MATHEMATICAL METHODS TO EVALUATE THE IMPACT ON THE AGRICULTURAL FIELD, DETERMINED BY THE AGRICULTURAL CROP-FIELDS IRRIGATION

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Climatic global changes expressed particularly by the gradual warming because of the rise of the multiannual monthly medium temperature determines in certain geographical areas the occurrence of the agricultural drought, aridity and even desertification of the agricultural fields.

The respective case study refers to the impact of agricultural field irrigation usage on the environment when the water source used for irrigation is an accumulation of the water and, the chemical fertilizers administration is done at the some time with the watering.

The mathematical method used to quantify the impact when irrigating the agricultural fields is known as Saaty matrix or Leopold matrix, after the two researchers who proposed and used it.

The mathematical method of impact quantification allowed obtaining some exact percentage values with the view to the complex impact distribution and also to the impact levels upon the territory, determined by the fields' irrigation, fertilizers, herbicides, and pesticides.

***Key words**: agricultural drought, aridity, desertification, irrigation*

A modern agriculture assumes the usage of agricultural fields irrigation, with the view to getting high and safe productions, and especially profitable. Climatic global changes have determined the occurence of the global warming mainly, expressed by the increase of the multiannual monthly medium temperature. Because of these climatic changes, the phenomenon of agricultural drought has occured which determined or has to determine the usage of the agricultural fields irrigation.

The positive impact provided by the irrigation application on a territory is not a territorial analysis theme, but a model to apply by any agricultural societies aware of the respective competition. The negative impact upon the agricultural territory determined by the unproper application of irrigation has the most important role in our territorial analysis.

MATERIAL AND METHOD

In order to cuantify the impact upon the environment determined by the intenssive agriculture, which applies the most advanced productive technologies – including the fields irrigation, a certain irrigated surface is taken into study, surface which irrigation source is the water coming from an accumulation lake.

We have a case study that refers to the impact upon a territory, impact determined by the usage of agricultural fields irrigation, when the water source is an accumulation lake. The environment pollution happens in two ways, namely:

- pollution of the entire hydrographic basin;
- pollution of the accumution lake waters, by discharging the surface or depth polluted waters.

AMBIENTAL COMPONENTS		ACTIONS GIVEN BY THE PROJECT	Resouces transformation: Irrigations	Soil and construction transformation: Aqueducts	Soil and construction transformation: Excavations	Water accumulations	Resouces transformations: Agricultural crop-fields	Chemical treatments: Fertilizers	Chemical treatments: Herbicides	Chemical treatments: Pesticides	
A. Chemical and phyisical characteristics	1 . Soil	a. pedological characteristics	/				/	/	/		A 1 c
		b. morphological characteristics			/						A 1 d
	2. Water	a. depth waters	/					/	/	/	A 2 a
		b. quality	/					/	/	/	A 2 d
	3. Transforming processes	a. erossion			/						A 4 b
		b. depositing	/								A 4 c
		c. absorption	/					/	/		A 4 e
B. Biological conditions	1. Flora	a. culture	/				/	/	/	/	B 1 d
	2. Fauna	a. birds							/	/	B 2 a
		b. fish and mollusca	/					/	/		B 2 c
		c. insects					/			/	B 2 e
		d. microfauna	/					/	/	/	B 2 f
C. Cultural factors	1. Soil usage	a. waterly areas	/					/	/	/	C 1 b
		b. agriculture	/				/				C 1 a
	2. Free time	a. fishing	/					/	/	/	C 2 b
		b. navigation						/			C 2 c
		c. balnear activities						/	/		C 2 d
	3.Human and aesthetical factors	a. landscape characteristics	/			/	/				C 3 d
		b. parks and reservations	/				/	/	/	/	C 3 f
	4. Cultural conditions	a. health and safety	/			/			/	/	C 4 b
		b. occupation	/	/	/	/	/				C 4 c
		c. population density	/				/				C 4 d
D. Ecological relations	1. Ecological relations	a. salinization	/					/			D a
		b. entriphization	/					/			D b
		c. soil salting	/					/	/		D c
			Ai	Bh	Bt	Ba	Da	Ia	Id	Ie	

Figure 1 **Primary matrix of impacts (Leopold)**

For the respective case study, the following actions given by the projects have been individualised, that can represent a potential impact upon the environment:

A. Regime changes:
- i- irrigations.

B. Territorial changes and constructions:
- l - energy transport lines, aqueducts, adduction etc;
- o – dams and accumulation basins;
- t – quarries.

