

GEOKOLOŠKO VRJEDNOVANJE RELJEFA OTOKA PAŠMANA

GEOECOLOGICAL EVALUATION OF ISLAND PAŠMAN RELIEF

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Geokološko vrjednovanje reljefa otoka Pašmana s aspekta njegova turističkog vrjednovanja provedeno je na temelju prethodne geomorfološke analize reljefa otoka, a za potrebe određenih tipova turističkih aktivnosti (kupanje, sunčanje, šetnja, škraping), i to u smislu njegove fizičke pogodnosti, estetske vrijednosti i dostupnosti.

Primijenjena je metoda relativnog vrjednovanja reljefa u okviru četiriju morfografskih kategorija: padine, vrhovi, dolinska dna i korita te obale. Prema toj metodi, kao glavni ograničavajući čimbenik turističke valorizacije pojedinih dijelova otoka Pašmana, javio se problem nedostupnosti, osobito na strmijoj jugozapadnoj strani otoka (udaljenost, nepostojanje ili manjak uređenih staza i pristaništa). U skladu s tim, dano je nekoliko prijedloga kao mogućih rješenja toga prisutnog problema (uređivanje staza, informiranje turista o mogućim individualnim ili grupnim šetnjama do pojedinog odredišta, organiziranje stručno vođenih izleta).

Ključne riječi: otok Pašman, geokološko vrjednovanje, metoda relativnog vrjednovanja reljefa

The geoecological evaluation of the relief of Pašman Island from the standpoint of its touristic evaluation was conducted on the previously conducted geomorphologic analysis of the island relief. The evaluation was conducted for the needs of specific types of touristic activities (swimming, sunbathing, walking, "škraping") in the sense of its physical favourability, aesthetic value and accessibility.

The method of relative relief evaluation was applied, whereby relief was evaluated within four morphographic categories: slopes, peaks, valley bottoms and beds and the coast. According to this method, as the principal restricting factor of tourist evaluation of certain parts of Pašman Island is the problem of inaccessibility, especially on the steeper south-west façade of the island (remoteness, inexistence or lack of arranged paths and wharfs). In accordance therewith, several proposals as possible solutions to the present problem were given (arrangement of paths, informing tourists on possible individual or group walks to certain destinations, organising trips with professional guides).

Key words: Pašman Island, geoecological evaluation, relative relief evaluation method

Uvod

Danas čovječanstvo, s time i znanost u službi života, stoji pred bitnim problemom vezanim za prirodni okoliš. Današnja civilizacija svojim razvojem na različitim područjima života velikom brzinom mijenja upravo prirodni okoliš, te je sve izraženiji imperativ zaštite i očuvanja okoliša i očita je potreba za optimalnim korištenjem životnog prostora i gospodarenjem njime.

Prirodni okoliš može se promatrati u širem (ekosfera, geosfera) i užem smislu (tehnosfera ili izmijenjeni prirodni okoliš). Vrjednovanje geosfere podrazumijeva analizu prirodnog okoliša (reljef,

Introduction

Humanity today, and thereby science in the service of life, face an important problem regarding the natural environment. Modern civilisation with its development in various walks of life changes precisely that natural environment at a great speed, and the imperative of protecting and preserving the environment is ever more pronounced, and the need for optimal use and management of living space is evident.

The natural environment can be observed in the wider (ecosphere, geosphere) and narrower sense (technosphere or modified natural environment).

klima, vode, tlo, biosfera) te analizu energetske izvora prirodnog okoliša (mineralni izvori, hidrometeorološki izvori, pedološki i biosferni potencijal). Pri vrjednovanju tehnosfere provodi se analiza izmijenjenoga prirodnog okoliša (antropogeni reljef, tehnogeni objekti, uzgajane biljne kulture, degradirana i revitalizirana tla, onečišćena vodna područja) te energetske izvori izmijenjenog okoliša (energetski izvori uzgajanih biljaka, turistički potencijali) (BOGNAR, 1990.).

Međusobna interakcija prakse i znanosti postavila je brojne zadatke pred sve prirodne znanosti pa tako i pred geografiju, unutar koje i izravno na geomorfologiju. Geomorfologija, kao znanost o značajkama, nastanku, evoluciji i suvremenoj dinamici reljefa Zemljine površine (BOGNAR, 1979.) svojim je pristupima, metodama i rezultatima istraživanja usko vezana za ekološku problematiku. Reljef se može promatrati kao pojavni oblik koji utječe na sve ostale prirodne datosti u prostoru (površinski i pripovršinski dio stijenskog kompleksa, obilježja tla, klime, vegetacije, vode, itd.). U skladu s tim, načini vrjednovanja reljefa mogu se provoditi s različitim motrišta, a rezultati se koriste u različitim gospodarskim granama (građevinarstvo, promet, turizam, itd.). Praksa traži određena rješenja problema te je sve više primijenjenih znanstvenih se radova u kojima se, poslije geomorfološke analize, provodi i geokološko vrjednovanje reljefa.

