USING GIS FOR MOUNTAIN WILD ROUTES ASSESSMENT IN ORDER TO QUALIFY THEM FOR TOURISM VALORISATION

Mihai VODA[1], Lucian MOLDOVAN[1], Adrian TORPAN[1], Adriana HENNING[1]

ABSTRACT:
Mountain wild routes represent the most spectacular ways into the heart of nature. No matter how far or difficult to reach, they are and always will be the most desirable places for adventurers. Using GIS techniques we selected and analyzed six pedestrian trails and seven motor/bike/auto routes from the Transylvanian Mountains. We consider that proposed routes are the best in terms of tourism valorisation in the near future. The lack of maps and geographical information did not stop foreign tourists from visiting and exploring our natural beauty. The aim of this paper is to help local communities to organize and better manage the mountain wild routes for the benefit and prosperity of their own people. Taking into account the environmental problems and protection, we determined the exact entry-exit points with no off-tracks on route in order to minimize the negative impact and increase the physical support capacity. Downloadable GIS data for tourists' GPS devices and two smart phone application proposals constitute the outcomes of this paper.

Key-words: *GIS techniques, mountains, trail, trekking, off-road, adventure tours.*

1. INTRODUCTION

The economic benefits from mountaineering tourism in Transylvania region (**Fig. 1**) are small and inconsistent, depending on the tour operators from city centers (Gherman, 2011). They send tourists on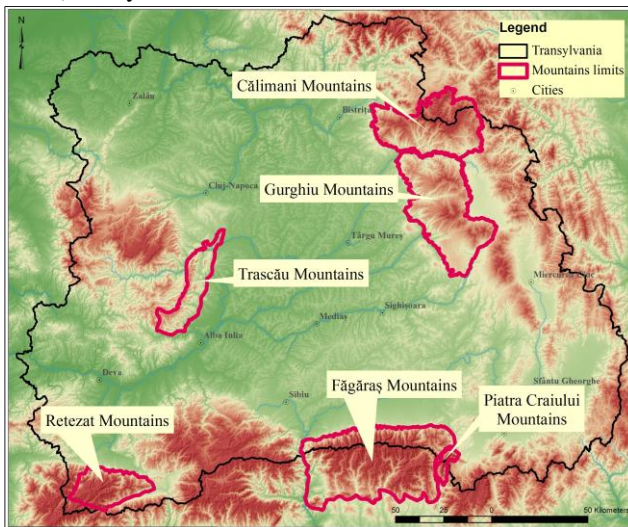 the mountain routes with a specialized guide accompanied by a local inhabitant. These are often forest rangers or local people involved in tourism by chance or need but their incomes are distributed unevenly. According to Steinicke and Neuburger (2012), a community-based tourism organization represents the best solution for the prosperity of mountain areas, because it stabilizes the livelihoods of rural households, contributes to the community welfare, and also reduces the vulnerability of families if it is well managed. The aim of this paper is to present the mountain wild

Fig. 1 Location of selected mountains in Transylvania.

[1] *Dimitrie Cantemir University, Faculty of Geography, Targu Mureş, Mureş, România*
mmvoda@yahoo.com; moldovandlucian@yahoo.com; aditorpan@yahoo.ro;
ghermanadrriana@yahoo.com

routes divided in two categories: pedestrian trails for trekking purposes only and motor/bike/auto routes. Considering our city, with international airport, E60 road access, Targu Mures, as a starting point we grouped the mountain routes in Transylvanian Volcanic Range (from East), Transylvanian Alps (from South) and Transylvanian Western Range (from West). As any other European region, Transylvania wild landscapes represent areas with outstanding scenery, with minimal evidence of human influence that creates diverse opportunities for outdoor trekking, biking or driving experiences (Glass, McMorran, & Price, 2013).

