# Site Location and Construction of Ski Resorts Using Geographical Information System (GIS) in Isfahan Province

# Site Location and Construction of Ski Resorts Using Geographical Information System (GIS) in Isfahan Province

**N Gabdrakhmanov[1], S Hosseini[2]**

[1]Kazan Federal University, Institute of management, economics and finance, Kremlevskaya str.18, Kazan, ZIP Code: 420008, Russia
[2]University of Isfahan, Hezarjerib Street, Isfahan, ZIP Code : 81746-73441, Iran

E-mail: nz99nz@yandex.ru

**Abstract**. Considering the dry and hot climate governing Isfahan province, development of winter tourism (tourism development and providing the conditions for tourism) can bring in a different attraction for this province adding to its tourism potentialities i.e. the countless historical and cultural tourism attractions. The availability of high mountainous regions appropriately covered with snow can provide a susceptible field for winter tourism. This research is applied-developmental in nature aimed to locate and identify the appropriate areas and points for the construction of ski resorts in Isfahan province. For positioning and identifying the susceptible areas for the construction of ski resorts, the Isfahan's high areas over than 2300 m were taken into account which were identified by applying analytic functions technique and satellite images. For locating, 7 measures including height, slope degree, temperature, snow depth, distance from the residential areas, infrastructure facilities and accessibility to communication roads were used. Besides, the statistical data obtained from 21 synoptic stations including that of Isfahan as well as nearby stations of Borujen, Saman, Si Sakht and Yasuj were also used. As per the obtained maps, Fereydunshahr, Semirom and a part of Chadegan were of high capability for the construction of ski resorts and winter tourism, respectively. In addition, the near distance between several villages and towns located close to these regions not only can play an effective role in the economic variety and development of these regions but also can significantly assist the management and maintenance of the ski resorts which should be deemed as a very important issue for the survival of such ski resorts.

## 1. Introduction

Tourism industry has experienced a considerable growth in the recent years (Casagrandi & Rinaldi, 2002: 1). The high potential of this industry has guided the developing countries toward tourism development as an "engine" driving the macroeconomic growth (Torres & Momsen, 2004: 294). As a particular branch of tourism, winter tourism provides the tourists the opportunity to perform different types of snow sports (Golijanin, 2011:4). According to Beyazıt, winter tourist is "any person who trips mainly for performing winter sport activities and enjoying the snow-dependent natural attractions" (Weber, 2001:361). As a climate phenomenon, snow is known as white gold in some developed courtiers that enjoy tourism advantage (Ximei, 2010: 174). It is noteworthy that "less desirable conditions like the lack of the snowfall in the winter may cause losses in this category of tourism (Steiger, 2011: 4). In the recent years, some factors such as increased level of skill, enhanced demand for quality, increased level of tourist's technical knowledge along with the improvement of the transit

