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The Slope - Valley Relation of the Șieu Morphohydrographic Basin in the Sărățel - Someșul Mare Junction Sector

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ABSTRACT

The Șieu river, a tributary of the Someșu Mare river, streams from the north – eastern end of the Călimani mountains, at the contact between the peaks of the Căliman Mountains and the Bistrița Depression, under the Căliman piedmont. The genesis and spatial development of the Șieu river basin is the result of its position in the northern extremity of the Transylvanian Depression, but also of the Transylvanian – Pannonian micro-board mobility, which generated a series of changes of the subsidence areas in the lower sector of the Șieu River. The relief of the Transylvanian Depression, by its actual appearance, is but a short sequence of the series of geomorphologic changes. Distinguishing them may follow different paths depending on the purpose, requirements and possibilities, one of which is represented by the analysis of the morphogenetic manifestation in the valley – slope systems, based on methodological support provided by functional geomorphology. Attention will be directed to the Sărățel sector – the juncture with the Someșu Mare river, where contemporary alluvial processes (alluvial bed elevation, the presence of sloughing sectors) the appearance of sectors due to the saliferous Quaternary neotectonics, the agrotechnical exploitation of land use, contribute to changes in the report of the slope – valley system. In this fluvial geomorphology study the spatial – temporal frame of the analysed system accounts for 268 km², of a total of 1691 km². The alternation of some saliferous formations (the Sărata and Sărățel Valleys) with other more friable ones (clays, marls, gravel) in addition to the fact that it is fully visible, it induces differentiations even in the water bed, valley sectors. The emergence of a series of wide NV–SE axial – plane separations: the Slătinița anticlines, the Târpiu syncline, confer uniqueness to the sector.

1. INTRODUCTORY ISSUES

The approached issue in this paper is of wide interest, specific not only to geomorphology. Further on, the attention will be concentrated on the present situation in the first sector, integrating an area of 268 km², of a total 1691 km². Knowing the cooperation that exists between them, each sector can be categorized according to the dominant process. The alternation of saliferous formations (the Sărata and Sărățel Valleys) with more friable ones (clays, marls, gravel) in addition to the fact that it is fully visible, on slopes, it induces differentiations even in the water bed or valley sectors. The Lower Șieu sector is limited to the north of the Cociu village area, the Curții Hill, the Făuriștii Hill, going up north of Târpiu (over Sărata river), continuing up to Dumitra;

to the east it descends towards Târgului Hill, Sigmir until the junction of the Bistrița river with the Șieu river; on the south it has as a limit the Sărățel village, going then up north of Țigău and Chiraleș (at the contact with the Dipșa river) towards Feleac, ending in the west with the Figel Hill, the Figa Bays until the junction with the Someșu Mare river.

In this sector the Șieu river deepens throughout his way and presents a first narrowness in the south – eastern extremity at Crainimăt, and a second one in the north – central part at Șieu – Odorhei and a significant widening between Chintelnic and Critur – Șieu, followed by another one from Șintereag, continued up to the confluence with the Someșu Mare river). The relief aspects denote a striking asymmetry: the left slope belongs to the Transylvanian Plain, under

500 m and forested, with very well developed terraces, that appear only on this side, while the right sided slope, although short is steep and constantly threatened by the Șieu river's waters, causing strong gullying and erosion processes [7]. Unlike the left slope, the edge rising to the right of the Șieu (the Pustiu Hill 430 m, the Coasta Tăului Hill 445 m, the Podirei – Bunguri Hill over 500 m) separates the Căila – Târpiu through the Roșua river, respectively Căila, but are maintained at the overall level of the hills across the Dumitra Depression.

The Dumitra Depression presents different characters, being a hilly erosion depression; it is a lower area of the peaks that close it to the north, east and south; however it is wide open towards the Someșu Mare and Șieu rivers.

Throughout the depression the relief presents a uniform succession of uniform slopes, alternating with relatively large valleys, with aging characteristics. The connection between the ridges and the valley's alluvial plains is unitary, slightly fragmented and without terraces. The valley floors in cross and longitudinal sections have pronounced aging aspects; by this feature they resemble the Transylvanian Plain valleys [5].