Pregled dosadašnjih geokoloških pristupa i istraživanja prirodnog okoliša

Geokologija (ili ekologija krajolika)¹ dodirna je znanstvena disciplina (na dodiru geografije, biologije i drugih srodnih znanosti) čiji je temelj proučavanje međudnosa čovjeka i njegova životnog prostora – otvorenog

¹ Ekologija krajolika (geokologija) je prema L. Miklosu (1994.) znanstveni temelj prostornog razumijevanja krajolika kao stvarnoga, cjelovitog okoliša života i rada čovječanstva. Izraz "ekologija krajolika" (engl. *landscape ecology*) prvi je put spomenuo C. Troll 1939. (*Landschaftsökologie*) kao ime znanstvene discipline na granici geografije i ekologije, definirajući krajolik s prostorno-funkcionalnoga (geografsko-ekološkog) gledišta usmjerenog samo na izgled i oblik (DRDOŠ, 1994.). U svom daljnjem radu Troll (1972.) je predložio novi međunarodni izraz Geocology, koji nije našao široku primjenu, ali ga dio znanstvenika ipak upotrebljava. Dakle, geokologija i ekologija krajolika su sinonimi i označuju istu znanstvenu disciplinu.

Evaluation of geosphere implies the analysis of the natural environment (relief, climate, waters, soil, and biosphere) and the analysis of energy sources from the natural environment (mineral resources, hydro-meteorological resources, pedological and biospheric potential). When evaluating the technosphere, the analysis of the modified natural environment is conducted (antropogenous relief, technogenic facilities, cultivated crops, degraded and revitalised soils, polluted water districts) and energy sources of the modified environment (energy sources of cultivated plants, tourist potentials) (BOGNAR, 1990).

The interaction of practice and science set numerous tasks to all natural sciences including geography within which also to geomorphology directly. Geomorphology, as a science of the characteristics, origin, evolution and modern dynamics of the relief of the Earth's surface (BOGNAR, 1979) is closely linked to ecological issues with its approaches, methods and results. The relief can be observed as a manifestation which influences all other natural givennesses in space (surface and near-surface part of the rock complex, characteristics of soil, climate, vegetation, water, etc.). In accordance with it, the manner of evaluating relief can be conducted from various aspects, and the results are used in various branches of economy (construction, traffic, tourism, etc.). The practice searches for certain solutions to problems and there are more and more applied scientific papers which after the geomorphologic analysis also provide the geocological evaluation of relief.

Overview of previous geocological approaches and researches of the natural environment

Geocology (or landscape ecology)¹ is a contact scientific discipline (on the contact of geography, biology and other similar sciences) the basis of

¹ According to L. Miklos (1994) landscape ecology (geocology) is a scientific basis of the spatial understanding of the landscape as a realistic, holistic living environment and activity of humankind. The term *landscape ecology* was mentioned for the first time by C. Troll 1939 (*Landschaftsökologie*) as the name of a scientific discipline bordering between geography and ecology, defining the landscape from the spatial-functional (geographic-ecologic) aspect oriented only on the appearance and form (DRDOŠ, 1994). In his further work Troll (1972) suggests a new international term Geocology, which did not encounter a wider application, but a certain number of scientists do use it nonetheless. Therefore, geocology and landscape ecology are synonyms and mark the same scientific discipline.

(prirodnog) i izgrađenog krajolika. Istraživanja se temelje na holističkom pristupu usvojenom od geografa, ekologa i dijela znanstvenika koji se bave planiranjem i gospodarenjem okoliša. Za razliku od regionalne, fizičke i socijalne geografije, geoekologija proučava ponajprije one geočimbenike koji imaju izravan ili neizravan utjecaj na živi svijet (GAMS, 1986.). To je interdisciplinarna grana znanosti čiji je objekt izučavanja vrjednovanje strukturnih i funkcionalnih veza u krajoliku – od prirodnoga krajolika preko kulturnoga sve do krajolika koji je snažno destruiran antropogenim djelovanjem.

Dakle, osnovni predmet istraživanja geoekologije je krajolik. U kontekstu geoekologije različiti autori različito su definirali pojam krajolika², no najzornijom se čini definicija koju je 1974. dao Krcho (MIKLOS, 1988.): "Krajolik se shvaća kao sustav koji se sastoji od dva, snažno prožeta podsustava – prirodni i socio-ekonomski dio sfere krajolika. Društvena i ekonomska sfera mnogo je složenija od prirodne sfere krajolika, te nije, u smislu geoekologije, u svim svojim aspektima uključena u sustav krajolika (*landscape system*)".

Najčešće poimanje krajolika je: *krajolik* = *geo(eko) sustav* (NEEF, 1967; KRCHO, 1978; NAVEH, LIEBERMANN, 1993. iz MIKLOS, 1994; MIKLOS, 1994.), a definira se kao SGk = (an, m), gdje su an – elementi sustava, a m – odnosi među njima. Posebno mjesto u geo(eko)sustavu zauzima georeljef (uz biotičke i antropogene faktore), koji čini dinamičnu, ali čvrstu, međuvezu litosfere, pedosfere, atmosfere, hidrosfere i biosfere (BOGNAR, 1990.). Odatle i ključna uloga reljefa u interpretaciji prostora i načina njegova korištenja.