Local community was involved in small scale tourism infrastructure building in the 1990s decade. Many huts were constructed during that time as a result of city people need for relaxation in week-ends. It was a trend all over Transylvania. Having a small cottage in the mountain area was a must for many. Some of them were bigger than others and rented after Christmas holydays for New Year's Eve to students. Not included in official accommodations list they are spreading along the mountain wild routes entry and exit points. Using old maps and geographical information found on internet and different social media sources, foreign tourists are visiting and exploring our selected Transylvanian wild routes. Local communities are not organized and do not have the knowledge to manage the mountain wild routes for their people benefit and prosperity. Inequitable enrichment of a small group with central tour operator connections, recent build guest houses and pensions represent a real problem between community members. Chaotic touring can affect the natural environment. Bikers and hikers would cause some environmental damage from their presence on wild routes like general trail erosion, reduction in water quality, disruption of wildlife and changes to natural vegetation (Davies & Newsome, 2009). It is not the case in Transylvania wild routes yet because the lack of tourists, but their increasing presence in the future will scare timber thieves who are using the routes in the process of illegal deforestation that really destroy wildlife and natural vegetation.

2. RESEARCH METHODOLOGY

To achieve the graphic material we used 1:25,000 topographic maps, which were the primary basis for achieving 1:5,000 scale maps and orthophotos (ANCPI, 2005) which helped in the process of identifying and vectorization of the wild routes (Nicoara & Haidu, 2011). For the final map elaboration we used general vector datasets of Romania (Craciunescu, 2007). The tracks were accurately measured and the trails plotted on both topographical map and orthophoto. GIS tools and interview results helped us in making the final routes selection from all mountain trails, trekking paths and gravel roads. Six pedestrian trails in Calimani, Gurghiu, Piatra Craiului, Fagaras, Retezat, Trascau Mountains and seven motor/bike/auto routes from Calimani, Gurghiu, Fagaras, Parang, Trascau and Apuseni Mountains.

We used a digital elevation model (DEM) in ArcGIS 10 to create topographic profile graphs, showing elevation as a function of distance along the profile route. The Digital Elevation Model (ASTER, 2011) was developed and made available online to the public by the METI and NASA at http://asterweb.jpl.nasa.gov/gdem.asp. From 3D Analyst toolbar we chose Interpolate Line tool to start creating the profile and adding points on the route. From the same toolbar (3D Analyst) we chose Create Profile Graph tool, finally obtaining the profile graph. The process of mapping wildness routes uses GIS to merge layers of data that reflect key criteria like ruggedness and remoteness from main access roads, naturalness of vegetation, density of modern human built structures that influence how wild a landscape

is perceived to be. These criteria were based on existing relevant policy and supported by public perception studies of wild land in Scotland (Glass, McMorran, & Price, 2013, p.103).

3. TRANSYLVANIAN VOLCANIC RANGE

The volcanic range in the East presents two pedestrian access options and two motor/bike/auto routes. Selection was based on foreign tourist options for off-road tours and tourist flow chart provided by Retitis Met Station and Lunca Bradului Mountain Rescuers Base Camp (Gherman, 2011). We have made the topographic profiles for Lunca Bradului Village- Ilva Valley- Negoiului Saddle- Pietrosu Calimanului Peak trail in Calimani Mountains (**Fig. 2**) and Lapusna Village- Secuieului Valley- Saca Tatarca Crater- Bucin Pass track in Gurghiu Mountains. For motor/bike/auto there is Toplita Cross- Retitis Peak- Met. Station in Calimani Mt. and Orsova Village- Gurghiului Meadow- Obarsia Glade-Prislop Glade- Copriana Glade- Breditel Meadow- Niraju Mare Valley- Campu Cetatii Village in Gurghiu Mt.