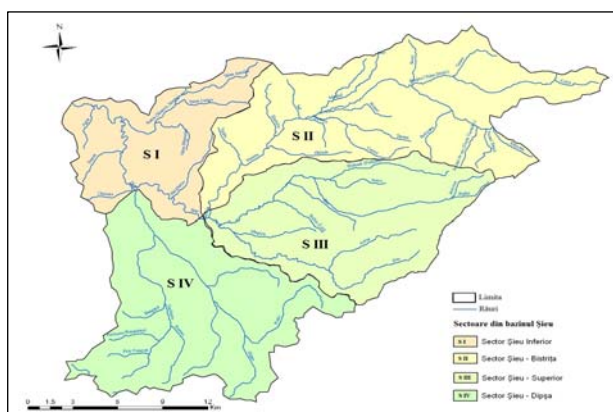


Fig. 1. The sectoral map of the Șieu River Basin.

The largest regions appear in the northern part of the depression, where saliferous clays and massive salt appear on the surface; there are numerous saline waters, sloughing areas and with rich swamp vegetation, which mark muddy portions. Currently, on most parts, streams are deepened in the meadows with 2-3 m, this behaving like a terrace. Flood plains that are subject to floods are caused thereby, mostly after the drainage of slope waters or after the melting of snow, than by the contribution of the river.

2. PRELIMINARY OBSERVATIONS

The lack of terraces is another aspect that should link the Dumitra Depression to the Transylvanian Plain. In the depression the major landslides are lacking and the structural relief is far from giving the specific note of the territory. In the relief particularities, across the depression, the structure is felt less. The emergence of a series of wide anticlines and synclines oriented from NV

to SE: the Slătinița anticline, the Târpiu syncline, the Sigmir syncline give the sector uniqueness.

The main river artery in the eastern side of the depression puts the left sided tributaries under an acute angle.

The valleys are not structure – adapted, and the too soft substrate cannot give any structural forms in the relief. To the south the steeper slope determines a landslide area, especially in the old torrential basins, today filled with flysch material. In the slope gently descends towards Blăjenilor Valley, lacking slope processes. On the left sided slope, because of its steepness, some strong torrential organisms appear very exceptional phenomena in the depression. The wide valley of the Șieu river closely follows the anticline area of Șieu – Tăurei [6].

Instead, the interfluvium of the Someșu Mare valley, widened as a depression and the Tăureni Depression, newer formations appear, grouped in a syncline. The relief inversions give us proof of an advanced morphological evolution, facilitated primarily by the intersected rocks. The large valleys do not take into account in their path the easily folded structure of the region; after crossing the dacite tuff strip, the Someșul Mare river intersects almost perpendicularly the Feleac – Șintereag – Figa anticlines; the same thing is done by the Șieu river on the last part of its course, just before its confluence (see attached maps).

In this article, aspects of the types of dynamic relations characteristic to the valley – slope systems are presented at first, and then we proceed to establish the type of relations existing at the level of valley – slope systems of Transylvania. This system relies on a number of factors from the inter-componential ones, specific to the lower order subsystems, much more complex, of the morphodynamic relations type, established between the alluvial plain subsystem and slope subsystem.

The type and manifestation intensity of the actual geomorphologic processes from the Șieu river basin, differ according to the slope types, lithology and land use. Along with the alluvial bed dynamics, the slopes represent the most active component under a dynamic report, their current differentiated and perpetual modelling relies on some older elements. However their dynamics is more accentuated on the cuesta front, and the slopes (see attached maps).



Fig. 2. Interference of water, salt spring that flows into Șieu (near Sărățel).

The fluvial modelling of the Șieu river valley crosses the diapirs (at Sărățel), that entail major changes in the flow, bed morphology, slope morphology and interfluves. By the presence of salt this leads to formation of its individuality. The presence of salt and gypsum tangles the displaying of processes by accelerating their dynamics. The confluence between the Bistrița and Șieu rivers occurs at Sărățel, in the middle of a saliferous folded area, sector where the Șieu river crosses the axis of the diapirs.

The valleys are much narrowed, with steep, forested slopes, resembling a „gorge”. Currently, the geomorphologic processes occur both at the level of rivers with high alluvial plains, as a result of the rivers with high alluvial plains, establishing the current morphodynamic, and at the slope’s surface level.

