industrial profile keeping and for the social wealth of the population. It is necessary in conclusion, that the economic efficiency growth, products range diversification made in the industrial companies and maximum turning into account of the economic potential of the community; encouraging the small traders to carry out production activities and so fighting against unemployment; stimulating new profession training and mediation with companies in need of labor force; improving the communication towards those interested by agriculture and breeding regarding the new regulation in the field; concluding the farming lands and forests re-distribution and offering the possession for them through property deeds; stimulating the creation of farms association and farms taking advantage from the agriculture potential of the community; community roads modernization and maintenance, removing the isolation for Almaşului basin villages by ensuring common means of transportation; portable water supply and sewerage works extension in all places of the community; automate telephone network general spreading; rehabilitation for the medical unit premises and improving the medical assistance service; rehabilitation and modernization of the buildings running educational and cultural activities; turn into account the touristic spots and developing activities for traditions and craftsmanship advantaging (traditional costumes making, painted furniture, especially in the Hungarian villages);fighting against the linear and area erosion by excavation works, tree planting, torrents extinction, pastures intensive seeding; consolidation and setting the sterile dumps, reallocate the surfaces for farming or forest circuit and taking measures for environment protection and entire area ecology.

From a touristic and economic point of view the community of Aghiresu may benefit from many arrangements, either on a short term or a long term perspective.

8.1 Short term perspectives

With Romania's integration into the European Union are taken into consideration a number of projects for tourism promotion that will help this hidden jewel to shine. The protection of the given wonderful natural resources by creating natural reservations like Leghia and Laguna Albastră, is among these considerations. One of the most promising projects on a short term perspective is the re-arrangement of the available lake side's into a touristic development with a strong sport tourism approach. It is very important to create a concept that allows the financial and governmental support not to other areas and projects first, and that meets the present existing market demands, helping not only to fight a against a further isolation of the community but at the same time being able to fight the increase risk of soil erosion with these funds. A land arrangement around the lakes is recommended by implementing an adequate golf court facility including a club house offering a shop, a restaurant and a little hotel. Beside these facilities, also a lake side beach front, a boat and off road rental, an adventure park and camping as well as tennis court are among the possibilities of the concept for the short term perspectives.

8.2 Long term perspectives

Looking on the long term perspectives, the surrounding of Aghiresu offers an ideal area for a race track development project, all adjusted in regards to the size and the structure to the financial and regional given aspects, possibilities and expectation (see Fig 16). In regards to the needed land arrangements for such a track and the related noise level of these events, Aghiresu and its former mining area suits perfectly these needed conditions. The new motorway passing Aghiresu in the next years, the community center of Cluj offering all needed infrastructure including an airport with mayor flight connections to Munich and other capitals in Europe as well as hotels, shopping possibilities, bars and restaurants, are all given and important for further development of such a business project. Aghiresu can adopt slow but constantly to demands resulting out of hospitality and restaurants and the related service industry around the track, accommodating the visitors and clients accordingly well.



Fig.16: The race track of Pavilion, NY ; Source: <http://www.driveblog.ru/wp-content/uploads/2008/07/monticello-motor-club-new-york-race-track-01.jpg>

Looking at the present forms of motorsport in the community of Cluj, you can only find local rally events, which already now attract a big crowd in the heart of Cluj, bringing not only tourists and fans but as well a good crowd of participants with it, spending their money on overnights, restaurants, bars, shopping, etc.. At present motorsport is completely under represented in the eastern parts of Europe, and the demand as well as the chances for such locations and events are enormous. Important to say is also, keeping in mind that racetracks are not only good for racing activities. Circuits are mostly used for races, but also for different kind of trainings, tests, incentives, open air concerts, other sport events like cycling tours or marathons. Also they offer special days and occasions, on which public cars or bikes can lap the racing track for a certain amount according the official road safety regulations which are valid that days giving the public the experience of motorsport feeling all year round bringing the economic benefits with it.