In Calimani Mountains we selected the best access option to the top (Pietrosu Calimanului Peak, 2303 m) from Lunca Bradului village on the Mures river valley. Railways network, county roads in excellent condition make this starting point feasible for plotting the trail on ortophoto (**Fig. 3**). The same reasons conclude for the off-road section Toplita Cross-
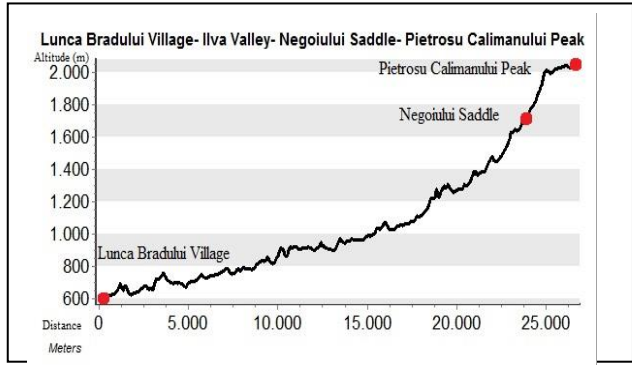

Fig. 2 Calimani Mt. walking track profile graph.

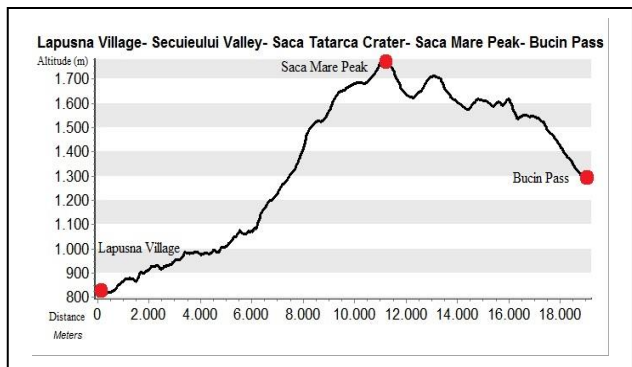**Fig. 3** Walking track in the Calimani Mountains.

Fig. 4 Gurghiu Mt. walking track profile.

Retitis Peak- Meteorological Station. This route is impracticable after heavy rains but it is always repaired and challenging with prolonging options over the Calimani Range to Gura Haitii Village and Vatra Dornei.

The Gurghiu Mountain options were diverse but finally we considered Lapusna Village as the hub point for the trekking trail (**Fig. 4**) because of the local community and former railway infrastructure.

Fig. 5 Gurghiu walking track ortophoto.

Until 1990s there was an old *wild –west* style train operating on the Secuieului Valley from Lapusna Village upstream to the Saca-Tatarca crater. The off-road route has two traditional villages at each end and its crossing the mountains (**Fig. 5**).

4. TRANSYLVANIAN ALPS

The Meridional Carpathians from the South are presenting three exquisite pedestrian trails in Piatra Craiului, Fagaras and Retezat Mountains with fantastic on-route views, easy access start points and unique scenery from the top. These are:

1. Piatra Craiului Mt. (**Fig. 7)**: Zarnesti Town- Plaiu Foii Hut- La Lanturi Route- La Om Peak.

The starting point is connected to the railway network from Brasov and offers a well maintained gravel road access to Plaiu Foii Hut (**Fig. 6**) that is also feasible for biking tours. The huge elevation (more than 1000 m) between this access road and mountain tops gives the fantastic and unique on-route views, that makes it the most scenic and impressive easy access wild track from the Transylvanian mountains. The trail from Plaiu Foii Hut to
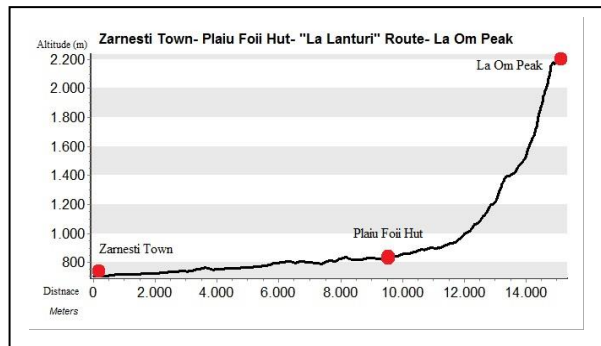