Its influence upon the water bed processes is felt due to the flow regime (Pericarpatian – Transylvanian with important waters in March, determined by the slopes’ snow - melting and floods in May – July), while on the slopes’ level interferes through the cyclicity induced by modelling processes.

The different manifestations of the valley – slope relation also has effects on the direction of evolution of the basin, as it has evolved through the withdrawal and repeated fragmentation for collaboration, respectively storage types of slopes formed reflecting the result of the valley – slope system morphodynamics [9].

Unfortunately, after application of the Land Law No. 18/1991, the return to the traditional cultivation on the hill – valley direction, and the continued fragmentation of land, have favoured the acceleration of soil erosion. Most times, through soil erosion, there is a redistribution of fertile upper soil horizons to the lower areas, with serious consequences for agricultural productivity.

In case of the majority of lands, located on ridges or slopes, affected by surface erosion, at the base of slopes a series of colluvial deposits are formed. In most cases the transition from the surface slopes to that of the alluvial plains. Usually, the transition from the surface of the slopes to the one of the alluvial plains is not sudden but through a connection area called glacises which are quite widespread [10].

Acknowledging the morphodynamic relations characteristic to the slope – valley systems is one of the possible paths to follow in the act of measuring processes and relief forms, as in the case of the Șieu river basin. Depending on the approaches, the slopes alongside with the alluvial plains represent the most dynamic geomorphologic element both in terms of geomorphologic evolution and land use (see attached maps).

3. RESULTS AND DISCUSSION

The bank withdrawal process in the analysed period, showed erosion rates (at fixed points) between 0 –

100m (at Arcalia) and 0 – 117 m (at Șieu – Sfântu) – see fig. 3, 4, 5, 6. The maximum rates of erosion, both for Arcalia site and the Șieu-Sfântu occurred during 04.01. – 02.02. 2009 [2, with modifications].

In the Arcalia site area, since February, the bank withdrawal rates has had a sudden fall, up to approximately 35 cm in February, 20 cm in March and almost nonexistent between March – May.

In the sector, the bank withdrawal rates have remained elevated for the following period (02.02. – 28.02. 2009) however a gradual decrease of withdrawal being recorded [2, with modifications].

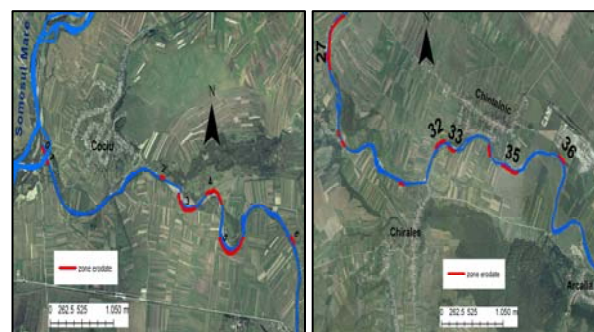


Fig. 3, 4. Area containing the eroded sectors 0 to 6 and 27 – 36 (data source: Google Earth).

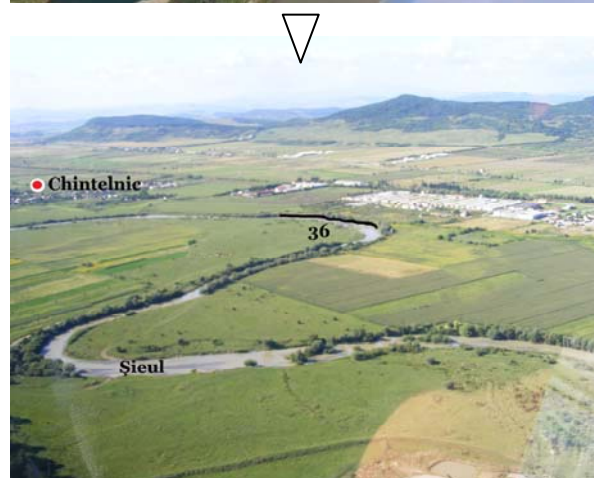


Fig. 5, 6. Aerial photo - Area containing the eroded sectors 0-1 and 36 (at Cocu, Chintelnic-08.2011).