² Zonneveld i Forman (1990.): *Krajolik, kako ga vidimo danas, prostorna je i materijalna dimenzija Zemljine stvarnosti i obilježava složeni sustav koji obuhvaća oblik reljefa i vodu, raslinje i tlo, te stijene i atmosferu.* Urbanek (1992.): *Krajolik je izvanredno složena pojava, on je prostorno-vremenski oblik reljefa. Ima svoj specifični prostorni raspored i vremenski ritam. Sadržan je u globalnoj i lokalnoj vremensko-prostornoj dimenziji* (iz DRDOŠ, 1994.). Drdoš (1994.): *Krajolik kao dom čovječanstva.*

which is the study of the interrelationship of the man with his living space – open (natural) and constructed landscape. The researches are based on the holistic approach adopted by geographers, ecologists and a certain number of scientists dealing with environmental planning and management. Unlike regional, physical and social geography, geoecology studies foremost those factors with direct or indirect influence on the living world (GAMS, 1986). It is an interdisciplinary branch of science the subject matter of which study is evaluation of structural and functional connections in the landscape – from the natural landscape over cultural to the landscape which is highly destroyed by anthropogenous activities.

So, the basic subject of geoecology research is the landscape. In the context of geoecology various authors define the concept of landscape² differently, but the most graphic seems to be the definition provided by Krcho in 1974 (MIKLOS, 1988): "The landscape is understood as a system which consists of two, intensely interfused subsystems – natural and socio-economic part of the landscape sphere. Social and economic sphere is much more complex than the natural sphere of the landscape, and it is not, in the sense of geoecology, included in the landscape system in all its aspects".

The most common conception of the landscape is: *landscape* = *geo(eco) system* (NEEF, 1967; KRCHO, 1978; NAVEH, LIEBERMANN, 1993 from MIKLOS, 1994; MIKLOS, 1994), and is defined as SGk = (an, m), where an – represent the elements of the system, and m – the relations between them. Georelief (along with biotic and antropogenous factors) takes a special place in the geo(eco)system which represents a dynamic, but strong, interrelation of lithosphere, pedosphere, atmosphere, hydrosphere and biosphere (BOGNAR, 1990). Therefrom originates the key role of relief in the interpretation of space and manner of its utilisation.

² Zonneveld and Forman (1990): *Landscape, as we see it today, is a spatial and material dimension of the Earth's reality and demarks a complex system which encompasses the relief form and water, vegetation and soil, and rocks and atmosphere.* Urbanek (1992): *The landscape is an extraordinarily complex phenomenon; it is a space-time form of relief. It has its specific spatial distribution and time rhythm. It is contained in the global and local time-space dimension* (from DRDOŠ, 1994). Drdoš (1994): *Landscape as humanity's home.*

Danas su sve aktualnija pitanja onečišćenja i degradacije okoliša³ te njegova zaštita i očuvanje. Posebno je to prisutno kao problem prostornog uređenja i načina korištenja prostora. Geoekologija, primijenjena znanost o krajoliku kao okolišu čovjeka i drugih organizama, ima praktično značenje u procesu rješavanja problema gospodarenja okolišem. Glavni zadatci i ciljevi primijenjenih geoekoloških metoda poznatih kao LANDEP (Landscape Ecological Planing) i uključivanja geoekologije u praksu sastoje se u definiranju ekološki optimalne prostorne organizacije, korištenja i zaštite krajolika. Te zadatke razradio je Institut za geoekologiju (ekologiju krajolika) Slovačke akademije znanosti u Bratislavi, a dani su i u okviru Agende 21 (poglavlje 10, str. 21, *UN Conference on Environment and Development*, Earth Summit, Rio de Janeiro, 1992.)

Jedna od praktičnih geoekoloških metoda pogodnih za planiranje optimalnog gospodarenja prostorom (krajolikom) je geoekološko vrjednovanje prirodnog okoliša. Cilj je te metode utvrđivanje pogodnosti prostora i ograničenje prostora za određenu društvenu djelatnost. Prema Zonneveldu vrjednovanje prostora je utvrđivanje korisnosti prirodnog okoliša u pojedinim sferama ljudskog društva, a prema Van Lieru ispitivanje pogodnosti (ZEE, 1992.).

Geoekološko vrjednovanje okoliša danas je široko prihvaćeno i ima više metoda vjednovanja. Koja će se metoda primijeniti, ovisit će o obliku korištenja prostora (okoliša, krajolika). Osnovni koncept vrjednovanja vezan je za jasno određen oblik korištenja, tzv. "tip korištenja prostora", u starijoj geoekološkoj literaturi poznat kao LUT (*Land Utilisation Type*).

Za svaki prirodni okoliš, a osobito za onaj velike turističke privlačnosti, posebno je važno kvalitetno i planirano upravljanje. Svako planiranje korištenja prirodnog okoliša i gospodarenja njime (općenito i u vezi s turističkim i rekreacijskim aktivnostima), namjenu i korištenje mora planirati i usmjeriti tako da okoliš bude maksimalno koristan čovjeku, a istodobno i zaštićen i sačuvan za

³ U razlikovanju pojmova okoliš, okolina, okolica u hrvatskom jeziku još postoje određene nejasnoće. Često se okolina koristi kao pojam društvenog okruženja, okolica prirodnog, a okoliš kao skupni naziv i za prirodno i za društveno čovjekovo okruženje. Česta je upotreba i izraza prirodni okoliš u smislu biotičkih (organizmi iste ili drugih vrsta) i abiotičkih (tlo, topografija /reljef/, klima i vrijeme) sastavnica.

