

ECOLOGICAL RECONSTRUCTION OF THE TROTUS BASIN (CASE STUDY BACAU COUNTY)

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Abstract: The area of the Trotus basin is of 4,456 km², of which at least 20% is in need of antropic interventions, as the ecologically areas affected by erosions and transports are continually increasing. Therefore the issue is the ecological reconstruction of about 900 km² = 90,000 ha. The length of the Trotus river is of 162 km, of which about 130 km in Bacau County. This length (river section) requires special works of water-bed and streamline regulation and ecological renewal of the affected flood-planes and terraces (15,000ha). Areas of forest clearings that have to be replanted represent about 70,000 ha, in order to complete forested areas, and without having the guarantee that this would solve the dramatic issue of floods. The catastrophic floods of 2005 were the synergetic outcome of thermo-climate deregulations due to the pollution of the stratosphere by toxic gases and the massive antropic degradation related mainly to the clearings in the Trotus basin.

Keywords: hydrographic basin, pollution, floods, ecological reconstruction, management

1. INTRODUCTION

The quantity of water falling on the basin's area (4,456 km²) and on an imbued soil, evenso capable to infiltrate into the soil, has different dynamic behaviors according to the slope of the land; but each time it reaches a certain

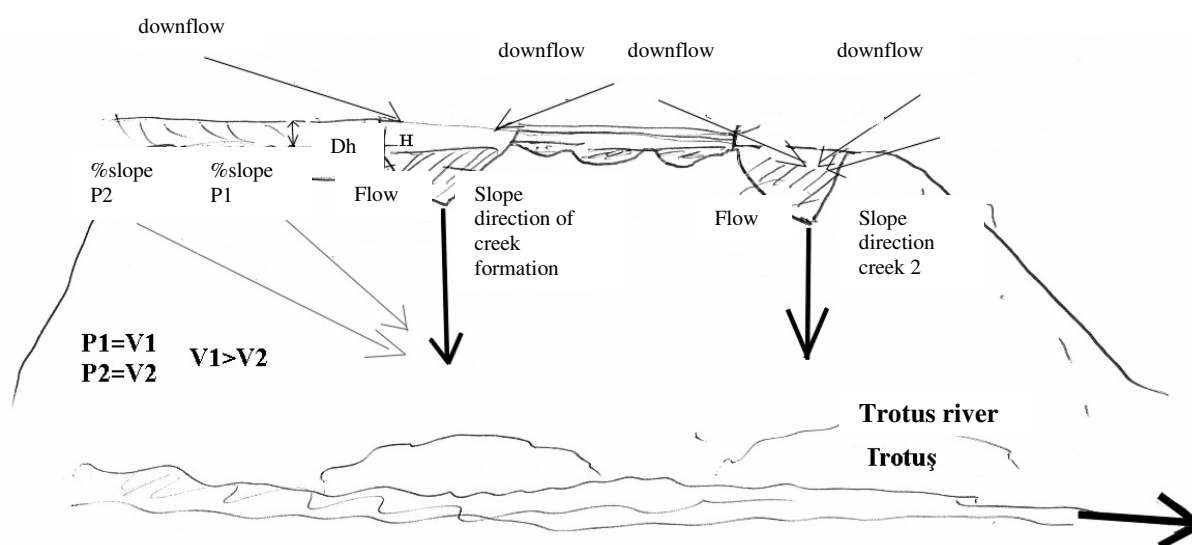


Fig. 1. Formation of new down-flows in the Trotus river basin

height “h” exceeding any unevenness of the land (Dh) it will seek its way towards a natural tributary and will flow down in successive accumulations in the direction of descending slopes (Fig.1).

Up to a certain height “h” or to a value “p” of precipitations, the chosen path of water is that of the minimum resistance of land, geo-hydrical characteristics being of crucial importance. Over 10 l/m² in 24 hours on a saturated soil “Dh” becomes active especially on impermeable soils, and the phenomenon of erosion becomes greater and greater.