The costs of constructing a circuit vary as much as the demands are of its clients. Permanent race tracks can reach from 3-5 Mio \$ in the cheapest case up to 300 Million \$ like one of the most modern ones in Bahrain in the Middle East. But of course Aghiresu would not be looking at a Formula 1 racing track, but a good small racing track fulfilling the needed FIA standards to host some of the mid-big events, being especially flexible on additional set up possibilities like grand stand seats etc., if needed. Looking at the cost and economical impact side of such a project, you

would be looking at initial cost of app. 3,5 to 5 Million Euro, an average income of 8.000 €/day at an average occupancy of 80% from racing rentals, activities or other events taking place. Further economical benefits could be attracted from races like the DTM, bringing estimated values of 7-8 Million € into the region from spending of all “visitors” during an event, compared to the relative low events cost side of only app. 300.000-350.000 € per year. Not to be forgotten are revenues from sponsorships, caterers, merchandisers, gaming industry, etc.

It is essential, that the focus is not given to prime and exclusive customers only but to the large middle class of the community, which increased over the last years due to the economic growth and who is ready to spend money for outdoor activities on close by locations for weekend trips. The demands have to go towards a little, demanding quality racetrack resort that offers a wide range of attractions for the diverse wishes of nowadays racing customers involving the ideal track conditions and landscape.

With successful projects like this one, also threats of tax increase as well as illegal work employment will pop up, which need to be taken into consideration and controlled by the local authorities. Especially has to be mentioned again the quality of the roads leading to the area have to be improved as already stated in a first step to take the benefit from the good and busy connections passing Aghiresu by road and train which enable further progress of the area. Without a drastic improve of infrastructure, other fields can't develop. Also for this race track project roads in good conditions must be available, to bring not only the clients, teams and trucks but then especially the fan crowds to the area. The combination of a wide variety of attractions also helps to create a demand for day trips, helping the region to have a permanent flow of visitors. Once this project has been created, the surrounding villages of Aghiresu will create additional demands, from their rich historic and cultural, up to the arising businesses. This project could be a milestone for the future development of the Aghiresu community.

SELECTED BIBLIOGRAPHY

1. **Abresch, J.; Bauer, S.** (1999), Naturschutz und Braunkohlenrekultivierung aus regionalwirtschaftlicher Perspektive – Landschaften des Mitteldeutschen und Lausitzer Braunkohletagebaus, Chancen und Problem aus Sicht des Naturschutzes und Landschaftspflege, S.78
2. **Amt der Steirischen Landesregierung** (2009): Informationen der Verkehrsabteilung über das Schienen- und Autobahn- bzw. Schnellstraßennetz der Steiermark.