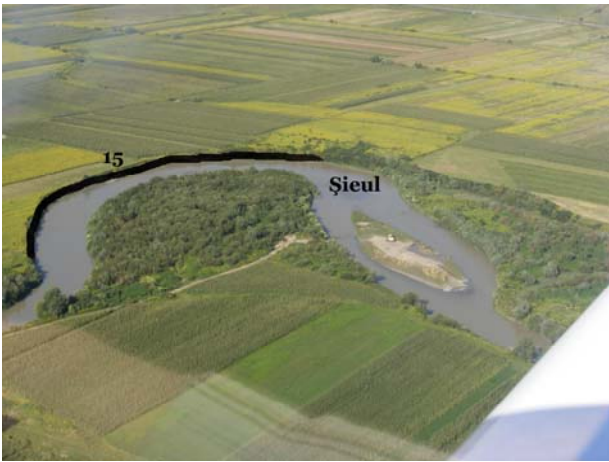


Fig. 7. Aerial photo - Area containing the eroded sector 15 (at Șieu Odorhei-08.2011).

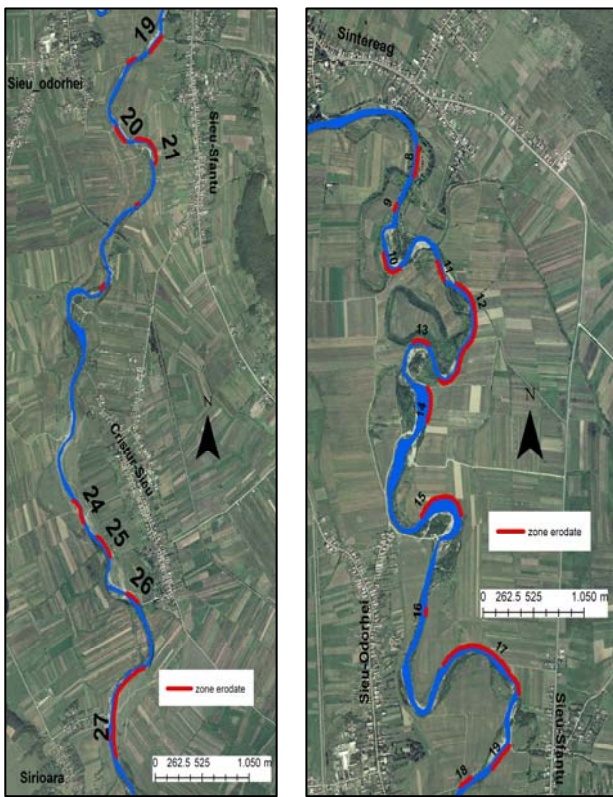


Fig. 8, 9. Area containing the eroded sectors 8- 19 and 19-27 (data source: Google Earth).

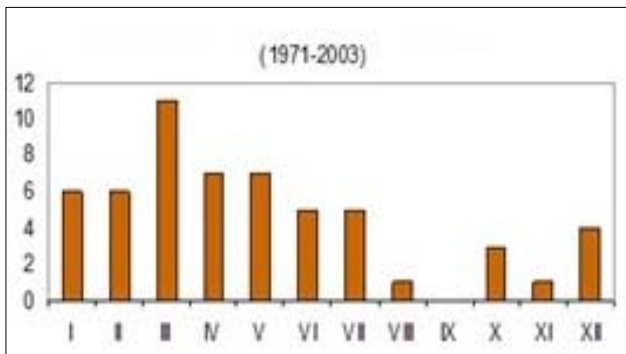


Fig. 10. Monthly frequency of floods at Șintereag station (1971- 2003).

The areas with the lowest slopes are located in the lower basin (sector S1, also called the lower sector) and the middle Șieu sector.

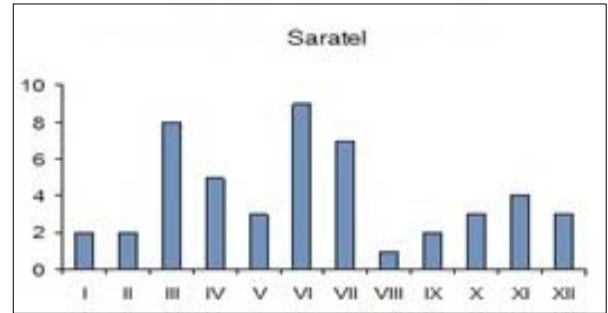


Fig. 11. Monthly frequency of floods at Sărățel station (1971- 2003).

