German K., 2011. Expansive, recessive and ephemeral geocomplexes as components in rational management of natural environment. The Problems of Landscape Ecology. Vol. XXX. 339-342.

Expansive, recessive and ephemeral geocomplexes as components in rational management of natural environment

Krystyna German

Jagiellonian University, Institute of Geography and Spatial Management, ul. Gronostajowa 7, 30-387 Kraków, Poland
e-mail: krystyna.german@uj.edu.pl

Abstract: Natural environment present in the mountains results from numerous stages of development of which most took place far in the past. As follows, an array of geocomplexes differentiated by age and origin is observed in the contemporary landscape. These geocomplexes pave the way for further trends in the development of natural environment with a pace of changes infrequently boosted by the extreme events. Apart from geocomplexes with stable boundaries of the total area only slightly altered, a significant number include expansive and recessive geocomplexes - their area shows a tendency to either a significant expansion or considerable downsizing. In addition, ephemeral geocomplexes are also distinguished as these originating suddenly and rapidly during extreme events, but also receding quickly what usually stems from human interference.
In specific conditions all of the three aforementioned types of geocomplexes change their boundaries rapidly. In the current Polish code concerning spatial planning and land development, fast relocations of boundaries in the landscape are not fully taken into consideration. This instability of boundaries substantiates the need to detect and incorporate expansive, recessive and ephemeral geocomplexes into planning and utilization of natural environment resources, thus providing uninterrupted and rational management.

Key words: natural environment, geocomplexes, extreme events, development

Introduction

Natural environment present in the mountains results from numerous stages of development of which most took place far in the past. As follows, an array of geocomplexes differentiated by age and origin is observed in the contemporary landscape. These geocomplexes pave the way for further trends in the development of natural environment. This trend is often stimulated and accelerated by extreme events such as: intensive precipitation, storms, tornadoes and human activity, all contributing to modifications or disturbances in the initial development trajectories. Apart from geocomplexes with stable boundaries and the total area only slightly altered, a significant number include these with mobile boundaries, which tend to expand in space. Correspondingly, the area of adjoining geocomplexes is reduced considerably. Such changes are easily discernible during extreme events something, by and large, causing new geocomplexes to develop and expand through the time. Similar influence is exerted by human activity, but geocomplexes formed in this manner quickly vanish from the landscape as people tend to reshape natural environment to its previous state.

Data and methods

The classification presented below shows the directions of geocomplex development produced from the data captured by mapping all of the effects induced by the extreme events in Beskidy and Pogórze in Żegocina surroundings registered on July 09, 1997 (German, 2000). Another dataset involves the selected, newly-formed geocomplexes, which were being monitored in different regions of the Polish Carpathians during the entire period of 1997-2010 (German, 2009).
This monitoring relied upon detailed, quarterly documented changes including repositioning of geocomplexes boundaries by the natural and anthropogenic factors. This work was done by several students completing their Master's thesis at the time; all in all, the whole research involved the following investigators: K. Bialik, K. Magiera, M. Musiał in Żegocina; M. Ścieńska in Ciężkowickie Foothills, P. Orawiec, P. Skrzypczak, A. Głuszek, P. Biela in Gubałowskie Foothills and subalpine levels of Tatra Mountains.
Long-lasting and laborious research on geocomplexes indicates that some specific trends of their natural development are connected with selected types of geocomplexes.

Directions of geocomplexes development

As many as three types of geoxomplexes were distinguished; all marked by the high pace of boundary relocation. These include expansive, recessive and ephemeral geocomplexes of which further development trends were inspected and determined.

Expansive geocomplexes

Expansion (Latin *expānsiō*) - to broaden or spread, expansive (French *expansif*)- with a propensity to extend/ expand the sphere of activity
Contemporarily, expansive geocomplexes show a tendency to extend their area through the annexation of geocomplexes adjacent to them; thus they can be considered as prospective forms. As being relatively young, these geoxomplexes are usually situated below or adjoin recessive ones within the slopes. Although their formation is estimated to take place thousands years ago, new geocomplexes can be also created presently. These usually include landforms of erosion or erosion-denudation origin. In case of intensive precipitation, rapid boundary changes reach up to a few meters causing the area of geocomplexes to expand.
Expansive geocomplexes comprise: V-shaped valleys, dells, headwater areas, gullies with boggy bottom, ravines, niches formed by slope movements, steep slopes of flat valley bottoms or terraced valleys and river channels. The expansion of valleys occurs in winding course of newly-shaped boundaries; niches and headwater areas expand centrifugally.