The speed of accumulation and down-flow depends on:

- a) the inclination of the slope %
- b) the length of the slope
- c) the volume of water

The speed of water will increase as the slope is more inclined and longer. On very inclined slopes and with a large volume of water, the speed of the flow approaches that of gravitation (i.e. waterfalls) diminished by a slowdown due to rugosity and possible obstacles on the slope.

Taking the above as a starting point, the study for the consolidation and rehabilitation of the hydro-graphic basin should proceed from the creation of engineering works on the slopes and all around the terraces, which would have the effect of:

- increasing the permeability of the soil and conducting waters towards the deepest level of ground waters, those being empty enough despite large quantities of fallen precipitations;
- preventing waters accumulating in down-flows;
- if the above would not be possible, down-flows formed at the upper end of the slopes have to be collected and freed at low speed towards regulated tributaries, irrespective to the volume of accumulated waters;
- collecting channels should be built in steps in order to reduce water speed and should be made of concrete;
- calming waters on lengthy slopes can be performed by building basins to this purpose;
- works as mentioned above have been created on some creeks but they are of poor quality;
- it is imperative to collect separate flows of waters that can easily lead to slides followed by rock-accumulation and slides; no creek or spring should remain un-collected and un-regulated;
- consolidating slopes in risk of sliding, either through engineering works or through well designed forest plantations, is also imperative; the most important goal is to reduce water-speed and to increase the lapse of time up to the Tc limit (critical time) for the volume to reach the Trotus-bed;
- hydro-technical and hydro-energetic regulation of the river by building dams and clean renewable hydro-electric power plants;
- preservation, stability and sustainability of areas adjacent to the reservoirs can be performed by the above mentioned methods and by hygiene measures in forests, lawns and pastures, and on small areas of subsistence crops;
- the Trotus-bed shall be regulated in two or three steps; the form, slope and the consolidation of the banks with concrete slates will be of priority concern; the dimensions of the new waterbed will be established by the designers, taking into account all the risk factors; without the above mentioned works, there is a major risk that cannot be correctly estimated, and the rehabilitation of the river cannot be accomplished within the right parameters which would ensure safety and sustainability to the area, to the economic developments highly necessary for increasing the living standards in the area.

Local authorities have a major role, they have to enforce the law and the European standards for environment planning and management, as well as for natural resource management, according to the universal principle CONSUMPTION < OUTPUT. This is the only way to re-establish natural balances.

2. ECOLOGICAL RECONSTRUCTION OF NATURAL AND AGRICULTURAL ECOSYSTEMS IN THE BIO SECTOR

The space of this paper does not allow for a detailed presentation of the above important issue, as it is tackled with in the research project. In case the local authorities would be interested and would have the necessary funds, they could address us and other consecrated researchers. The ecological rehabilitation should be approached in the following way (Fig.2):

- aim (why it is necessary)
- implementation, carrying out (how, by what means and by whom)
- its effects