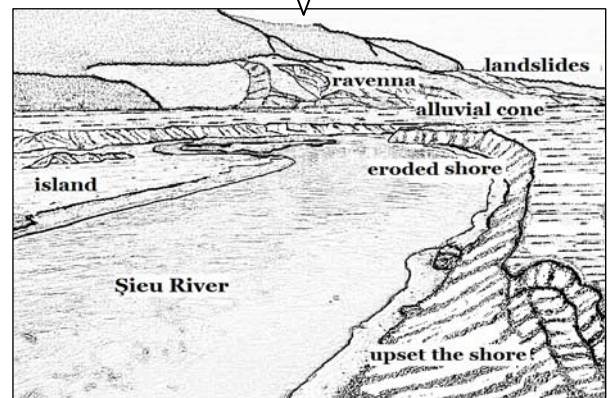


Fig. 12, 13. Outline with erosion – accumulation forms and processes on the Șieu River, at Crainimăt 2011.

Agricultural land prevails, arable land having the largest share, large areas being cultivated especially with cereals.

For the interfluvial sectors, mainly forested and secondary meadow areas (transition between forests and shrubs) are specific, but there are plenty cases when they are used as arable lands, which worsen slope processes, especially rain erosion and surface erosion (Șieu – Măgheruș – Podirei).

The terrace bridges and alluvial plains, are low sloping surfaces, used as arable lands (Chintelnic, Cristu-Șieu, Coasta, Șieu-Odorhei, Blăjeni de Jos, Șintereag, Cociu, etc.).

The influence of Șieu river channel processes, upon land use – meander processes- determined in concave banks the appearance of erosion processes, withdrawing them at the expense of agricultural land. For this reason for the Sărățel - Crainimăt - Arcalia - Chintelnic sector a series of bank consolidations have been conducted (fig. 8, 9).

Land use on inclined surfaces, on the fronts of the secondary cuesta (Blăjeni de Sus, Blăjeni de Jos) due to overgrazing, land degradation and acceleration of current modelling processes. Also for the cuesta fronts (but on the main ones this time) there are specific uses from a sector to another (fig. 15, at Cociu).

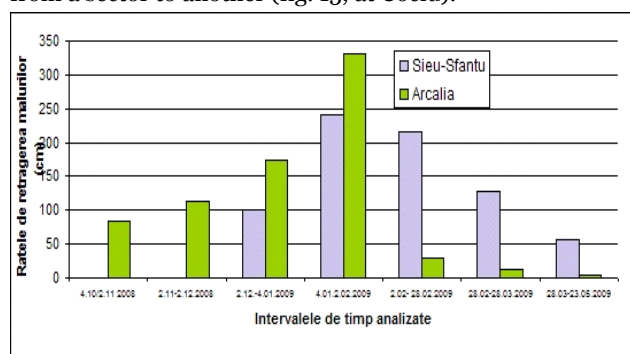


Fig. 14. Bank withdrawal rates on analysed intervals for the Arcalia and Sfântu sites, 2010.

For example the cuesta front that goes along the right side the Măgheruș Valley, is used as posture (between the Șieu-Măgheruș-Caila localities) but there are also sectors with plum and apple plantations, such as in the alluvial plain with the same name, and up to the main part of the cuesta front. In the upper sectors of the cuesta reverses, small forested areas are still preserved, but most of them have been cleared, making way for agricultural land (Feleac, Bretea).



Fig. 15. Aerial photo-Land use in the Valley of Șieu (at Cociu, 08.2011).

4. SPATIAL AND RURAL PLANNING

In this sector (SI) the Șieu River deepens throughout its course, and has a narrowing at the eastern end (Sărățel - Chintelnic) followed by a considerable

widening (from Chintelnic to Șieu – Odorhei) where it favoured the formation of a six rural settlements cluster (fig. 16), as well as a large scale development of agriculture and tourism through the presence of some tourist resorts, the Figa Spa centre being among the most recently rehabilitated. Also the settlements from this sector are concentrated along the axis of influence in the territory represented by the Șieu River and communication routes (E 58).