infrastructure has unprecedentedly increased the number of winter sports tourists (Unbehaun, Probstl & Wolfgang, 2008: 37). Winter tourism is being strongly welcomed by the nations in this era in so far as this type of tourism accounts for as much as %80 of the tourism-related income in some countries such as Swiss and Austria (Pestereva, 2012: 1603). Tourists tend to prefer those vacation destinations more that besides being snowy, possess high quality accommodation facilities and recreational facilities (Unbehaun, Probstl and Wolfgang, 2008: 37). Skiing is known as the most common and popular winter sports (Beyazit, *2010.679*). In fact, by ski tourism, a tourist can benefit from trip, sport as well as recreation-related advantages simultaneously (Weber, *2001*: 361). Developing ski tourism resorts brings numerous advantages for the involved regions including economic and income variety, infrastructures and services improvement, mental safety of the local residents and lowered negative environmental effects (Lasanta, 2007: *1327* ). There are different factors that have a deterministic effect on the site location and designing of the ski resorts. Hence, different criteria especially climate, topography as well as tourism-related factors must be taken into account by the planners (Badri et al, 2009: 36). Among the studies conducted on winter tourism and ski, the following ones can be enumerated: Lasanta (2007) has examined the effects of ski resorts on the local communities in the central Spanish Pyrenees. Based on the results of this study, although ski resorts has resulted in positive demographic changes, it has also placed some negative effects on the main economic activities common in this region, namely animal husbandry and agriculture so that the number of the individuals performing such activities has shown a gross decrease. Andrew Holden (2000) in his article has studied the conflict between the winter tourism and the environment meticulously illucidating the positive and negative environmental effects of tourism on the mountain areas focusing on Cairngorm, Scotland. In the same vein, Kamer (2002) has examined the impact of the global warming on the winter sports in the Alps in Europe. He also has detailed the restoration project implemented for the winter sports by creating artificial snow in this region. Breiling et al (1999) conducted a study on the effect of global warming on the winter tourism and skiing determining the snow quality and characteristics based on a regional model in Austria. In Iran, Taghvaei & Hedayati Moghadam (2008) investigated the criteria used for site location for designing the skiing resorts and its respective problems and benefits clarifying the existing problems for operating and using ski resorts in Iran. Mahdavi & Bishmi (2014) looked at the development of rural tourism in Shemshak ski resort using Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis model. As per the results, the current strategies taken for the development of winter tourism in the villages adjacent to the Shemshak ski resort have been targeted towards the competitive strategy. This strategy is traceable and operationlizable in terms of 8 sub-strategies. However, to attain the desirable position in the winter tourism development domain centered on the participation of the villages adjacent to the Shemshak ski resort, taking the leap-aggressive strategy seems to be a necessity. In another study, Rezvani et al (2013) explored the site location for the construction of ski resorts in terms of tourism perspective in the Northern regions of Tehran. They concluded that some parts of the village of Roudbar Ghasran in Shemiranat county, the central part of Abali village in Damavand county and the central and western parts of Firuzkuh county are among the most susceptible areas for the construction of ski resorts. The ski tourism capacity has not been sufficiently exploited in Iran in terms of the operation of winter sports-recreational facilities. Furthermore, it is noteworthy that due to the low quality of the existing facilities in the Iranian ski resorts and their insufficient capacity, from among 26 ski resorts available in Iran, only 6 resorts have succeeded to be certified by the International Ski Federation. The start of the cold season in Isfahan province is usually accompanied by stagnation and in trips due to undesirable tourism climate. However, the availability of tourism potentials such as its numerous high mountaintops due to its location in the route of Zagros range can be effective in attracting the tourists to these regions in the cold seasons of the year. This can be used as a justification for the construction of skiing resorts and the expansion of winter tourism. As a result, it is necessary to conduct further convincing research on planning for exploiting the environmental and climate related capacities of these regions. In addition, since these ski resorts are located close to the

villages, it can be used as an appropriate opportunity for the economic empowerment and employment in the non-agricultural activities in a lot of villages.
This research tries to find the answers to the following questions regarding the construction of ski resorts in Isfahan province (see figure no. 1):

- Does Isfahan province possess the required capability and potential for the construction of the ski resorts?
- Does Isfahan province enjoy the appropriate resources and facilities for the appropriate management of these ski resorts?

**Figure 1.** Isfahan province.

## 2. Methodology

The main purpose of this study was to locate and identify the potential tourism points and areas for the construction of ski resorts in Isfahan province. Given the factors in question, this research was applied-developmental in type conducted using descriptive-survey research method based on systematic analysis taking into account the following items: the capacity exploitation, capability assessment, and integration, combination and identification of potential areas. Site location and identification of the potential points and areas for the establishment of ski resort was done by applying the analytic function technique and satellite imagry. The topographic maps (Digital Elevation Model (DEM)) were prepared applying the satellite maps (Shuttle Radar Topography Mission (SRTM)) and GIS software to be used for the study of the topographic conditions and available spatial analyses. Enjoying a much higher precision compared to other methods common in Iran, the Special Sensor Microwave Imager (SSM/I) satellite data were also used for calculating the snow depth.