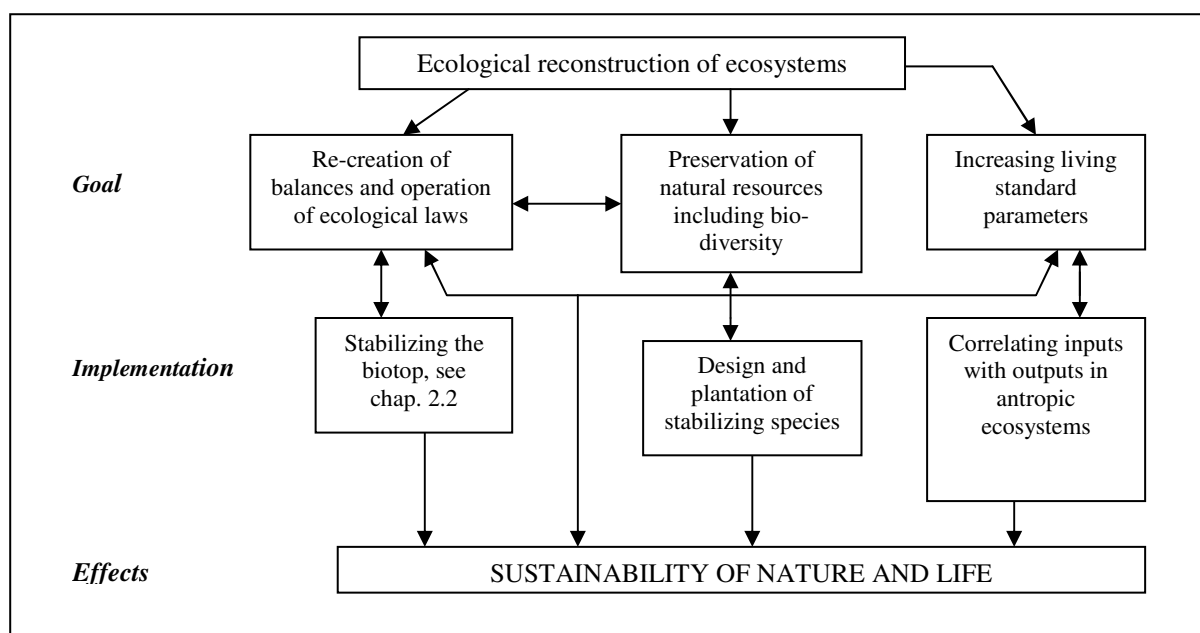


Fig. 2. Chart of the ecological reconstruction of natural and antropic ecosystems

Natural balances are give by the ratio between biotope (Bi) and biocenose (Be) in a certain ecosystem. The most important element of the biotope is SOIL, without which the very existence and general functioning of life could not be imagined. Soil degradation is very widely spread in the study area; this is the reason why major imbalances are severe with consequences on people's lives as described above. Population in this territory find it hard to cope with insecurities, with the constant fear of a massive water flow large as the Danube pouring over them or even the mountain towering their habitats moving downwards and swallowing up their lives and belongings.

It is no wonder that on such a beautiful valley as that of the Trotus (meaning its natural beauty) no tourist objectives or residential buildings (up-scale houses) could been developed. Well-to-do people in Bacau County had been over exploiting natural resources in the area, creating and developing risk factors, without assuming the responsibility to live in the very area. The best villas and houses in the county have been built in other areas, but not in the Trotus valley.

As concerns the relationship between soil – biocenose, there are certain specific and universal rules that should be complied with:

- 1) The soil should never stay more than 6 month without vegetation.
- 2) Soils permanently covered by vegetation are 2-3 times more protected than those without vegetation.
- 3) Soils permanently covered by forests are 5-100 times more protected than soils in category 1.

As mentioned, the soil should be protected against the kinetic force of raindrops. If we measured in m^2 the surface area of all the foliage on 1 ha we would obtain B_{cm}^2 . For a good protection against dislocation, it is imperative that the inequation below exists.

$$[1] \quad B_{cm}^2 > B_t m^2 \quad \text{in which } B_t = \text{non-covered soil at moment "t"}$$

In the Trotus area, in the alternative S_n :

$$B_{cm}^2 = (5 - 30) B_t m^2$$

had always been greater, so that we could say that the stability in the area was ensured.

After the 2000s, in over 20% of the area we had:

$$20\% = B_c \cdot m^2 = 0,1 - 0,3 B_t$$

$$15\% = B_c \cdot m^2 = 0,3 - 0,9 B_t$$

$$\text{Only on 15\% } B_c \cdot m^2 \geq B_t m^2$$

The second ratio between the biotop soil and biocenese is given by the stabilization of the soil by the roots. The better the roots are spread in the soil (i.e. the roots of living plants) the greater its stability. In the latter case, the volume of roots of annual cereal crops, especially the perennial ones, is the best suitable to protect soils against down-flows, contrasting with forests which offer protection against dislocation. Soil resistance to down-flows is given by the ratio between the weight of roots and the weight of soil in the first 30 cm of soil, i.e.:

$$[2] \quad \frac{GR}{GS} \leq 1 \quad \text{sau} \quad > 1$$

If this ratio is fulfilled, there will be no ecological problems in the area. In the Trotus basin we often find on large surfaces that

$$[3] \quad \frac{GR}{GS} < 0,3$$

The morphology of roots has also an important role to play. It is desirable that we have two categories of plants in the exposed areas:

- Plants with strongly spread out roots instead of pivoting ones (cereal crops instead of umbelliferones)
- Wooden plants with network-type system of roots, such as buckthorn which is an excellent stabilizer for soils in danger of displacement (Fig. 2).