Today, the question of pollution and degradation of the environment³ is becoming more and more pressing, as well as its protection and preservation. This is especially present as a problem of spatial planning and manner of space utilisation. Geoecology, as applied science of landscape as the environment of the man and other organisms, has a practical meaning in the process of solving the problem of environment management. The main tasks and goals of applied geological methods known as LANDEP (Landscape Ecological Planning) and inclusion of geoecology in the practice is to define ecologically optimal spatial organisations, utilisation and protection of the environment. These tasks were elaborated by the Institute for geoecology (landscape ecology) of the Slovakian Science Academy in Bratislava, and are reported within Agenda 21 (chapter 10, page 21, *UN Conference on Environment and Development*, Earth Summit, Rio de Janeiro, 1992)

One of practical geoecological methods suitable for planning optimum management of space (landscape) is geoecological evaluation of the natural environment. The objective of this method is determining the space and restriction of the space for a certain social activity. According to Zonneveld evaluation of space represents the determination of the usability of the natural environment in certain spheres of human society, and according to Van Lier it is testing of favourability (from ZEE, 1992).

Geoecological evaluation of the environment is widely accepted today and there are several evaluation methods. Which method shall be applied depends on the form of space (environment, landscape) utilisation. The basic concept of evaluation is connected with a precisely defined form of utilisation, the so-called "space utilisation type", in older geoecological literature known as LUT (*Land Utilisation Type*).

For each natural environment, especially for that of great touristic attraction, quality and planned management are especially important. Each planning of natural environment utilisation and management (in general, as well as in connection with touristic and recreational

³ There are still certain vaguenesses in the Croatian language regarding the difference between the terms environment, surroundings, environs. Surroundings as a term is often used in the meaning of social setting, environs of the natural setting, and the environment as a collective name both for the natural and social human setting. The use of the term natural environment in the sense of biotic (organisms of same or different species) and abiotic (soil, topography / relief/, climate and the weather) elements is also frequent.

budućnost. Dakle, planiranje i upravljanje određenim prostorom mora se temeljiti na dobrom poznavanju i prirodnog okoliša i načina potencijalnog korištenja. Zadatak je vrjednovanja definirati zahtjeve planiranog oblika korištenja te na temelju toga odrediti stupanj pogodnosti ili eventualna ograničenja vrjednovanog prostora.

Rekreacija je općeniti, osnovni način korištenja prostora, no i u tom je slučaju potrebno definirati "tip korištenja" za koje se provodi vrjednovanje. Dakle, treba točno odrediti koji su zahtjevi prema prostoru, odnosno za koji će se oblik rekreacije provesti vrjednovanje (plivanje, ronjenje, biciklizam, planinarenje, ribolov, škraping...) jer svaki od oblika rekreacije ima svoje zahtjeve u kvaliteti i značajkama prostora, te se za vrjednovanje uzimaju u obzir samo pokazatelji relevantni za dani oblik rekreacije. Kakvoća prostora tako za jedan oblik rekreacije može biti izražena pozitivnim vrijednostima, a za neki drugi oblik negativnim (FAO, 1977.).

Prema kriteriju vrijednosti (pogodnosti) okoliš može biti vrijedan (pogodan), što znači da je za promatrani vid korištenja, odnosno određeni oblik rekreacije, pogodan u svom trenutnom stanju, bez nekih većih izmjena. Potencijalno vrijedan prostor je onaj u kojem su potrebna poboljšanja ili izmjene (pod uvjetom da je to moguće) da bi se zadovoljili zahtjevi određene ljudske aktivnosti (ZEE, 1992.).

Cilj i zadatci

Prirodni okoliš (geosfera) na egzistenciju i razvoj čovjeka ne djeluje parcijalno već u svojoj cijelosti, te se istražuje i vrjednuje kao zaseban čimbenik. Potrebno je provesti analizu svakog dijela posebno, a poslije toga rezultate sintetizirati. Pri tome načela vrjednovanja moraju biti jedinstvena, a kriteriji u skladu s određenim načinom valorizacije.

Turizam, kao gospodarska grana, oslanja se, razvija, opredjeljuje i ostvaruje na primarnim vrijednostima prirodnog okoliša. Jedna od tih vrijednosti je reljef koji je sveprisutan te ga se može mijenjati, iskorištavati i uništavati. Područje istraživanoga otoka zadarskog arhipelaga u svom je znatnom dijelu izmijenjeno, antropogeno izgrađeno i devastirano. Na osnovi provedenoga geomorfološkog istraživanja u ovom je radu obavljeno geokološko vrjednovanje reljefa kao

activities), should plan and direct the intention and utilisation in such a manner that the environment is maximally useful to the man, and at the same time protected and preserved for the future. So, planning and managing a certain space must be based on profound knowledge of both the natural environment and the manner of its potential utilisation. The task of evaluation is to define the requirements of the planned utilisation form and based on it to determine the degree of favourability or possible restrictions of evaluated space.