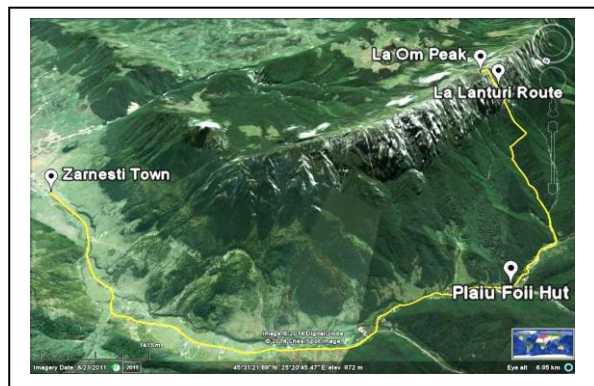**Fig. 6** Walking track profile in Piatra Craiului Mt.

Fig. 7 Piatra Craiului Mt. walking track ortophoto.

the La Om Peak is rock challenging because of the steepness and iron cables designed for helping the tourist to cross the gaps and overcome the high declivity.

2. Fagaras Mt.: Brancoveanu Monastery- Valea Sambetei Hut- Moldoveanu Peak.

This walking track (**Fig. 8**) reveals the wild beauty of the trail to the highest Romanian mountain. Foreign tourists are looking for the shortest and easiest way to the top and often choose the Vistei Valley wrong route, because it appears the shortest on tourist maps (Voda, 2013). Combining cultural tourism embedded in Brancoveanu Monastery from the start point (**Fig. 9**) with ecoturism on the Sambetei Valley route this pedestrian trail offers the best mountain experiences for those who are seeking the highest mountain from each visited country.
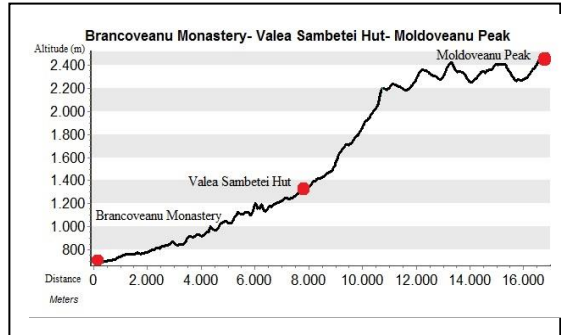

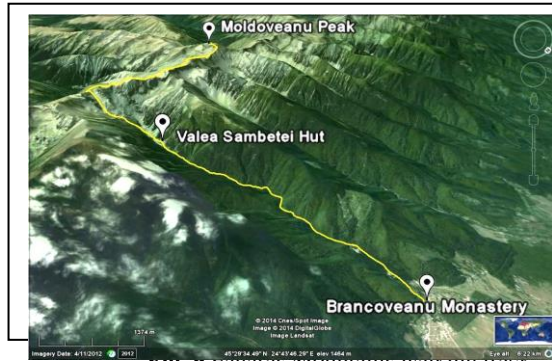**Fig. 8** Walking track profile in the Fagaras Mt.

Fig. 9 Fagaras Mountains walking track ortophoto.

The local community from Sambata de Sus Village is actively involved in tourism. Many pensions were built after 2000s by the locals.

3. Retezat Mt.: Carnic Village- Pietrele Hut- Bucura Saddle- Peleaga Peak (**Fig. 10**).

This mountain wild route (**Fig. 11**) is one of the most popular for Romanian mountaineers, taking you in the heart of untouched wilderness surrounded by spectacular granite massifs standing like the towers of an immense citadel.