3. **Armstrong, T.** (2000), Regional economics and policy, Edition. 3
4. **Asheim, B. & Dunford M.** (1997), Regional futures. Regional studies 1997, Vol. 31.5, p.445–455.
5. **Ballon** (1994), Umstrukturierung in den Braunkohlerevieren für Privatisierung, Auslauf und Sanierungsbergbau
6. **Berbecaru, I., Botez, M.** (1977), Teoria și practica amenajării turistice, Edit. Sport Turism, București
7. **Berbu Gh., Snak O.** (1981), Turismul, ramură a economiei naționale; Turismul în economia națională, Editura Sport-Turism, București.
8. **Berkessy P.,** (2002), Auswirkungen der Großveranstaltungen am A1-Ring auf die Tourismusregion Steiermark
9. **Berkessy P.,** (2007), The risks of global warming to the Austrian winter tourism industry, Riscuri si catastrofe, Casa cartii de stiinta, Cluj, Romania
10. **Bioflux AACL** (2009), The Aghires mining area, The opening of the old mining galleries
11. **BMfW** (2004), Österreichisches Montan Handbuch, Before and after the re-cultivation process of surface mine “Barabara” in 2003
12. **Bogue, D.** (1948): The Structure of the Metropolitan Community: A Study of Dominance and Subdominance. Diss. Ann Arbor, Mich.
13. **Boshold, A.** (1998), Tourismus als Potential für das Braunkohlerevier Niederlausitz
14. **Bozau & Strauch** (2002), Lage, lokale Geologie und Bathymetrie von RL-111 im Lausitzer Braunkohlerevier
15. **Bundesberggesetz (BBergG)**,(1990); Verlag Glückauf GmbH
16. **Bradshaw, M.** (1998), The new global order: a world of regional geography
17. **Carstens, I.; Hering, F.; Saupe, G.; Ziener, K.** (1998), Erholung in der Bergbaufolgelandschaft?
18. **Câdea Melinda, Simon Tamara** (2006), Potențialul turistic al României, Edit. Universitară București.
19. **Cazes G. Lanquar, R., Raynounard, J.** (1980), L’amenagement touristique, Presses Universitaires de France, Paris.
20. **Cazes G.** (1992), Le fondaments de la geographie du tourisme, Edit. Masson, Paris.
21. **Ciangă, N.** (1984), Economia turismului în Depresiunea Transilvaniei, Studia Univ. „Babeș-Bolyai”, Seria Geol.-Geogr., Cluj-Napoca.
22. **Ciangă N.** (1998), Turismul din Carpații Orientali. Studiu de Geografie Umană, Edit. Presa Universitară Clujeană, Cluj-Napoca
23. **Ciangă N.** (1998), Le rôle de la fonction touristique dans l’organisation de l’espace rural în vol. „Rural Space and Regional Development”, Edit. Studia, Cluj-Napoca.
24. **Ciangă N, Rotar Gabriela, Dezsi Șt.** (1999), L’amenagement touristiques des franges interdepartementales du nord-ouest de la Roumanie, Studia Univ. Babeș-Bolyai”, Geographia, nr. 2, Cluj-Napoca.
25. **Ciangă N.** (2001, 2003), România. Geografia turismului (partea întâi), Edit. Presa Universitară Clujeană, Cluj-Napoca.
26. **Ciangă N., Dezsi Șt., Rotar Gabriela** (2002), Aspecte privind estimarea valorii potențialului turistic și a bazei materiale din Regiunea de Nord-Vest a României, Studia Univ. Babeș-Bolyai”, Geographia, tom XLVIII, nr. 2, Cluj-Napoca.
27. **Ciangă N., Dezsi Șt.** (2005), Turismul rural – aspecte teoretice și conceptuale, Studia Univ. Babeș-Bolyai”, Geographia, tom L, nr. 2, Cluj-Napoca.

