EVALUATION TECHNIQUES FOR THE IMPACT GENERATED BY THE MINING ACTIVITY IN JIU VALLEY

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Abstract *The purpose of this study was to highlight the impact generated by the mining industry from Jiu Valley on the environment, using as instruments for evaluating the impact: the matrix and the impact networks.*

After analyzing the impact matrix and the four types of networks made, we can observe that the mining activity regardless how it comes off always leads to long term negative effect on the environment. The environment factor mostly affected by the mining activity is the soil then the water and with this one the entire ecosystem from the area. The destructive effects most considerate on the soil and the subsoil are made by the methods of preparation and transportation of coal, by the buildings and infrastructures both the sterile banks associated with them.

Key words: heap, arrays, network impact

1. General considerations

The evaluation phase is the time passing from an estimate of the expected impacts on the various ambient components, quantitatively measured depending on the physical nature, quality estimate to assess the importance of these impacts.[1]

Evaluation of environmental quality in an area at one time is made possible by the assessment of the quality of the air, water, soil, state of the fauna and flora of the area and the health status of the population in the area. These factors can be characterized by representative quality indicators for assessing the degree of pollution factors that have determined admissible limits.[3]

Evaluation of environmental plans and programs that can have an eloquent impact is done to promote a durable development and assuring a high level of environmental protection.[2]

2. Impact arrays

Evaluating the impact represents the main method to appreciate de decay degree of the environment as a result of anthropic activities.

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The matrix method represents the most common used instrument by the methodology of impact assessment. The matrix is a table, in its columns are positioned the activities that can produce impact on the environment while the rows contain the criteria by which we can determine the chose of an activity. In each cell of the matrix we can mark a conclusion that can indicate de degree of negative or positive effect that the activity is susceptible to have on the criterion indicated. Frequently the conclusion represents a numerical value or symbol indicating the level of intensity of the effect.[2]

The Leopold-matrix method (named like the author), was formulated in 1971 and is made of 100 columns and 88 lines. The columns represent actions proposed that can produce impact on the environment and the rows represent components an characteristics of the environment.[2]

The environmental characteristics that are kept track of in an impact analysis are:

- physical-chemical characteristics of soil, water, air, processes, etc.;
- biological conditions: flora, fauna;
- cultural factors: the use of terrain, recreation, human interest, status, culture, ease and manmade activities;
- Ecological relations: water sources salinity, eutrophication of water resources, disease transmitting insects, etc.

In the case of environmental balance this method can be applied to estimate the evolution in time of the relationship between the activity analyzed and the environment after some equipment and installations to protect the environment are introduced.

The impact matrices have been perfected to create the possibility of representation of an impact process thru multiple logical correlated matrices. The assembly is set out as a coaxial matrix and permits the highlight of mutual roles and different categories of elements that interfere in an impact process: actions, interferences, etc.

The use of this method permits the analysis of all the possible relations, which makes the total assessment more objective. It must be asserted that this method permits the evaluation of the direct and indirect impact. Usually, in impact evaluation matrices reliability scales and grids are used for differentiating the roles of different types of activities and ecological factors, which give a complex character to the method.

Among the advantages of this method are: the possibility to compare different types of impacts based on common judgment, transparency, flexibility, ease and economical character. The main disadvantages of the method are: its subjectivity because it involves the judgment of an evaluator or of a team of evaluators and the fact that a matrix has been drawn up by attaching numerical values, obtained by transforming the impacts generated by the mining activity on the environmental factors in values related to a conventional scale, so the numerical scale (-3…+3) has been chosen.

We can observe from the matrix (tab.nr.3) and the table of conversion of environmental scores (tab.nr.2) that on every environmental component analyzed an impact appears generated by the mining activity:

- atmosphere: negative impact, environment subjected to the effects of mining activity producing disturbance to life forms;
- water: moderate negative impact, environment subjected to the effects of mining activity producing discomfort;
- flora and fauna: negative impact, environment subjected to the effects of mining producing disturbance to life forms;
- soil: moderate negative impact, environment subjected to the effects of mining activity producing discomfort;
- environment: negative impact, environment subjected to the effects of the evaluation is qualitative, although quantitative grades are given.
- mining producing disturbance to life forms;
- social-economical factors: negative impact, environment subjected to the effects of mining producing disturbance to life forms;

A positive impact can be observed regarding the quality indicators of life by offering of work places.