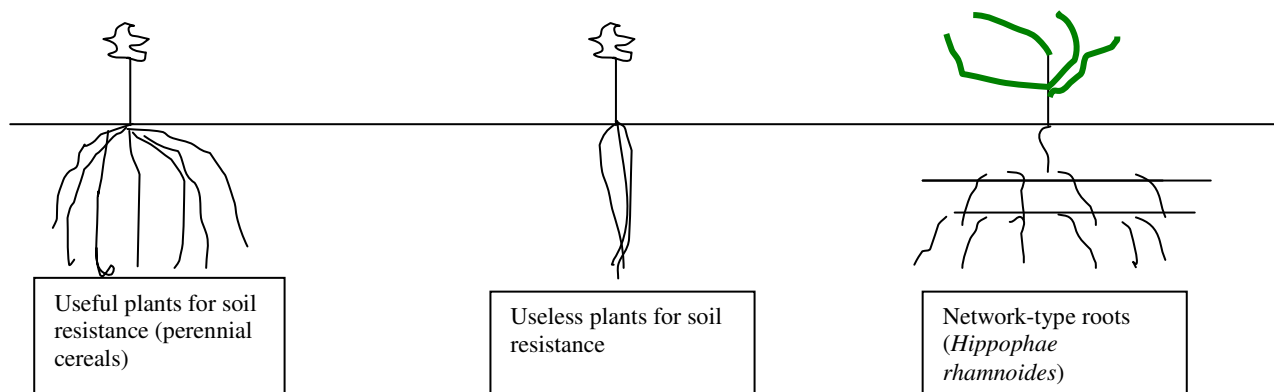


Fig. 3 – Root-types and useful and less useful plants for soil stabilizing

Recommendations:

- insemmination and over-insemmination of lawns with seeds of type (a) roots,
- replacing white cedar or other brushes with buckthorn (Fig.4) in order to stabilize banks and slopes.



Fig. 4. The stabilization of the banks of the Trotus mouth at Siret river is inefficient. Buckthorn is recommended.

In the Southern area where agricultural land is predominant and there is an area of over 15,000 ha of floodplain with scarce vegetation, the followings are recommended:

- Growing fodder plants in field rotation and reducing mono-crops of corn.
- Re-introducing lucerne that would bring about the following advantages:
 - a) stabilizing the soil and its content in nitrogen and organic materials;
 - b) regulating nitrogen balance in soil, improving nitrogen management;
 - c) developing cattle breeding in the area and increasing soil fertility by using stable manure.
- Integral use of organic waste in order to obtain energy. Growing plants with the aim to producing energy, sorghum, silo corn, miscanthus etc.
- In areas destroyed by flooding it is recommended to afforest with rapidly growing species such as poplar, willow, alder, fast-growing pine and using biomass for energy production, as it is very useful for the inhabitants of the area. It is imperative to reconstruct biodiversity as an indicator of sustainability in the area.

3. CONCLUSIONS

3.1.1 The Trotus valley requires various investments for full ecological reconstruction of at least 2 billion euro. The investments are absolutely necessary and profitable.

3.1.2 Each year of delay in implementing this reconstruction in accordance with the principle of accumulating imbalances and damages in waves would increase at least by 50,000 euro/year the amount of damages and at least by 100,000 euro the level of additional investment.

3.1.3 However, no investment is feasible without arresting and controlling the risk factors in the area and carefully monitoring the basin.

3.1.4 Quick fixes that are being carried out presently are inefficient, without benefiting of the perspective of a complete and efficient project in the area.

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