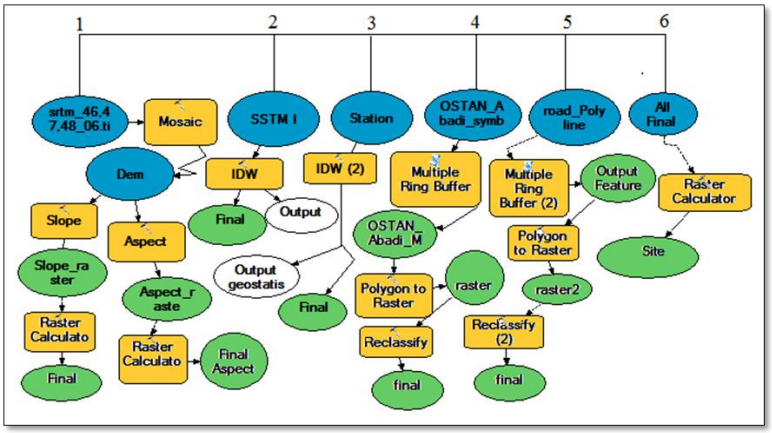


**Figure 2.** Algorithm developed for the site location and construction of ski resorts in Isfahan province using GIS.

To respond to these questions, firstly, the layers and mappings relating to each measure were prepared based on the rankings and classification common for each measure. In the next stage, the necessary conditions were applied to each measure so as to produce the map for each criterion considered for the construction of ski resort (see figure no. 2).

## 3. Results & Discussion

The main purpose of this research was to locate the ideal sites for the construction of ski resorts in Isfahan province. Identification and selection of the metrics and criteria (as summarized in table no.1) is considered as the first stage in this research. In the present study, the following metrics were used for delineating the status of Isfahan province: height, slope gradient and slope direction prepared using the digital height model, temperature prepared using 25 synoptic weather stations, the snow depth prepared using SSM/I data. As an appropriate resource for snow depth estimation, SSM/I is of more accurate compared to other common techniques in Iran considered as superior to other techniques used in similar research, as a result. Access to communication roads and the value of distance from the residential areas and consequently, the infrastructure facilities available for the construction of the ski resorts so as to provide safety, better management, servicing and employment in the region are also of high significance.

**Table (1).** Assessed metrics for the site location of ski resorts.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Height | Slope gradient & direction | Temperature | Snow depth | Temperature | Infrastructure facilities | Access to the communication roads | Distance from the residential areas |

Table (2): Meteorology stations used in the research

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Zarishahr | Daran | Khour & Beabanak | Khansar | Choopanan | Boroujen | Isfahan | Ardestan |
| Kaboutarabad | Kashan | Fereidounshahr | Shahreza | East of Isfahan | Sisakht | Semirom | Saman |
| Varzaneh | Natanz | Najafabad | Naein | Meimeh | Mourchekhort | Mobarakeh | Golpayegan |

Due to the raw nature of the data collected from various resources, it was necessary to process them in the first stage so as to make them appropriate for their subsequent use for the site location purpose. Accordingly, after selecting the respective metrics and identifying their respective sources, valuation of the data layers (i.e. separating and conditioning of the afore-mentioned maps) was done that led to the creation of the maps for the following attributes: height, slope, slope direction, temperature, depth of snow, distance to village and roads scattering. Slopes higher than 10% and lower than 35% (the slopes considered as appropriate for ski for different people) and the Northern, Northeastern and Northwestern directions were considered as appropriate for the purpose of this research. Snow depth and snow persistence patterns are closely related to temperature so that the lower the temperature, the higher the persistence of snow will be. On the average, the persistence period in the range of 2-3 month or a snow depth of 10 cm are generally deemed as appropriate for skiing purpose. Spatial modeling of various involved criteria was done using GIS software and analytical functions. As for final mapping of the optimal sites, it was necessary to combine the maps produced for each class. To do so and to perform the raster analyses, the produced raster maps are required to be reclassified. Based on the new classification, new rankings are assigned to different levels. In the next step, the maps that differ in terms of their score are combined in 3-D analyst tool. For the purpose of this research, 200×200 m2 was used as the size of the. The main but the most challenging stage in the evaluation process is data summation that allows final evaluation. As for evaluating and identifying

the appropriate areas for building ski resorts in Isfahan province, firstly, the digital mappings of the metrics in question were prepared. Then, the necessary conditions in the classified format were considered and their respective mappings were produced. Accordingly, Isfahan province was subdivided into 4 distinct categories (see map no.10). The first and second categories were inappropriate for the construction of ski resorts while the forth category enjoyed the highest capacity deemed as highly appropriate for the ski resort construction. In more detail, as per the results, the most ideal and optimum areas for the construction of ski resorts in Isfahan province were as follows: Fereydunshahr county especially its southern regions including Moguei Poshtkuh and Ashayer villages, Semirom county especially its central regions and finally, Northern and Southern Chenarud villages located in Chadegan county.