Recreation is a general, basic manner of space utilisation, but even in this case it is necessary to define the "utilisation type" for which evaluation is conducted. Therefore, it is necessary to define precisely which requirements for the space are, i.e. for which form of recreation the evaluation shall be conducted (swimming, diving, cycling, climbing, fishing, "škraping"....) since each of form of recreation has its requirements regarding the quality and characteristics of the space, and therefore only those indicators relevant for a given form of recreation are taken into account for the evaluation. The quality of space for one form of recreation can therefore be expressed in positive values, but at the same time in negative values for another type of recreation (FAO, 1977).

According to the value (favourability) criterion, the environment can be valuable (favourable), which means that for the observed utilisation type, i.e. a certain form of recreation, it is favourable in its current condition, without larger modifications. Potentially valuable space is the one where improvements or modifications (provided they are possible) are needed to satisfy the requirements of a certain human activity (ZEE, 1992).

The objective and tasks

The natural environment (geosphere) does not act partially on the human existence and development but in its entirety, and therefore it is researched and evaluated as a separate factor. It is necessary to conduct the analysis of each part separately, and thereafter to synthesise the results. Thereat, evaluation principles must be unique, and the criteria in accordance with the determined manner of evaluation.

Tourism, as an economic branch, relies on, develops, is determined and realised on the primary values of the natural environment. One of those values is the relief which is omnipresent and can

jedne od najvažnijih datosti prirodnog okoliša, a s naglaskom na turizam i rekreaciju.

O vrjednovanju reljefa Bognar (1990., str. 61) kaže: "Vrednovanje reljefa kao samostalnog čimbenika među datostima prirodnog okoliša predstavlja jedan od najtežih zadataka. Vrednovati se ipak mora jer se aspekti vrednovanja pojedinih korisnika mogu u znatnoj mjeri razlikovati."

Cilj je provedenog istraživanja ustanoviti u kojoj su mjeri pojedini dijelovi otoka Pašmana vrijedni, odnosno potencijalno vrijedni glede njihova turističkog vrjednovanja i vrjednovanja u vidu rekreacije i športa. Budući da se korištenje krajolika na Pašmanu provodi uglavnom stihijski, bez većih grupnih organizacija i mahom u ljetnim mjesecima, u provedenom vrjednovanju reljefa korištena je metoda pretpostavke o tome koja se vrsta korištenja prostora može očekivati na određenom području, uzimajući u obzir ranije registrirane vidove korištenja pojedinih dijelova otoka. Vrjednovanje je temeljeno na vrjednovanju relativnog ekološkog potencijala reljefa. Za vrjednovanje reljefa izdvojeni su dijelovi reljefa za koje se smatra da su privlačni te je tako izvršeno vrjednovanje za padine, vrhove i dolinska dna, te obale. Vrjednovanjem prirodnog okoliša utvrđuje se stupanj pogodnosti određenog prostora za određeni vid korištenja (u ovom radu turističkog i rekreacijskog). Stupanj pogodnosti reljefa otoka Pašmana za potrebe turizma i rekreacije određen je na temelju triju glavnih pokazatelja: njegove fizičke pogodnosti, estetske vrijednosti, koja je iznimno važan pokazatelj za vrjednovanje obala, i dostupnosti.

Za ocjenu *fizičke pogodnosti* reljefa korišteni su podatci o visini i obliku, nagibu i mobilnosti padina. Definirane su reljefne forme pogodne za turističku valorizaciju i neke oblike rekreacije (šetanje, manje planinarenje i slobodno penjanje, škraping). Kriteriji za određivanje fizičke pogodnosti mogu se razlikovati prema stupnju važnosti (KLEMSTEDT, 1975. iz ZEE, 1992.): prijeko potrebni minimum (uvjete bez kojih određena rekreacijska aktivnost uopće nije moguća), pozitivni čimbenici (nisu prijeko potrebni, ali povećavaju potencijalnu vrijednost određenog prostora, odnosno reljefnog oblika), ograničavajući uvjeti (djelomično ili potpuno onemogućavaju rekreativnu aktivnost). Pri vrjednovanju reljefa za potrebe turizma i rekreacije posebna je pozornost poklonjena ograničavajućim uvjetima, oglavito mobilnosti

be modified, used and destroyed. The area of the researched island in Zadar archipelago is in its larger part modified, anthropogenic built up and devastated. Based on the conducted geomorphologic research this paper provides the geoecological evaluation of the relief, as one of the most important givennesses of the natural environment, with the emphasis on tourism and recreation.

Bognar (1990, p. 61) says the following about evaluating the relief: "Evaluation of relief as an independent factor among the givennesses of the natural environment represents one of the most difficult tasks. Nevertheless, it must be evaluated, as the aspects of evaluation by individual users can differ to a great degree."