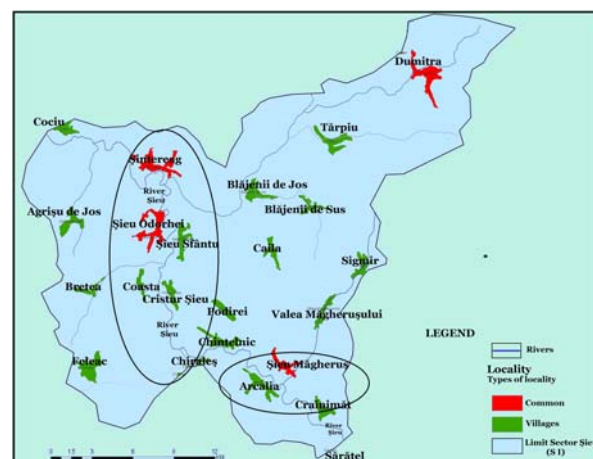


Fig. 16. Map of localities in the Lower Șieu Sector (S I).

From Chiraleș to Șintereag, there is a grouping tendency, of households gathering, between the boundaries of well-shaped centres, it normally appears in the plain areas, but also in the lower part of the inter-hill depressions and even in some sectors of the Transylvanian Plain sector.

Compact villages characterise areas based on intense agricultural economies, of cereals and reduced relief fragmentation, often devoid of inside vegetation.

The phenomenon of gathering households was either spontaneous, in need to save agricultural land, either guided through the action of populating some regions (low drained plains, embanked meadows, the German colonization in the Bistrita region etc). The degree of thickening of households is directly proportional with the age and economic power of the villages.

The rural plain – hill settlements, rated as important, have the following characteristics:

1. Arable agricultural land in proportion of over 80%.
2. Rural population occupied mainly in agricultural activities.
3. Changes in the demographic structure of the population, mainly due to: increased mortality, lower birth rates and net migration.
4. Way of living characterised by low housing density (approximately 3 persons/house, approximately one person per room, over 10 sq m/ person, 3 rooms/housing).
5. Approximately 25% local roads upgraded.

The Șieu valley corridor, functions as a true depression corridor, providing material, energetic and human flow, therefore bringing the whole sector into a territorial unit– development corridor with „disheveled effect” [4].

In terms of organization and management of hunting, the area under study, overlaps (or partially overlaps) the territory of two hunting areas (H.A.): H.A. 21 Măgheruș located in the middle basin of the Șieu River and the lower basin of the Roșua River, a right sided tributary of the Șieu River, extended in the jurisdictions of the Șieu Măgheruș and Șintereag municipalities; H.A. 22 Dumitra, located in the upper and middle basin of the Roșua River and included in the jurisdiction of the Dumitra village up to Șintereag.

The agricultural potential of the sector is given by the high fertility, giving agriculture the possibility of diversifying its branches and sub-branches. The agricultural profile is defined by intensive farms specialized in the production of milk, vegetables (Cociu) and fruit (Târpuiu – Sigmoid) (fig. 13, 14).

The weekend tourism in this sector is shaped by the changes caused by subsoil use for leisure activities (fig. 17.).



Fig. 17. Băile Figa Complex, 2011.

5. CONCLUSION

The complexity of the relief from, distributed in the Șieu river basin sector, conditioned the choice of a general study direction, which took into account both the current shapes, as well as the „inherited” ones which were shaped in different geomorphologic conditions, that the present ones.

The relief is formed and evolves positively or negatively, depending on the way the terrestrial evolution adapts to the progress (in time and space) of the exogenous and endogenous morphological processes, as always there must be a perpetual relation between form and process, as well as between process and form.

Current geomorphologic processes can not be analysed without taking into account the dynamics of water beds (as subsystems), the dynamics of the slopes that make a system of their own, and on the other part the slope – valley system considered as a whole system, in which it comes to relations of cooperation and non – cooperation, and driven by certain factors provide to geosystemic functionality of the Șieu river basin [8].

All these are part of the process of reaching a dynamic balance both at the level of slopes, and river beds, and land use is conditioned by the direction of development of morphodynamic processes.

6. ACKNOWLEDGEMENTS



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ANNEX

Maps of the lower sector of the Șieu River morphohydrographic basin (hypsometrical map, geological map, soil map, slope map, slope orientation map, fragmentation depth map and land use map) after ArcGis version 9.3.