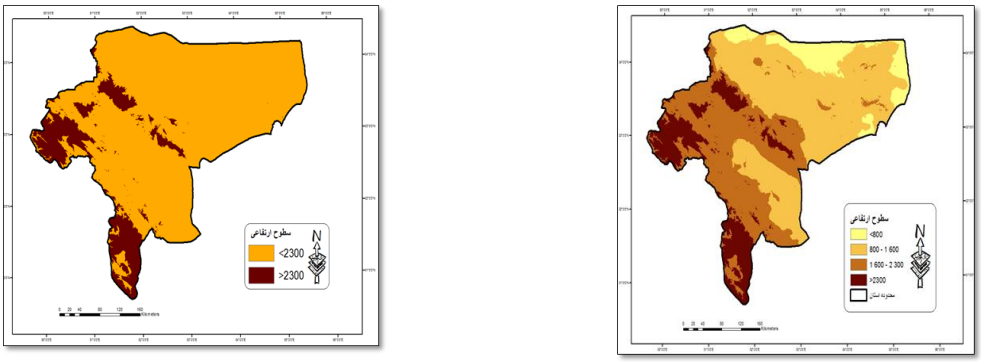

**Figure 3.** The elevation map for the construction of ski resorts (source: authors).

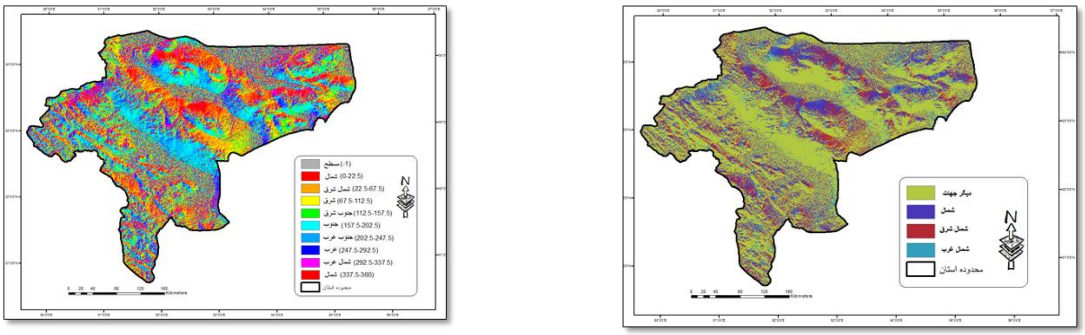

**Figure 4.** The slope map (source: authors).

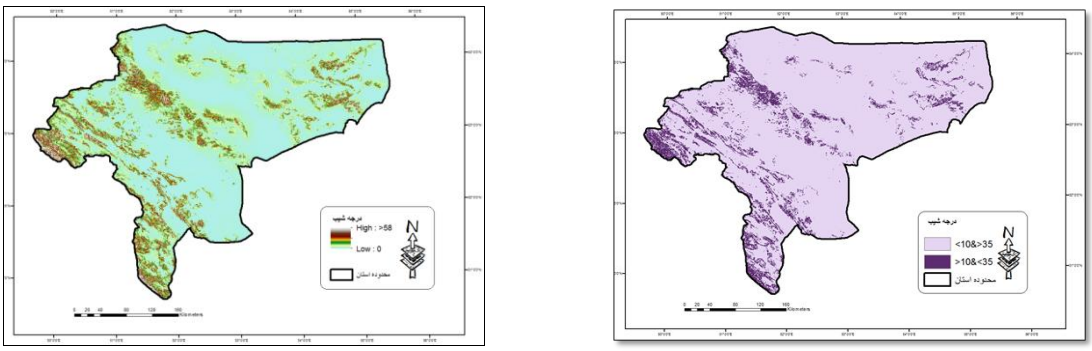

**Figure 5.** The slope gradient map (source: authors).

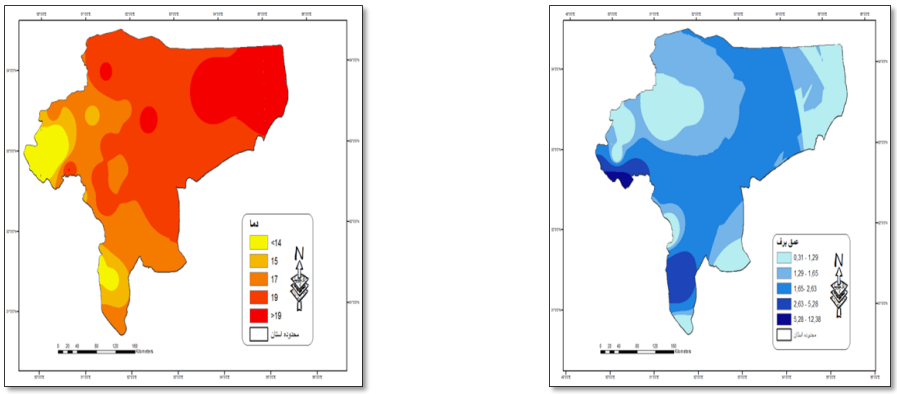

**Figure 6.** The temperature and snow depth maps (source: authors).

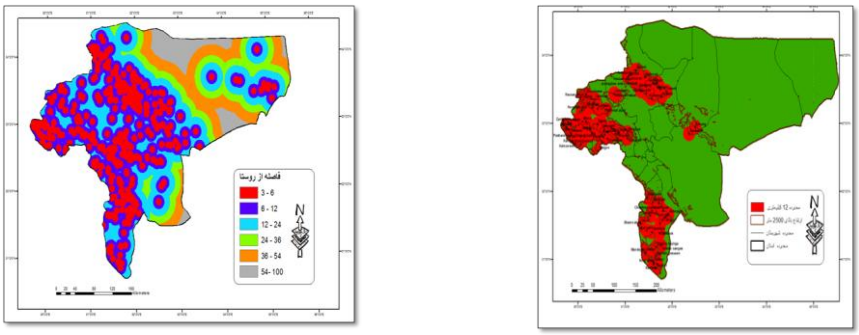

**Figure 7.** The distance from residential areas map (source: authors).

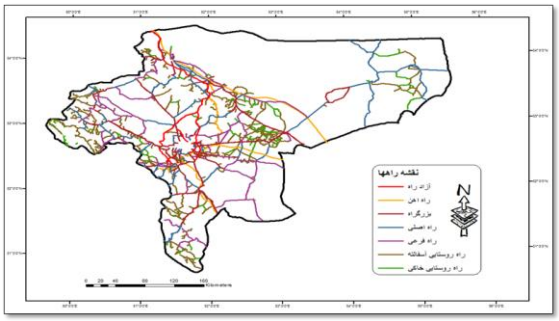

**Figure 8.** The roads map(source: authors).

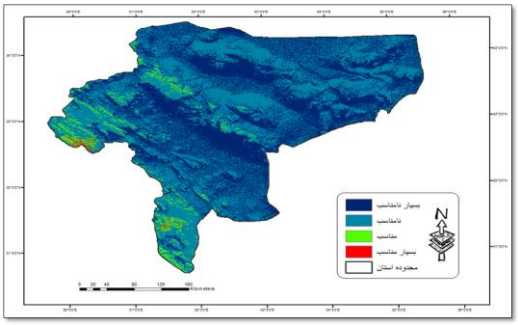

**Figure 9.** The appropriate and inappropriate areas map based on climate- environmental factors (source: authors).

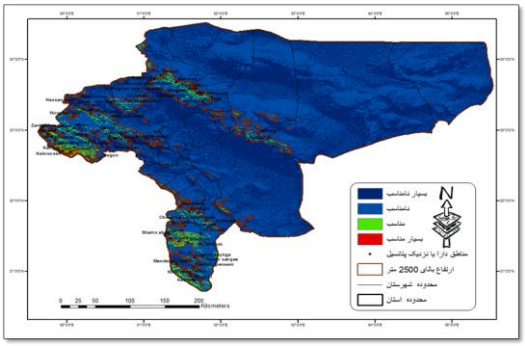

**Figure 10.** The final mapping of site location of ski resorts in Isfahan province (source: authors).

## 4. Conclusion

On the basis of the data gathered in the analysis step, the results obtained in this study as for the site location and identification of susceptible points and areas (areas with height over 2300m) for constructing the ski resorts and winter tourism destinations in Isfahan province in fact represent the region's capacity assessment in the form of a classification (map no. 10). Every classification possessed its own particular attribute. The assessment was done in four levels so that levels no. 1, 2 and 3 represented an area without capacity, inappropriate area and a high capacity area as for the development of the winter tourism and construction of ski resort in the region, respectively. As a result, spatially represented in the final map as the potential points, Isfahan and thus, its towns and civil/rural areas possessed the background required for the expansion of such activities. As per the data obtained from the integration of the maps prepared in Isfahan province, the most appropriate and significant potential area for the construction of ski resort belonged