28. **Ciangă N.** (2006, 2007), România. Geografia turismului (partea întâi), Edit. Presa Universitară Clujeană, Cluj-Napoca.
29. **Ciangă N., Dezi Șt** (2007), Amenajare turistică, Edit. Presa Universitară Clujeană, Cluj-Napoca.
30. **Ciangă, Nicolae** (2007), România. Geografia turismului, (Romania. The geography of tourism) ed Presa Universitară Clujană, Cluj – Napoca
31. **Cocean P., Dezi Șt.** (2001), Prospectare și geoinformare turistică, Edit. Presa Universitară Clujeană, Cluj-Napoca.
32. **Cocean P., Vlăsceanu Gh., Negoescu B.** (2002), Geografia generală a turismului, Meteor Press, București.
33. **Cocean, P. Marc, D. Vescan, I. Dan, R.** (2002), Geografia Romaniei, problem fundamentale, (The geography of Romania, fundamental issues) Editura Sigma, București
34. **Cocean P., Dezi Șt.** (2009), Geografia turismului, Edit. Presa Universitară Clujeană, Cluj-Napoca.
35. **Dauphiné, A.** (1979), Espace, region et systeme, Economica, Paris
36. **DEBRIV** (2003), Verbreitungsgebiete deutscher Braunkohle, ihrer geologischen und wirtschaftlich gewinnbaren Reserven sowie der jährlichen Fördermengen für die 3 größten Abbaureviere
37. **Dezi St.** (2006), Patrimoniu și valorificare turistică, Edit. Presa Universitară Clujeană, Cluj-Napoca.
38. **Donath, H.** (1998), Ungeahnter Artenreichtum auf ehemaligen Bergbaukippen
39. **Drebstedt, C.** (1998), Das Lausitzer Braunkohlerevier – Planungsgrundlagen der Wiedernutzbarmachung
40. **Drebstedt, C.; Möckel, R.** (1998), Gewässer in der Bergfolgelandschaft
41. **Drebstedt, C.; Rascher J.** (1998), Zu den geologischen Bedingungen und den Bergbautechnischen Möglichkeiten der Wiedernutzbarmachung im Lausitzer Braunkohlenrevier
42. **Erdeli, G., Istrate, I.** (1996), Potențial turistic al României, (Touristic potential of Romania) Editura Universității București
43. **FIA** (2003): Internal guidelines for motor racing course construction and safety
44. **Fischer, M.** (1997), Die Bergbauregion Niederlausitz – Probleme und Lösungsansätze
45. **Fodorean I.,** (2007), Lacurile dulci din Podisul Transilvaniei (Fresh water lakes from Transylvania plateau), Teza de doctorat, Cluj, Romania
46. **Förster, W.**(1993), Setzungsfleßen in der Lausitz - Ursachen und Erscheinungsbild; im Material zum Symposium "Setzungsfleßen und bergrechtliche Genehmigungsverfahren" des Oberbergamtes des Landes Brandenburg
47. **Förster, W.; Walde, M.** (1993), Slope Failures of Spoil Dumps due to Soil Liquefaction in Eastern German Opencast Mines; Proceedings 4th International Symposium on the Reclamation Treatment and Utilization of Coal Mining Wastes, Krakow, 1993, Vol. I, S. 411 – 420
48. **Förster, W.** (1994): Der Braunkohlenbergbau in der Lausitz - Perspektiven - Folgen für die Umwelt -; Jahrbuch 1994 der Berlin-Brandenburgische Akademie der Wissenschaften, S. 209 – 211
49. **Förster, W.; Goeckel, G.,** (1995): Geotechnische Anforderungen an den Flutungsprozess; Proceedings des Dresdner Grundwasserforschungszentrums e. V., Heft 8
50. **Förster, W.** (2002), Stellungnahme zu Standsicherheitsuntersuchungen und zu Vorschlägen zur Herstellung der endgültigen Sicherheit der Uferbereiche und der Inseln des Silbersees, der Uferbereiche und der Inseln des Tagebaurestlochs Morkka und der Gleisanlagen des Bahnhofes Lohsa; LMBGmbH,(unveröffentlicht)
51. **Förster, W.; Goeckel, G.**(2004): Forschungen zum sicheren und bautechnischen Nutzen von Kippen und Kippenböschungen des Braunkohlebergbaus; Zeitschrift für angewandte Umweltforschung; Sonderheft 14; Analytica Verlag 2004
52. **Friedrich, W.** (2003), Wirtschaftsgeschichte und Wirtschaftspolitik in der Lausitz
53. **Friese, K.** (2005), Hydrochemie und Sedimentgeochemie eines Pyrit-verauerten Bergbausees des Lausitzer Braunkohlereviere(RL-111) als Grundlage zur Entwicklung eines Neutralisationsverfahrens.
54. **Gans, P., Horn, M. & Zeman, Chr.** (2003), Sportgroßveranstaltungen – ökonomische, ökologische und soziale Auswirkungen
55. **Gastescu P.,** (1971), Lacurile din Romania (Romanian's lakes), Ed.Academiei, Bucuresti, Romania
56. **German Authority of Geosciences** (2005), Brown coal mining statistics