Table 1 *Numeric scale between the interval (-3...+3)*

Value	Impact
Null	No impact
-1	Some individual and amended impacts
-2	Potential or economical negative impacts
-3	Relevant negative ambient impacts (who can impose the redesign of intervention)
+1	Positive impact of local importance
+2	Positive impact of regional importance
+3	Positive impact of national importance

Table 2 *Conversion of environmental scores into impact categories*

Environment scores	Impact categories
+ 72 → + 108	Major positive impact
+ 36 → + 71	Eloquent positive impact
+ 19 → + 35	Moderate positive impact
+ 10 → + 18	Positive impact
+ 1 → + 9	Slightly positive impact
0	Lack of change / of the status-quo / Is not applied
- 1 → - 9	Slightly negative impact
- 10 → - 18	Negative impact
- 19 → - 35	Moderate negative impact
- 36 → - 71	Eloquent negative impact
- 72 → - 108	Major negative impact

3. Impact networks

The rigidity of matrices can be overcome by the use of networks where the nodes dispose sequentially the elements in an impact process.

The networks resemble in many ways the matrices but they are recommended for the study of cause-effect relations which stay at the base of impacts. An impact network permits the identification of direct and indirect chains of impact, primary and secondary generated by an action or the determination of actions which generate a certain impact.[2]

The networks used to highlight the impacts are made of flux diagrams or chains of multiple relationships, which indicate the connection between the actions of the project and the ambient components which these actions could modify. These permit the highlight of secondary or indirect effects, the presence of multiple interactions and the accumulation of effects in a more systematic way than the matrices actions – cause – effect. Also they have the capacity to localize the impacts in a temporal dimension.

Towards the identification of impacts generated by a project, the networks rebuild the chain of events or potential effects induced by the projects specific actions on the initial state of the environment, the potential modifications of the environmental conditions, the multiple effects of the impact and possible measures of minimization.

Table 3 *Impact matrix of mining activity in Jiu Valley*

Elementary actions / *Ambient components*		Buildings and infrastructures	Industry workshops	Macro and micro pollutants emissions	Noise, vibrations	Transport	Coal extraction	Water consumption	Water discharge	Sterile dump	Decantation ponds	Fuel deposits	Occupy of workforce	Total
Atmosphere	*Air quality*		-1	-1		-2	-1			-1	-2			-14
	Microclimate			-1		-2	-1							
	Macroclimate			-1		-1								
	Meteorological hazards										-1			
Water	*Surface water*			-1				-2	-1	-1	-1	-1		-28
	Ground water			-1			-2	-1			-1	-1		
	Temperature								-1					
	Quantity	-1	-1					-2	-1		-1			
	Quality		-1	-1			-1		-1	-1	-1	-1		
Flora	*Natural vegetation*	-1	-1	-1	-1	-1		-1	-1	-1	-1	-1		-16
	Grown vegetation			-1										
	Protected species	-1		-1	-1	-1				-1				
Fauna	*Earth animals*	-1	-1	-1	-1	-1		-1	-1	-1	-1	-1		-18
	Aquatic animals			-1				-1	-1		-1	-1		
	Protected species	-1		-1	-1					-1				
Soil	*Quality*	-3	-3			-2	-2		-1	-2	-2	-2		-32
	Permeability	-2	-2			-2			-1	-2	-2	-2		
Environment	*Landscape*	-1	-1			-1	-1		-1	-2	-2	-1		-18
	Ecosystem	-1	-1		-1	-1			-1	-1	-1	-1		
Socio-economic factors	*Cultural system*					-1								-10
	Health, security		-1	-1	-2	-1		-2	-1	-1	-1	-1		
	Population												+2	

Classic examples of network utilization to highlight the environmental components and the impacts are the methods elaborated by Sorensen and Bereano's method to evaluate the alternative technologies. The Sorensen method uses both matrices and networks. The matrices permit the highlight of different types of terrain utilization and the identification of primary impacts on the ambient components, and the networks allow the passing thru graphs from primary impacts to secondary impacts and assess the relations between secondary impacts and elementary actions, also assessing the necessary measures of improvement.