Retezat Mountains are the most beautiful mountains on Earth, a combination of Mount Kenya, Himalaya and Rocky Mountains. The largest glacial lake lays here: Bucura Lake (more tha 8 ha) and the deepest also: Zanoaga Lake (more than 35 m).
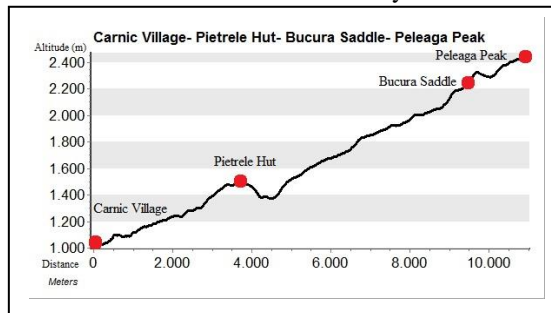

Fig. 10 Walking track profile in Retezat Mt.

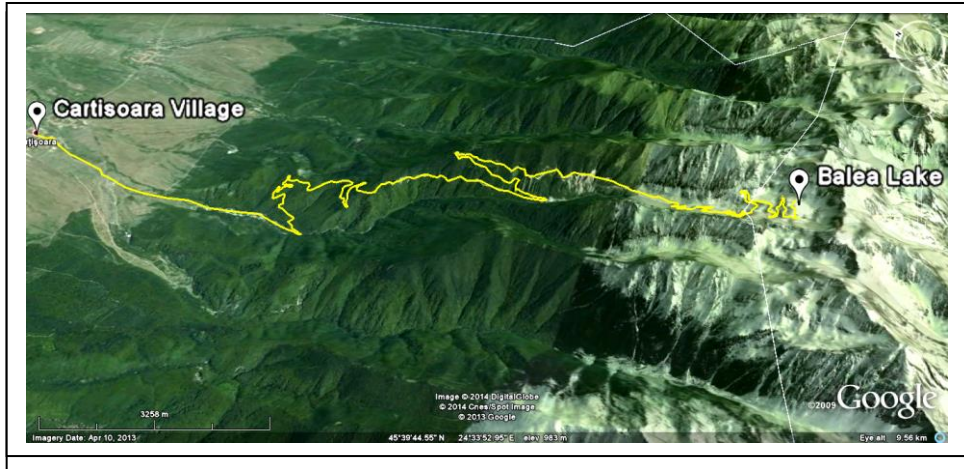**Fig. 11** Retezat Mountains walking track ortophoto.

Fig.12 Transfagarasan acces auto route.

Fig.13 Transalpina access route in Parang Mountains.

Wild bears, grey wolfs, chamois, red deer, Eurasian lynx and the golden eagle are all spread here. The best two auto routes are also here in Fagaras and Parang Mountains. First one starts in Cartisoara Village climbing up to Balea Lake and its simply called *Transfagarasan* (**Fig. 12**) because is crossing the Fagaras Mountain range to Vidraru storage reservoir and Curtea de Arges city. The second one is an access route to the famous *Transalpina* and starts in Sebes Town following the Sebes Valley up to Oasa Lake and Obarsia Lotrului Crossing (**Fig. 13**). The motor/bike and off-road route follows the Frumoasei Valley up to the Cindrel Pass descending on the other side trough Sadu Valley down in Talmaciu Village.

5. TRANSYLVANIAN WESTERN RANGE

The Occidental Carpathians bordering Transylvania from the West are offering a wide variety of ancient rural landscapes with amazing traditional houses on these two selected motor/bike/auto routes:

1.Trascau Mt.: Aiud Town- Ramet Gorges- Ponor Village- Mogos Village- Buciumarilor Valley- Abrud Town (motor/bike/off road route)

2. Apuseni Mt.: Turda City- Ariesului Valley-Campeni Town- Abrud Town- Brad Town- E 673 exit (*Transapuseni* auto route).

The Trascau Mountains pedestrian trail is starting at Ramet Monastery to a scenic gorges series: Rametului Gorges and Piatra Baltii Gorges going up to the traditional Intregalde Village than descending trough Intregalde Gorges to Galda de Sus Village.

6. CONCLUSIONS

Using new maps and geographical information freely provided on internet and promoted on different social media channels, foreign tourists number will increase on Transylvanian wild routes. Each summer more and more bikers arrive at the Retitis Meteorological Station in Calimani Mountains, in Cartisoara Village for Transfagarasan or at Obarsia Lotrului Crossing for Transalpina route.