to Fereydunshahr county especially its southern districts including the villages of Moguei Poshtkouh and Ashayer, Semirom county and its central regions with the centrality of Semirom as well as Northern and Southern Chenarud villages located in Chadegan town. The optimal sites in the county of Semirom were found to be Semirom city, Bardakan village, Vanak city, Khefer and Shamsabad villages, in order. As for Fereydunshahr county, the Ghale'h Sorkh village (rural center with a Health Care Center), Koluse, Dorak and Pashandegan (with a HealthCareCenter) were found to enjoy the first priority while Vezve, Vastegan, Kahgan, Gukan, Kahgan Nargushe, Viheh, Bardshir, Tahlegi and Zemestaneh occupied the following rank. Finally, as for Chadegan county, the Oregan of Dolatabad, Gukank, Agaricheh, Cheshmandegan, Baghnazar, Hermank and Varbad were among the top priority appropriate susceptible tourism areas to be taken into account by the province's tourism authorities for the future respective planning.

## 5. References

[1] Meteorological Organization Department of Chaharmahal and Bakhtiari Provinc
[2] Badri, Sayed Ali, Vosoughi, L Site Location tourist spots for skiing, Case study *Ardabil Province Geographical Research Quarterly 93 .44-25 ،*(Persian)
[3] Taghvaei M. Hedayati M Z 2008The criteria for switching the location and designing ski resorts and benefits and issues in Iran *Geography: growth of geographic* 86 pp 37-44 (Persian)
[4] Rezvani M, Najafi M *2013* Site location ski resorts in point of view from tourism (Case study: In the north of Tehran) *Journal of Regional Planning* 10 27-44 (Persian)
[5] Statistical Yearbook of Isfahan province 2011 (Persian)
[6] Meteorological organization website 2016 (Persian)
[7] Mahdavi M, Bishami B 2014 The development of winter tourism in rural destinations (Case study: villages along the track SHEMSHAK north of Tehran) *Journal of research in Human Geography* 4 pp 889-903 (Persian)
[8] Beyazit M F 2010 An Analysis of Snow Options Forski Resort Establhsments Tourism Management 31 676- 683