Bereano's method is developed to evaluate the technological alternative solutions to conserve the ambient values, uses the networks to identify the impacts thoroughgoing. Therefore, multiple networks are constructed (effects networks), which depend by the nature of the project. The links between the different elements of the network represent o way to establish the relations between cause and effect.[2]

After Bereano, building a network must stop only when its continuance is no longer possible because of the lack of information or when the effects of the project variations can no longer be differentiated. Each category of relationships is evaluated based on the probability that each impact can appear. The assembly of the two parameters, probability and physical measurement, permits the calculation of an aggregated impact risk index for each alternative analyzed.[2]

After analyzing the four types of networks (fig.nr.1,2,3,4), the mining extracting activity, regarding its deployment, always leads to long term negative effects on the environment. The environmental factor most affected by the mining activity is the soil followed by the water and with those the entire ecosystem from the area. The destructive effects the most significant on the soil and the subsoil are made by the coal preparation operations, transportation, buildings and infrastructures, and the sterile deposits associated with operation.

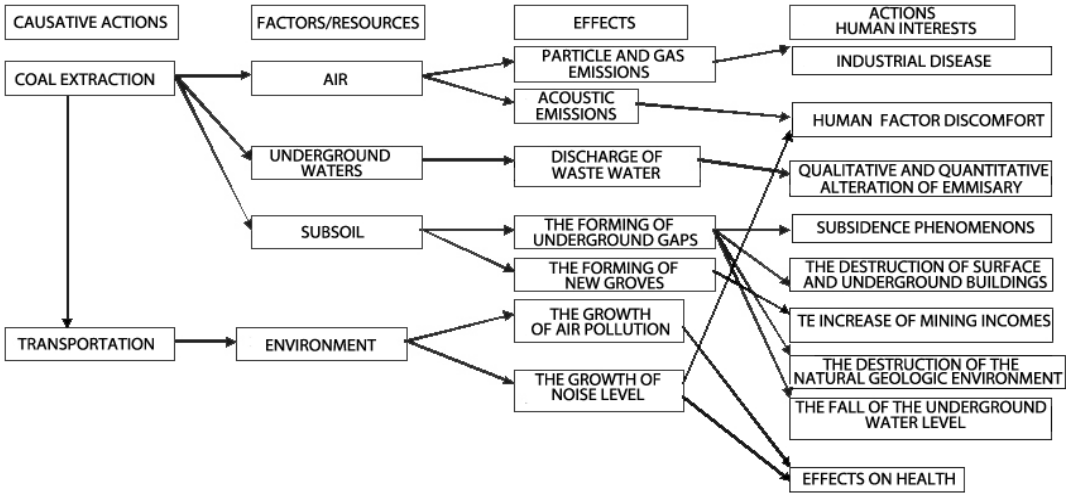

Fig. 1 *Network impact for extraction of coal from the underground*

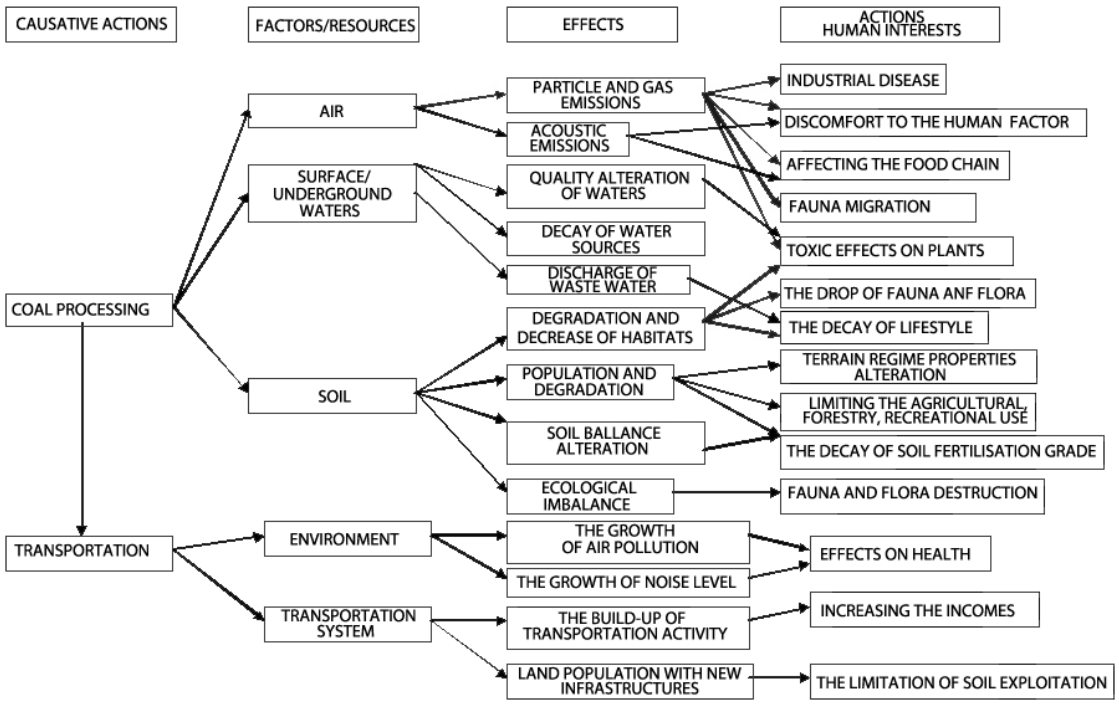

Fig. 2 *Network impact for coal preparation*

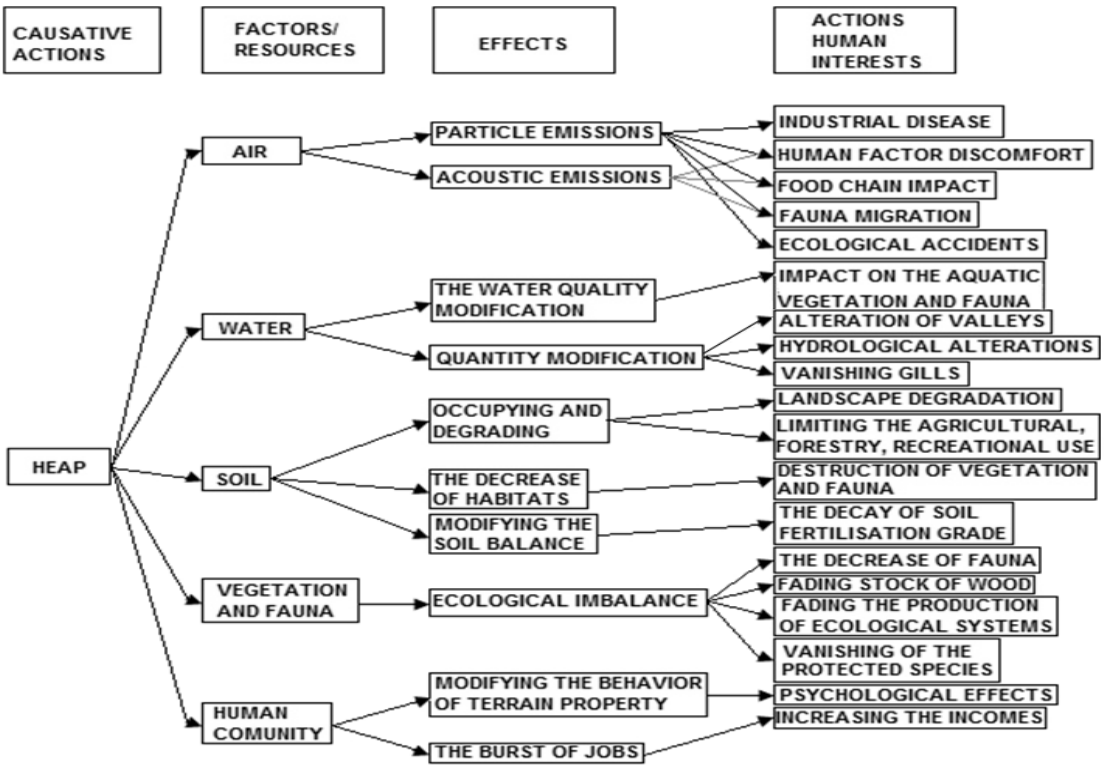

Fig. 3 *Impact network for dumping of sterile - heap*

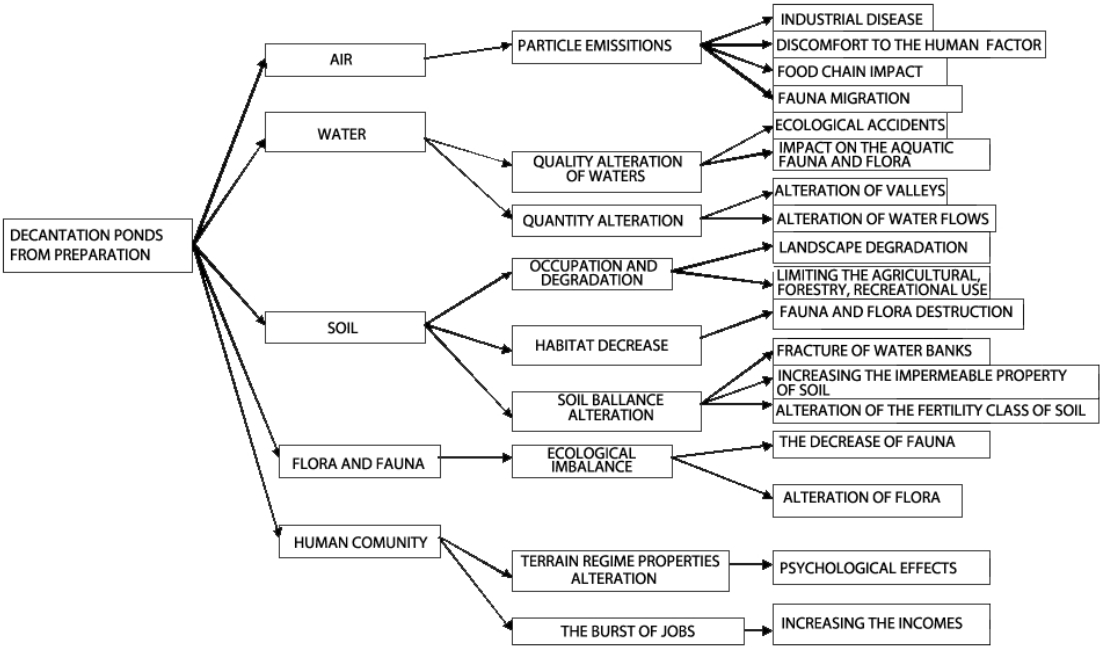

Fig. 4 *Network impact for depositing of sterile – decantation pond*

4. Conclusions

The impact matrix and the networks join information regarding the impacts produced by mining actions on different ambient components, covering different analysis phases with profound correlations between information.

In conclusion the mining activity, regarding its deployment, always leads to long term negative effects on the environment.

1. The quality of environmental factor soil from the exploitation area, preparation and heaping works of coal is entirely negative affected by the direct and connected activities of coal exploitation. The same situation can be found on the subsoil, where the

extraction activity affects in a brutal manner the natural geological environment.
2. The mining industry with its branches is a big consumer of industrial water, contributing in a big manner to the quantity and quality pollution of the natural rivers: East Jiu and West Jiu.
3. The quality of the environment factor air is affected by the dust in the air, the dust deposits locally evacuated, the gas emissions, the acoustic emissions as a result of mining exploitation.
4. In the plant and animal communities changes between the balance of species appear: reducing the sensitive breeds determines the alteration of structure and function of the entire community, migration or number reduction of individuals in the mining exploiting perimeter. The potential environmental impact is maintained during the entire exploitation process, displaying in a permanent increase of the plant and animal species vulnerability.
5. The potential environmental impact is maintained during the entire existence of the mining activity on the human factor thru negative effects: increase in industrial or nonindustrial disease, visual impact, auditory, indirect effect by food and water because of the natural parameters of soil, water, vegetation and positive effects by offering work places.

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