This paper will help local communities to organize and better manage the mountain wild routes for the benefit and prosperity of their own people. Offering accommodation in their own houses, providing food from their own garden increases the success rate on the hard way to prosperity. Taking into account the environmental problems and protection, we determined the exact entry-exit points with no off-tracks on route in order to minimize the negative impact and increase the physical support capacity of every wild track analyzed from Transylvanian mountains.

Community-based tourism organizations can stabilize rural households' livelihoods and contribute to community welfare. Establishing this type of organizations in the proximity of mountain wild routes, with a democratic structure, with elected and regularly rotating offices—prevent the inequitable enrichment of a small group of members and ensure that benefits are evenly distributed among all members and the whole community (Steinicke & Neuburger, 2012). Small or big week-end cottages built in the 1990s on the Ilva Valley can became official tourist accommodations runned by locals for their community welfare.

Electronic devices with built-in GPS receivers such as smart phones and recently tablet computers have become increasingly popular and affordable in the past years (Schobesberger & Kriz, 2010). Downloadable GIS data for tourists' GPS devices will help them stay exactly on the routes minimizing the environmental impact. First smart phone application will give information about the accommodation in the route area with photos for each house, hut or cottage in order to ease the identifying process and choose from a wide variety of local homes in order to help the locals for their own benefit.

Mountain wild routes are not very well marked with tourist signs so even with a modern GPS you can get lost. Magyari-Sáska and Dombay (2012) tried to determine possible locations where a lost tourist could reach in after a given time from its lost. Our second smart phone application proposal will offer tourist on-line assistance. This way they can call anytime an operator for indications if they feel lost or in need for something. The mobile phones built-in GPS receiver will transmit their position to the operator who can easily give them directions and information.

R E F E R E N C E S

ANCPI. (2005) *Orthophotoplans.* Direcţia Comunicare, Bucureşti.

ASTER. (2011) *Global Digital Elevation Model Version 2* (GDEM V2), [Online] Available from: http://asterweb.jpl.nasa.gov/gdem.asp. /, [Accessed 16 January 2014].

Craciunescu, V. (2007) *Romania: seturi de date vectoriale*. [Online] Available from: http://earth.unibuc.ro/download/romania-seturi-vectoriale. [Accesed 10 January 2014].

Davies, C. & Newsome, D. (2009) *Mountain bike activity in natural areas: impacts, assessment and implications for management: a case study from John Forrest National Park*. Western Australia, CRC for Sustainable Tourism Pty Ltd.

Glass, J., McMorran, R. & Price, M. F., (2013) The Centre for Mountain Studies Contributes to Sustainable Mountain Development at All Scales. *Journal of Mountain Research & Development*, 33 (1), p.103.

Gherman, Adriana (2011) *SW*OT analyssis, strategies and proposals for development of tourism in the volcanic massive Caliman and Gurghiu. In *Vol. Simpozionului Universitatii Dimitrie Cantemir*, Tg. Mures.

Magyari-Sáska Zs. & Dombay, Ş. (2012) Determining minimum hiking time using DEM. *Geographia Napocensis*, 7 (2).

Nicoară, M. E. & Haidu, I. (2011) Creation of the Roads Network as a Network Dataset within a Geodatabase. *Geographia Technica*, 2, 81-86.

Schobesberger, D. & Kriz, K. (2010) Advances of interdisciplinary cartography in the Himalayan Mountains. *Geographia Technica*, 12, p.123.

Steinicke, E. & Neuburger, M. (2012) The Impact of Community-based Afro-alpine Tourism on Regional Development. Case Study Mt. Kenya. In: *Mountain Research and Development Journal*, 32 (4), 420-430.

Voda, M. (2013) The role of Geospatial Technologies, Geographic Information and ICT in promoting rural communities sustainable development in Transylvania. *Academica Science Journal, Geographica Series*, 3, 90-95.