The goal of conducted research is to establish to which extent certain parts of Pašman Island are valuable, or potentially valuable regarding their touristic evaluation and evaluation in the sense of recreation and sport. Since landscape utilisation on Pašman is conducted mostly in a disorganised manner, and mostly during summer months, the method of assumption of which type of space utilisation can be expected in a given area was used in the conducted relief evaluation, taking into account earlier registered utilisation types of certain parts of the island. The evaluation was based on the evaluation of the relative ecological potential of the relief. For relief evaluation parts of relief considered to be attractive were singled out and in this manner the evaluation of the slopes, peaks and valley bottoms, and coast was executed. The degree of favourability of a certain area for the defined utilisation type (in this paper it is touristic and recreational) is determined by evaluating the natural environment. The degree of favourability of Pašman Island relief for the needs of tourism and recreation is determined based on three main indicators: its physical favourability, aesthetic value, which is a very important indicator for coast evaluation, and accessibility.

Data about height and form, inclination and mobility of slopes was used for evaluation of *physical favourability* of the relief. Relief forms favourable for touristic evaluation and some forms of recreation (walks, minor climbing and free climbing, "škraping") were defined. The criteria for determining physical favourability can differ according to the degree of importance (KLEMSTEDT, 1975 from ZEE, 1992): the indispensable minimum (conditions without which a certain recreational activity is not at all possible), positive factors (are not indispensable but increase the potential value of a certain space, i.e. relief form), restrictive

padina. Naime, padinski procesi (odroni, osipanja, stijenske lavine, i dr.) neposredno utječu na smanjenu sigurnost, što, ovisno o vrsti i intenzitetu prisutnih padinskih procesa, može umanjiti ili poništiti potencijalnu vrijednost određenoga reljefnog oblika. Uz mobilnost padina, kao ograničavajući faktor u obzir je uzeta i izloženost padina prevladavajućem vjetru.

Pod *estetskom vrijednošću* razumijeva se privlačnost određenoga reljefnog oblika, odnosno, njegova "sposobnost" da svojim izgledom privuče što veći broj turista. Sigurno je da kod ovog pokazatelja subjektivni stav osobe koja je obavila vrjednovanje nije u potpunosti izbjegnuto jer je pitanje atraktivnosti stvar subjektivne procjene svakog pojedinca. Da bi rezultati vrjednovanja ovog kriterija bili što objektivniji, potrebno je izvršiti opsežniju studiju koja bi se temeljila na anketiranju velikog broja ljudi. Takva studija zahtijevala bi veći broj stručnjaka i precizno pripremljen anketni upitnik. Anketiranjem velikog broja ljudi različite dobi, različitoga socijalnog i materijalnog statusa, različitog podrijetla i stupnja obrazovanja, različitih interesa i sklonosti, dobio bi se precizniji uvid u reljefne oblike koji se smatraju atraktivnim, odnosno estetski vrijednim. No, i na ovaj način dobio bi se samo šire prihvaćen kriterij, ali ne bi se zadovoljili ukusi i sklonosti svih posjetitelja otoka. Ipak, takva studija pridonijela bi povećanoj objektivnosti vrjednovanja estetske vrijednosti reljefa.

Treći, vrlo važan, pokazatelj turističke (rekreacijske) vrijednosti prostora je *dostupnost*. Pod dostupnošću se misli na "vanjsku" i "unutrašnju" dostupnost. "Vanjska" dostupnost označava udaljenost određenoga turističkog, odnosno rekreacijskog središta od područja veće koncentracije stanovništva (gradovi). Pri vrjednovanju vanjske dostupnosti u obzir se uzima (osim udaljenosti) i procjena kakvoće postojeće prometne (cestovne ili neke druge, npr. trajektne) infrastrukture. "Unutrašnja" dostupnost pak označava stupanj povezanosti određenih točaka unutar turističkog područja. I u slučaju unutrašnje dostupnosti postoje određeni zahtjevi za prometnom infrastrukturom. Naime, ovisno o veličini prostora koji se koristi u rekreacijske svrhe te o reljefnim značajkama danog krajolika, prije nego je potrebno da postoji barem minimalna razvijenost mreže staza ili cesta.

conditions (partly or completely disable recreational activity). When evaluating the relief for the needs of tourism and recreation, special attention was paid to restrictive conditions, primarily to the mobility of slopes. Namely, slope processes (slides, dispersal, rock avalanches, etc.) directly influence reduced safety, which, depending on the type and intensity of present slope processes, can reduce or nullify the potential value of a certain relief form. Along with the mobility of slopes, the exposure of slopes to the dominant wind is taken into consideration as a restrictive factor.

Under *aesthetic value* the attractiveness of a certain relief form, i.e. its "capability" to attract as large a number of tourists as possible with its appearance, is implied. It is certain that with this indicator the subjective attitude of the person who conducted the evaluation is not completely avoided, since the issue of attractiveness is a matter of subjective assessment of each individual. In order to render the results of evaluation of this criterion as objective as possible, it is necessary to realise a more comprehensive study based on surveying a large number of people. Such a study would demand a larger number of experts and a precisely prepared questionnaire. By surveying a large number of people of different age, social and material status, of different background and education, of different interests and inclinations, a more precise insight in relief forms which are considered to be attractive, i.e. aesthetically valuable would be obtained. However, even in this manner only a more widely accepted criterion would be obtained but the tastes and inclinations of all visitors of the island would not be satisfied. Nonetheless, such a study would contribute to an increased objectivity of evaluation of the relief aesthetic value.