57. **Gerstner, S.; Jansen, S.; Süßer, M.; Lübbert, C.** (2002), Nachhaltige Erholungsnutzung und Tourismus in Bergbaufolgelandschaften
58. **Götzinger, M. ; Wagreich, M.** (2006), Der geologische Aufbau der Steiermark
59. **Großer, K.** (1998), Der Naturraum und seine Umgestaltung
60. **Groza S.,** 2009, Valorization of natural touristic potential of the community of Aghires, In: Studia Univ. „Babeş-Bolyai”, Geographia, Cluj-Napoca.
61. **Hahn, B.; Fromm, H.** (2000), Biotische und abiotische Eigenschaften von Böden naturnaher Offenlandbereiche der Niederlausitzer Bergbaufolgelandschaft
62. **Hille, M., Kremlitzka, K.; Sterk, G.** (1981) Statistische Daten über die Versorgung Österreichs mit mineralischen Roh- und Grundstoffen.- Grundlagen der Rohstoffversorgung, Heft 1, 135 – 204, Bundesministerium für Handel, Gewerbe und Industrie, Wien 1981.
63. **Horny, C.** (2002), Touristische Großprojekte als Allheilmittel für strukturschwache Räume?
64. **Huluban, I. Todoran, R.** (2003), Comuna Aghires- județul Cluj: aspecte din trecut și prezent,(Aghires community – Cluj County: past and nowadays issues) Editura Cartimpex, Cluj Napoca.
65. **Hüttel, R.** (2003), Vom Punkt zur Fläche: Das Fallbeispiel Nierderlausitzer Bergbaulandschaft
66. **Susan, I.** (1973), Municipiul Cluj- studiu de geografie economică, (Cluj municipality - economic geography study), teza de doctorat (PhD thesis)
67. **Ionescu, I.,** (2000), Turismul fenomen social-economic și cultural, (The tourism social-economic and cultural phenomenon) Editura Oscar Print, București
68. **Inskeep E.** (1991), Tourism planning, an intergraded and sustainable development approach, John wiley & Sons, Inc. New York.
69. **Irimuş Ioan-Aurel,** (1998) Relieful pe domuri și cute diapire în depresiunea Transilvaniei (The relief on domes and diapiric folds in Transilvania depression), Presa Universitară Clujană, Cluj-Napoca
70. **Irimus I.,**(2003), Geografia fizica a Romaniei (Romanian phisical geography), Casa cartii de stiinta, Cluj, Romania
71. **Istrate, I., Bran, Fl.,** (1996), Amenajarea satelor turistice, (The arrangement of touristic villages) Tribuna Economică, Nr.5/1996
72. **Istrate, I, Bran Florina, Rosu Anca Gabriela** (1996), Economia turismului și mediului înconjurător, Edit. Economică, București.
73. **Jeserigk, H.; Saupe, G.; Ziener, K.** (1998), Badeseen in der Niederlausitz Erwartungen und Realisierungsmöglichkeiten
74. **Keßler, J.** (2009),Das Speichersystem Lohsa II – Textbeitrag zum Fachbuch „Theorie und Praxis der Braunkohlensanierung“, Herausgeber: LMBV mbH,Freiberg
75. **Krätke, S.** (1995), Globalisierung und Regionalisierung
76. **Landesumweltamt Brandenburg** (2002), Naturschutz in der Bergbaufolgelandschaft
77. **Landesumweltamt Brandenburg** (2001), Tagebauseen: Wasserbeschaffenheit und wassergütewirtschaftliche Sanierung
78. **Lasuén, J.R.** (1973): Urbanization and Development – The temporal Interaction between Geographical and Sectoral Clusters. Urban Studies, 1973, Vol. 10, p. 163–188.
79. **LMBV mbH** (2001), Empfehlungen und Bemessungsgrundlagen für die Gestaltung von Tagebaurestseen
80. **LMBV mbH** (2002),Rehabilitation process of ground within the Lausitz area; Broschüre „Wandlung“
81. **LMBV mbH**(2003), Comparison of landscape before and after the surface mine activities
82. **LMBV mbH** (2005), Employment situation of brown coal surface mining rehabilitation in the year 2005, Employment level of the rehabilitation process in the Lausitz area
83. **Luckner, L.; Goeckel, G.; Seidel, K.-H.**(1997), Restlochflutung – Gefahrenabwehr, Wiedernutzbarmachung und Normalisierung der wasserwirtschaftlichen Verhältnisse im Lausitzer Revier; Herausgeber: Lausitzer und Mitteldeutsche Bergbau Verwaltungsgesellschaft mbH
84. **Luckner, L.; Werner, F.; Goeckel, G.; Vogt, A.**(2003), Restlochflutung Maßnahmen zur Steuerung der Wasserbeschaffenheit in den Bergbaufolgeseen der Lausitz; Herausgeber: Lausitzer und Mitteldeutsche Bergbau- Verwaltungsgesellschaft mbH
85. **Maghiar N.,** (1970), Din istoria mineritului în România (From mining history on Romania), Științifică, București, Romania
86. **Matei Elena** (2004), Ecoturism, Edit. Top Farm, București.
87. **Morariu T., Savu Al.** (1970), Col. Județele patriei. Județul Cluj, Edit. Acad. R.S. România, București.