[9] Breiling M and Charamza,P 1999 The Impact of Golobal Warming on Winter Tourism and Skiing: a Regionalized Model for Austian Snow Conditions *Regional Environmental Change1*
[10] Holden A 2000 Winter Tourim and the Environment in Conflict: The Case of Cairngorm Scotland *International Journal of Tourism Research* 2 4 247-260
[11] Jenning G 1998 Tourism research *John Wily SongLtd Australia* 241
[12] Kammer P 2002 Floristic changes hn subalpine grasslands after 22years of artificial snowing *Journal for Nature Conservation* 10 109-123
[13] Lasanta Teodoro and Srgio Laguna 2007 Do Tourism- Based Ski Resorts Contribute to the Pyrenees *International Journal of Tourism Management* 28 1326-1339
[14] Pestereva Nina M. Popova Nina Yu And Shagarov Lev M 2012 Modern Climate Change and Mountain Skiing Tourism: the Alps and the Caucasus *European Researcher* 30 9-3 1602-1617

[15] Steiger Robert 2011 The impact of snow scarcity on ski tourism: an analysis of the record warm season 2006/2007 in Tyrol (Austria) *Tourism Review* 66 3 4-13.
[16] Weber karin 2001 Outdoor Adventure Tourism A Review of Reasearch Approaches *Annals of Tourism Research* 28 2 360-377
[17] Ximei Z 2010 Research on marketing developmnt of central of Plains on Tourism case of Henan Province Proceedings of 2010 *International Symposium on Tourism Resources and Mangement* 174-178
[18] Torres Rebecca and Momsen Janet Henshall 2004 Challenges and potential for linking tourism and agriculture to achieve pro-poor tourism objectives Progress in Development Studies 4 4 294–318
[19] Golijanin1 Jelena 2011 Geological Evaluation of Ravna Plannia in The Function of Winter Tourism Journal of the Geographical Institute 2 pp 1-10
[20] Unbehaun Wiebke Probstl Ulrike and Haider Wolfgang 2008 Trends in winter sport tourism *challenges for the future Tourism Review* 63 1 36-47
[21] Casagrandi R, Rinaldi S 2002 A theoretical approach to tourism sustainability *Conservation Ecology* 6(1) 13 http://www.consecol.org/vol6/iss1/art13/