The third, very important indicator of touristic (recreational) value of space is *accessibility*. Under accessibility "external" and "internal" accessibility are implied. "External" accessibility refers to the distance of a certain touristic, recreational centre from the area of a larger concentration of inhabitants (cities). When evaluating the external accessibility, (apart from distance) the assessment of the quality of the existing traffic (road or another, such as ferry) infrastructure is taken into consideration. "Internal" accessibility, on the other hand, refers to the degree of connection between certain locations within a touristic area. In case of internal accessibility there are also certain requirements for the traffic infrastructure. Namely, depending on the size of the area used for recreational purposes and on relief characteristics of a given landscape, at least a minimally developed network of paths or roads must exist.

U slučaju geokološkog vrjednovanja reljefa otoka Pašmana vrjednovana je samo unutrašnja dostupnost. Pod njom se podrazumijeva udaljenost bilo kojeg, potencijalno privlačnog, odnosno rekreacijski i turistički vrijednog dijela otoka, od glavne otočne ceste.

Budući da u većini slučajeva rekreacija započinje tek dolaskom na određeno, za to predviđeno mjesto, zahtjevi za što većom dostupnošću obično su naglašeniji. U slučaju provedenog vrjednovanja, za određivanje stupnja dostupnosti u obzir je uzeto vrijeme potrebno da se stigne od autodostupnosti (mjesta dostupnog automobilom) do određene "točke" na otoku (sati hoda prema osobnom iskustvu), nagib padine na kojoj je staza, stabilnost padine na kojoj je staza, te eventualno (ne)postojanje prohodne staze do određenoga, vrjednovanog reljefnog oblika.

Metode vrjednovanja

Vrjednovanje prostora (krajolika) za potrebe turizma i rekreacije, nikako ne može biti predstavljeno jednim, uniformnim postupkom koji bi se primjenjivao kao standardna metoda (ZEE, 1992.). Ne postoji opća pogodnost prostora za razvoj rekreacije, već svaki tip rekreacije zahtijeva oblikovanje (preoblikovanje!) postupka vrjednovanja "po vlastitoj mjeri".

Budući da je u Hrvatskoj dosad vrlo malo radova s geokološkim vrjednovanjem okoliša (BOGNAR, 1990; OSREČKI, 1992; SALETTO JANKOVIĆ, 1995; ŠUNDOV, 2004; MAMUT, 1999; 2005.), metodologija vrjednovanja nije šire razrađivana (osim za potrebe spomenutih provedenih vrjednovanja). Od navedenih radova četiri su rađena za otočne prostore (otok Hvar i otok Krk, zadarski otoci), a ostali za prostore NP "Paklenica" i Dubrovačkog primorja.

Za potrebe geokološkog vrjednovanja reljefa otoka Pašmana s aspekta turizma i rekreacije u ovom radu korištena je metoda relativnog vrjednovanja reljefa (BOGNAR, 1990.). Metoda je prilagođena specifičnostima vrjednovanog reljefa otočnog prostora Pašmana.

Metoda relativnog vrjednovanja reljefa

Vrjednovanje reljefa ovom metodom temelji se na grupiranju svih datosti prirodnog okoliša s gledišta iskoristivosti različitih gospodarskih grana. Potrebno je odrediti i definirati sve ponuđene

In case of geocological evaluation of Pašman Island relief, only internal accessibility was evaluated. It implies the distance from any, potentially attractive, or recreationally or touristically valuable part of the island from the main island road.

Since in most cases recreation begins only after arrival to a specific location intended for it, the demands for a greater degree of accessibility are usually more emphasised. In case of conducted evaluation, for determining the degree of accessibility, time needed to reach car-accessibility (place accessible by car) to a certain "point" on the island (hours of walk according to personal experience), inclination of the slope where the path is located, stability of the slope where the path is located, and possible (non)existence of a negotiable path to a determined, evaluated relief form was taken into consideration.

Evaluation methods

Space (landscape) evaluation for the needs of tourism and recreation can by no means be represented by one, uniform procedure which should be applied as a standard method (ZEE, 1992). There is no general favourability of a space for the development of recreation, but each type of recreation demands a "tailor-made" formation (modification!) of the evaluation procedure.

Since so far in Croatia there have been but a few papers on geological evaluation of the environment (BOGNAR, 1990; OSREČKI, 1992; SALETTO JANKOVIĆ, 1995; ŠUNDOV, 2004; MAMUT, 1999, 2005), the evaluation method was not elaborated in detail (apart from the needs of the said evaluations). From listed papers, four were conducted for islands (Hvar and Krk islands, islands of Zadar), and the rest for the areas of the NP "Paklenica" and Dubrovnik littoral.

For the needs of geological evaluation of the relief of Pašman Island, from the aspect of tourism and recreation, this paper has used the method of relative relief evaluation (BOGNAR, 1990). The method has been adapted to the specificities of evaluated relief of the island area of Pašman.