88. **Mureșan, P.** (2000), Descrierea economică a localității Aghires, județul Cluj, (Economical description of Aghires place) Lucrare de diplomă, (University degree paper) Cluj Napoca.
89. **Muntele I, Iașu C.** (2003), Geografia turismului: concepte, metode și forme de manifestare spațio-temporală, Edit. Sedcom Libris, Iași.
90. **Mutihac V.**, (1974), Geologia României (Romanian's geology), Tehnică, București, Romania
91. **Mutihac V.**, (1990), Structura geologică a teritoriului României (Geological structure of Romanian territory), Tehnică, București, Romania
92. **NABU, ESS** (2003), Vision Anfang der 1960er Jahre für die Lausitzer Seenkette
93. **Oldenboom, E.** (2006) Cost and benefits of major sport events
94. **Oprea, S.** (1972), Monografia Comunei Aghires, (The monography of Aghires community) Cluj Napoca
95. **Pandi G.**, (2004) The Red Lake. Hidrogeographyc Study. Editura Casa Cărții de Știință, Cluj-Napoca.
96. **Pandi G., Serban Gh.** (2005): A tómedencék dinamikájának környezeti hatásai természetes és antropikus rendszerekben (Environmental effects of the lake dynamics in natural and anthropic systems), Környezetvédelem, regionális versenyképesség, fenntartható fejlődés, Pécs, Hungary
97. **Pandi G.** (2007): Lacul Roșu – obiectiv turistic în pericol (Red lake – touristic unit in danger), Dezvoltarea regională și multiculturalitate în Uniunea Europeană, Tg.Mureș, Romania
98. **Pandi G., Berkessy P.**, (2008): The risks of the re-cultivation processes of brown coal surface mine. pp. 197-207. In: Riscuri și catastrofe, Cluj-Napoca.
99. **Pandi G.**, (2009), Folyékony halmazállapotú kontinentális vizek (Liquid continental waters), Casa cartii de stiinta, Cluj, Romania
100. **Pandi G., Bătițaș R., Vigh M.** (2010): Evaluarea morfometrică a unor unități lacustre din zona minieră Aghireșu – județul Cluj, (Morphometric estimation of some lake units from mining zone Aghiresu – Cluj county), Resursele de apă din România, Transversal, Târgoviște, Romania
101. **Pandi G., Berkessy M., Vigh M., Berkessy L., Berkessy P.**, (2009), The impact of mining upon the features of the Blue Lagoon Lake in the Aghireșu area. pp. 109-119, In: AACL Bioflux. Volume 2 (2)
102. **Petrea Rodica, Petrea D.** (2001), Turismul rural, Edit. Presa Universitară Clujeană, Cluj-Napoca.
103. **Petravian N.**, (1973) [Useful mineral deposits]. Editura, Tehnică, Bucharest.
104. **Pflug, W.** (1998), Braunkohletagebau und Rekultivierung
105. **Pohl, W.** (1976), Geology of the brown coal deposits of the Köflach-Voitsberg Bay area, Heft 10
106. **Pop. Gr.**, (2001), Depresiunea Transilvaniei (Transylvanian Depression), Presa Universitară Clujeana, Cluj, Romania
107. **Pop P. Gr.** (2007), Județul Cluj, Edit. Academiei Române, București.
108. **Popa A.**, (1961), Exploatarea miniere (Mining exploitations), Didactică și Pedagogică, București, Romania
109. **Pricăjan, A.** (1985), Substanțele minerale terapeutice din România, Edit. Științifică și Enciclopedică, București.
110. **Rauminformationssystem Steiermark, Regionsprofil Voitsberg** (2005), The population development of the 25 communities of the county of Voitsberg
111. **Redlich, K.A. ; Sellner, F.** (1999) Bergbaue Steiermarks, S.99-136,
112. **Regionaler Planungsverband Oberlausitz-Niederschlesien** (1998), Braunkohleplan – als Sanierungsrahmenplan für den stillgelegten Tagebau Bärwalde
113. **Regionalmanagement der Lausitz** (2003), Lausitzer Seenland
114. **Ring, I.** (1997), Nachhaltige Entwicklung in Industrie und Bergbauregionen – Eine Chance für den Südraum Leipzig?
115. **Sakkis, T.** (1994), A Guide to Motorsports Circuits of the World
116. **Savu, Al.** (1963), Podișul Someșan. Studiu geomorfologic (Somesan Plateau. Geomorphologic study), Doctorate study, Cluj, Romania
117. **Savu A.**, 1973 [The Someș Plateau and its relations with the Transylvania Plateau]. In: Realizări în geografia României, Editura Științifică, Bucharest.
118. **Sächsisches Landesamt für Umwelt und Geologie** (2001), Overview hydrologic map of the province of Sachsen
119. **Sächsisches Staatsministerium des Inneren** (2000), Braunkohleplanung im Freistaat Sachsen
120. **Schröder, W.** (2003), Regionale Entwicklung der Lausitz
121. **Seifert, P.** (2003), Die Lausitzer Seenzone