D. Resouces change:
- a – agricultural fields;

I. Chemical treatments:
- a – fertilizers;
- d – herbicides;
- e – pesticides.

Evaluation method developed in two phases, each of the individual impacts in the matrix:

- the estimated impact of absolute importance, assigning values from 1 to 10, the marks on the left side above the bar and pass the + when the impact is positive;
- evaluates the impact of the relative importance of giving it –the values of 1 to 10, and is written at the bottom of the box in the bar.

The first matrix of the potential impacts (fig 1) **–** based on the structural model of Leopold matrix, on the abscissa are presented the main actions determined by the project and on the ordinate, are presented the environment components that are affected by the actions given by the project. Each box is barred in accordance with an eventual impact, resulted from the cause-effect interaction, among all factors positioned in the matrix

RESULTS AND DISCUSSIONS

Relationship to calculate the impact of complex for the matrix in figure 2 is:

$$I_{Ai} = \sum_{n=1}^{19} x_{Ai} \cdot w_{Aii}$$

Where

I_{Ai} = complex impact of the action against Ai point

X_{Aii} = Ai action impact evaluation upon the environment components

W_{Aii} = Ai action weight upon the environment components

In our case we have:

Complex impact of irrigation on the components of environmental action in the entire ecosystem that is positive (+ 68)

$$I_{Ai} = \sum_{i=1}^{19} x_{Aii} \cdot W_{Aii} = +202 - 134 = +68$$

Complex impact of agriculture on the components of environmental action in the entire ecosystem that is positive (+ 183)

$$I_{Da} = \sum_{i=1}^{19} x_{Dai} \cdot W_{Dai} = +189 - 6 = +183$$

Complex impact of fertilizers on the components of environmental action in the entire ecosystem that is positive (+ 33)

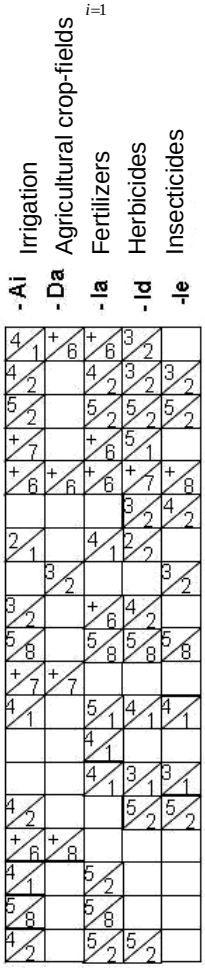
$$I_a = \sum_{i=1}^{19} x_{Iai} \cdot W_{Iai} = +168 - 135 = +33$$

Complex impact of herbicides on components of environmental action in the entire ecosystem, which is negative (-63)

$$I_{Id} = \sum_{i=1}^{19} x_{Idi} \cdot W_{Idi} = +49 - 106 = -57$$

Complex impact of insecticides on the components of environmental action in the entire ecosystem, which is negative (-27)

$$I_{Ie} = \sum_{i=1}^{19} x_{Iei} \cdot W_{Iei} = +64 - 91 = -27$$



A 1 c - Pedological characteristics
A 2 a – Shallow waters
A 2 d – Water quality
A 4 e - Ionic exchange
B 1 d – Agricultural corp-fields
B 2 a – Rivers
B 2 c – Fish and molluscs
B 2 e - Insects
B 2 f – Micro fauna
C 1 b – Watery areas
C 1 e – Agriculture
C 2 b – Fishing
C 2 c – Navigation
C 4 d – Balneal activities
C 4 b – Health and safety
C 4 c – Occupation
D a - Salinization
D b - Eutrophization
D e - Soil salting

Figure 2 **Final matrix of impact evaluation (Leopold**)

The graphical repartition of the impact level for each anthropogenic action is graphically represented in fig.3, and the percentage repartition on groups of actions that lead to positive impacts and / or negative is represented in *fig. 4.*