Recessive geocomplexes

Recession (Latin *recessiō*) – to retreat or move back, ceding from and giving way to other forms, recessive (Latin *recessus*) – receding, yielding, reversing
Recessive geocomplexes are bound to complete vanishing from the landscape by constant diminishing their area and receding in favor of expansive geocomplexes. This progressive process provides a new quality to the existing landscape, but negatively affects expansive geocomplexes through the time. The latter is evidenced by winding boundary shapes something that mirrors a loss in total geocomplex area.
These include denudation flattenings - often the oldest forms present in the landscape - shaped up during several stages of development far in the past (as measured in millions of years). The oldest comprise these from Paleogene period characteristic for uplands and Brama Krakowska and formed during the last 65 million years.
As for foothill landscape, Miocene and Pliocene flattenings are usually situated within ridge tops forming land culminations. However, in Beskidy they are located within ridges or slopes and remain at the close of their existence. Recessive character also concerns slopes surrounding expansive forms and edges of river terraces

gradually eroded by present-day flows.
Contemporary edges of recessive geocomplexes are determined by the development of expansive geocomplexes.

Ephemeral geocomplexes

Ephemeris (Latin *ephēmeris*) – an object or event lasting for a markedly brief time, rapidly finishing or going by, ephemeral (Latin *ephēmeros* – lasting a day, daily) – lasting a very short time, passing
Ephemeral geoxomplexes are marked by a very short lifespan and development period, which can be measured in years before they gradually wane and cease to exist. Regularly, they can be found in the areas devoted to agricultural and silvicultular use.
These geocomplexes are formed presently during severe weather events such as hurricanes or heavy rainfalls. New ephemeral landforms quickly vanish from the landscape as a result of deliberate and planned human activity rather than natural factors. This kind of human interference is aimed at restoring agricultural or silvicultular functions present in the landscape before it was affected by the extreme events.
Ephemeral geocomplexes detected during this research include: slope flows and tongue-shaped landslides removed by farmers from arable lands within 2-4 years from their formation; erosion dissections found on farmlands (the largest up to 15 m in length and 2.5 m in width), intensively developing, but continually covered with garbage and waste by land proprietors. As a consequence, these forms are completely buried and leveled off after 10 years following their formation. Such actions are seriously dangerous for the quality of the natural environment. The following years will verify whether such landform features remain in the landscape permanently. Tornado and hurricane blowdowns include these of the longest lifespan as 50 years are usually required for forest succession or plantation in order to fully restore wind-fallen sylvan areas (Niedźwiedź i in. 2004).

Conclusions

In specific conditions all of the three aforementioned types of geocomplexes change their boundaries rapidly. The pace of development and boundary changes depends on the frequency of extreme events and intensity of human interference.
In the current Polish code concerning spatial planning and land development fast relocations of boundaries in the landscape are not fully taken into consideration. Consequently, new investments are located in a precarious proximity to the boundaries of expansive geocomplexes.
Rational management of natural environment requires adequate identification of mobile boundaries characteristic for expansive and recessive geocomplexes. The studies exploring the pace of boundary movements imply that larger distance ought to be kept between these geocomplexes and planned investments, buildings and roads in particular. This distance must be greater than the present threshold value of 10 m. According to the research conducted in Żegocina surroundings, the stability of expansive geocomplexes cannot be guaranteed even by concrete lined boundaries.
Exceptionally intensive expansive character during extreme events concerns all of the convex sections of valley boundaries, which are jeopardized by the energy of the flowing water (constructed too close to the bent edge of Skawa river terrace the Roadhouse in Zembrzyce was destroyed in 2010; numerous damages of paved and unpaved roads were also found in the aftermath).
Conflict-free coexistence of human and nature in mountainous landscape remain a task both challenging and difficult, although indispensable in order to follow the principles of sustainable development. This kind of management minimizes expenditures on effects caused by future extreme events.

References

German K., 2000, Funkcjonowanie geosystemów fliszowych w okolicach Żegociny w ekstremalnych warunkach opadowo-powodziowych 9 lipca 1997 roku. Prace Geograficzne Instytutu Geografii i Gospodarki Przestrzennej UJ, 105, Kraków, 235-256.

German K, 2004, Wybrane problemy zrównoważonego rozwoju na terenie karpackich dolin rzecznych, [In:] M. Kistowski (red.) Studia ekologiczno-krajobrazowe w programowaniu rozwoju zrównoważonego. Problemy Ekologii Krajobrazu XIII, Gdańsk, 235-241.

German K., 2009, Metody geoekologiczne w badaniach funkcjonowania środowiska przyrodniczego, Problemy Ekologii Krajobrazy XXIII, Kraków, 85-90.

Nieźdzwiedź T, German K., Sadowski P., 2004. Synoptic conditions of the tornado occurrence, in the Podhale region on 29 May 2001 and its natural and economic impacts, Prace Geograficzne Instytutu Geografii i Gospodarki Przestrzennej UJ, 112, Kraków, 55-67.