122. **Serban P., Galie A.**, (2006), Managementul apelor. Principii si reglementari europene (Water management. European principles and settlements), Tipored, Bucuresti, Romania
123. **Șerban Gh., Sorocovschi V., Bătănaș R.**, (2007), Spatial variation of some physical-chemical parameters in the ponds from Sarului Valley (Noroias brook). pp. 183-194, In: Studia Univ. „Babeș-Bolyai”, Geographia nr.2, Cluj-Napoca.
124. **Snak O, Baran P, Neacșu N.** (2003), Economia turismului, Edit. Expert, București.
125. **Surd V., Bold I., Zotic V., Chira Carmen** (2005), Amenajarea teritoriului și infrastructuri tehnice, Edit. Presa Universitară Clujeană, Cluj-Napoca.
126. **Sorocovschi V.**, (2002), Hidrologia uscatului I, II (Land hydrology I, II), Casa cartii de stiinta, Cluj, Romania
127. **Steiner, M.** (1990), Regionale Ungleichheit
128. **Tamaskovics, N.; Förster, W.** (1993): Mechanismus von Sprengverdichtungen; Veröffentlichungen des Instituts für Geotechnik der TU BAF, Heft 96-1, S. 77 - 114
129. **Teodorescu D.**, (2002), Resurse de apa. Legislatie europeana (Water resources. European legislation), H.G.A., Bucuresti, Romania
130. **Thomae, M.** (1997), Die Bedeutung des Braunkohlebergbaus für die Herausbildung industrieller Ballungsräume
131. **Thierstein, A.** (1996): Auf der Suche nach der regionalen Wettbewerbsfähigkeit – Schlüsselfaktoren und Einflussmöglichkeiten. Raumforschung und Raumordnung, 1996, Magazine 2/3, March–June, Vol. 54, p. 193–202
132. **Tourismusverband Niederlausitz e.V.** (2006); The Lausitz lakes; Ferienjournal
133. **Varduca A.**, (1997), Hidrochimie și poluarea chimică a apelor (Hydrochemistry and chemical pollution of waters), H.G.A., București, Romania
134. **Vellen, M.; Hüller, D.** (2003), Die Geschichte des Erholungsgebietes Senftenberger See
135. **Vickerman, R.W.**, (1991): Infrastructure and Regional Development. London: Pion, 1991
136. **Wagner, H.** (2004) Der österreichische Bergbau im Wandel der Zeit (1950 – heute
137. **Welch-Guerra, M.; Schaubert, U.** (2004), Instrumente der räumlichen Planung und ihre Auswirkungen auf die Landschaftsstruktur in der Niederlausitz
138. **Wiedemann, D.** (2002), Voraussetzungen und Probleme der naturschutzorientierten Sanierung in der Lausitz
139. **Wittig, H.** (1998), Braunkohle und Sanierungsplanung im Land Brandenburg
140. **Zundel, S.; Linn, R.** (2003), Auf der Suche nach einem wirtschaftlichen Profil – Regionale Wirtschaftspolitik in der Lausitz
141. **Zsilincsar, W.** (2005): Neue Einzelhandelsstrukturen am Rande von Kleinstädten. In: Tagungsband. Inst. f. Geographie und Raumforschung d. Univ. Graz. Graz, p.178
142. *******, Atlasul R.S. România, Institutul de Geografie, Edit. Academiei R.S. Române, București.
143. ******* (1983), Geografia României (Romanian's geography), Academiei, Bucuresti, Romania
144. ******* (1984), Geografia României, II, Geografie Umană și Economică, Edit. Academiei R.S. România, București.
145. *******, (1987), Geografia României, III, Carpații Românești și Depresiunea Transilvaniei, Edit. Academiei R.S. România, București.
146. ******* (1998), PUG Comuna Aghireșu, jud. Cluj (General planning project, Aghiresu commune, Cluj county), Scm Program Srl., Cluj, Romania
147. ******* (1999), Studiul zonelor expuse riscurilor naturale din Jud. Cluj, comuna Aghireșu (Study of the natural risk expose zone from Cluj county, Aghiresu commune), SC Minesa- Institutul de Cercetări și Proiectări Miniere, Cluj, Romania