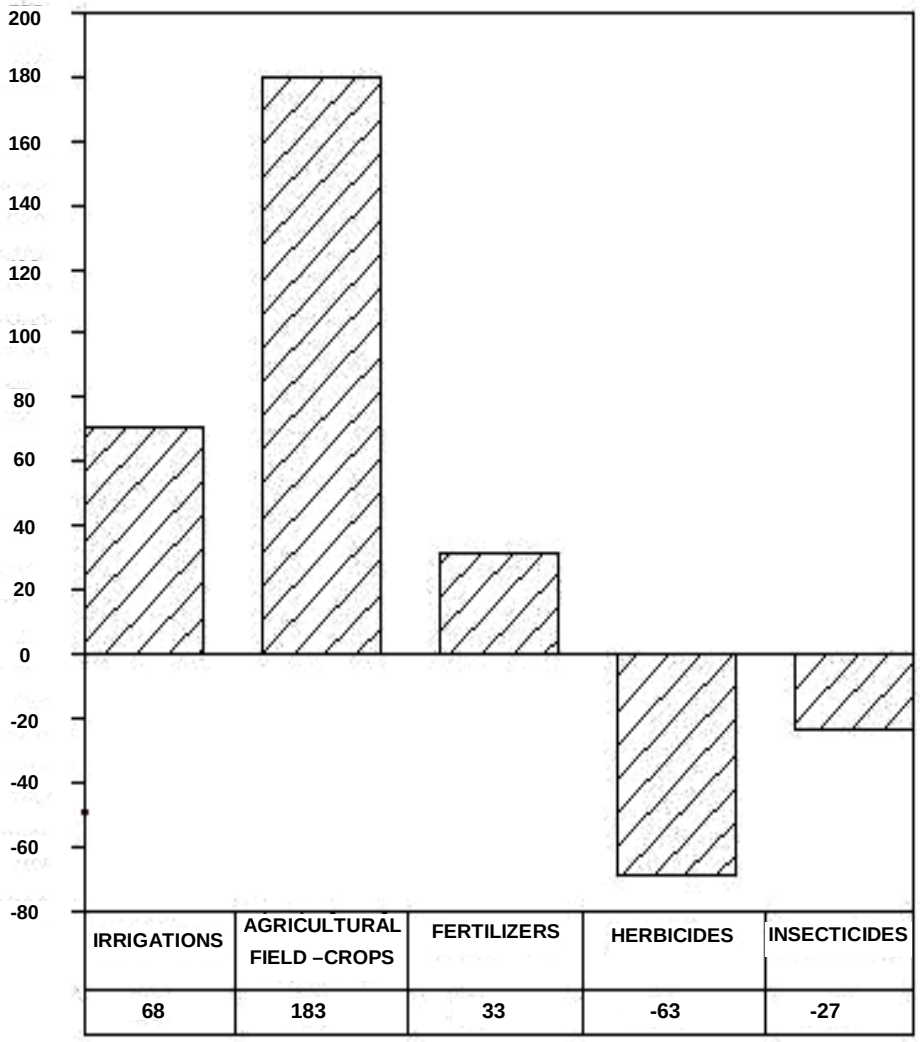


Figure 3 **Graphical repartition of complex impacts**

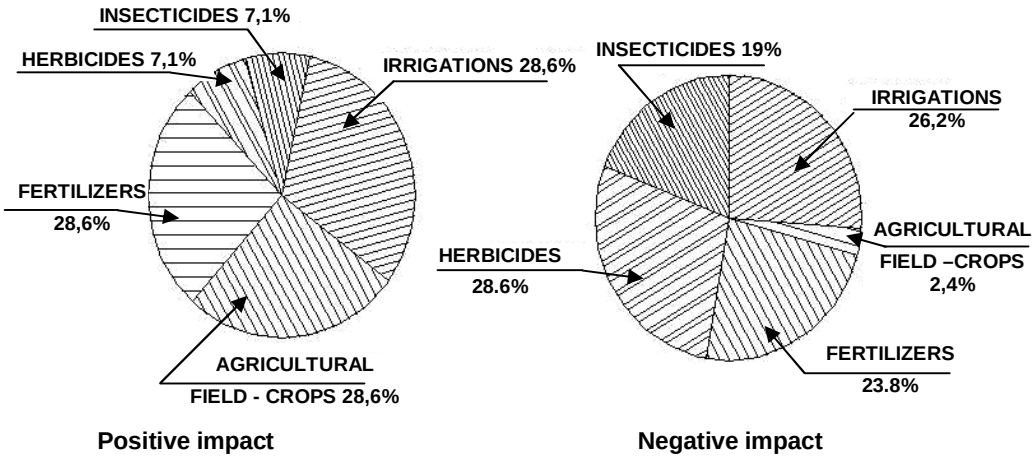


Figure 4 **The distribution percentage of the level of impact**

CONCLUSIONS

The matrix method of impact quantification is an expeditive, flexible method, that is much applicable in practice and that, at its turn is improvable; with its help, more realistic results are obtained.

The evaluation method of the impact upon the environment is a tool of identification and distribution of responsabilities to those polluting the environment.

Through the complex analysis of the impact generated by the modern agriculture upon a territory and so, by the impact generated by the irrigations upon the environment, with an aproximate accuracy, the percentage distributions of the positive impacts are obtained along with the percentage distribution of the negative impacts.

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