Relative relief evaluation method

Evaluating the relief using this method is based on grouping all the givennesses of the natural environment from the aspect of usability for

Tablica 1. Bonitetne kategorije reljefa
Table 1 Relief bonity categories

Bonitetna kategorija	Razred	Broj bodova
Bonity category	Class	Number of points
9	najvrjedniji tereni / most valuable terrains	91-100
8	veoma vrijedni tereni / very valuable terrains	81-90
7	pretežno vrijedni tereni / prevalently valuable terrains	71-80
6	relativno manje vrijedni tereni / relatively less valuable terrains	61-70
5	pretežno manje vrijedni tereni / prevalently less valuable terrains	51-60
4	relativno nepogodni tereni / relatively unfavourable terrains	41-50
3	pretežno nepogodni tereni / prevalently unfavourable terrains	31-40
2	nepogodni tereni / unfavourable terrains	21-30
1	vrlo nepogodni tereni / very unfavourable terrains	11-20
0	izrazito nepogodni tereni / extremely unfavourable terrains	1-10

Izvor / Source: BOGNAR (1990.)

kategorije reljefa i njegove pozitivne, odnosno negativne, implikacije na sadašnji i budući razvoj određene djelatnosti. Nakon toga slijedi njihovo uvrštavanje u 10 bonitetnih kategorija prema dobivenim relevantnim vrijednostima. Svaka od njih dobiva bročane oznake 0-9, pri čemu 0. bonitetna kategorija ima najmanje vrijednu, a 9. relativno najvredniju kvalitetu (Tab. 1.).

Reljefni oblici, odnosno elementi vrjednovanja, sistematizirani su na temelju reljefnih tipova, i dalje prema grupama reljefa i sastavnicama oblika. Pri vrjednovanju uzet je u obzir izravni i neizravni utjecaj reljefa na turističku i rekreacijsku valorizaciju prostora. Reljef je tako uvršten u međusobno kvalitativno različite razrede. Svaki od tih razreda raspolaže s odgovarajućim brojem bodova, s jasno naznačenim graničnim vrijednostima. Broj bodova svakoga pojedinog razreda doveden je u vezu s odgovarajućim hijerarhijskim intervalom kvalitativnih vrijednosnih razreda.

Da bi vrjednovanje bilo što točnije, primijenjen je i princip negativnog bodovanja u slučaju kada neka od obilježja reljefa djeluju kao ograničavajući čimbenik pri njegovoj društveno-gospodarskoj valorizaciji. Ograničavajućim osobinama reljefa dodijeljena je određena količina bodova koja će pri konkretnom vrjednovanju za toliko smanjiti maksimalno danu vrijednost bodova. Ako se javi više ograničavajućih osobina, zbroj korektivnih vrijednosti oduzima se od maksimalne količine bodova. Na taj način preostala količina bodova određuje bonitetni razred vrjednovanoga reljefnog oblika – elementa. Tako vrjednovan izdvojeni reljefni oblik – element – unosi se na kartu.

various branches of economy. It is necessary to determine and define all available relief categories and its positive, or negative, implications on the present and future development of a given activity. After that their classification according to 10 bonity categories, according to obtained relative values, follows. Each of them is given numeric designations 0-9, whereat 0 bonity category is the least valuable, and 9 relatively most valuable (Tab. 1).

Relief forms, i.e. elements of evaluation are systematised according to relief types, and further according to groups of relief and shape elements. During the evaluation, direct and indirect influence of the relief on the touristic and recreational evaluation of space was taken into account. The relief was thus divided into qualitatively different classes. Each of those classes is allocated a certain number of points, with clearly defined border values. The number of points of each individual class was brought into correlation with an appropriate hierarchical interval of qualitative values categories.

In order to render the evaluation as accurate as possible, the principle of negative scoring was also applied in case when some of the relief characteristics act as restrictive factors during its socio-economic evaluation. The restrictive relief characteristics are scored negatively and the maximum allocated value of points shall be reduced by such negative points in concrete evaluation. Should more restrictive characteristics appear, the sum of corrective values is deducted from the maximum amount of points. In this manner the remaining amount of points

Tablica 2. Bodovi po razredima apsolutnih visina, nagiba, vertikalne raščlanjenosti i mobilnosti padina za potrebe ekološkog prevrjednovanja

Table 2 Points per categories of absolute height, inclination, vertical articulation, and mobility of slopes for the needs of ecological pre-evaluation

Kategorija	Visina (m)	Bodovi	Nagibi (°)	Bodovi	Vertikalna raščlanjenost (m/km ²)	Bodovi	Mobilnost	Bodovi
Category	Height (m)	Points	Inclination (°)	Points	Vertical articulation (m/km ²)	Points	Mobility	Points
1.	0-50	25,0	0-2	25,0	0-5	25,0	stabilno / stable	25,0
2.	50-100	20,8	2-5	20,8	5-30	20,8	spiranje / washing	20,8
3.	100-150	16,6	5-12	16,6	30-100	16,6	spiranje, klizenje / washing, sliding	16,6
4.	150-200	12,4	12-32	12,4	100-300	12,4	snažna erozija / strong erosion	12,4
5.	200-250	8,1	32-55	8,1	300-800	8,1	odnošenje materijala / carried off mat.	8,1
6.	250-300	4,1	> 55	4,1	> 800	4,1	odroni / landslide	4,1

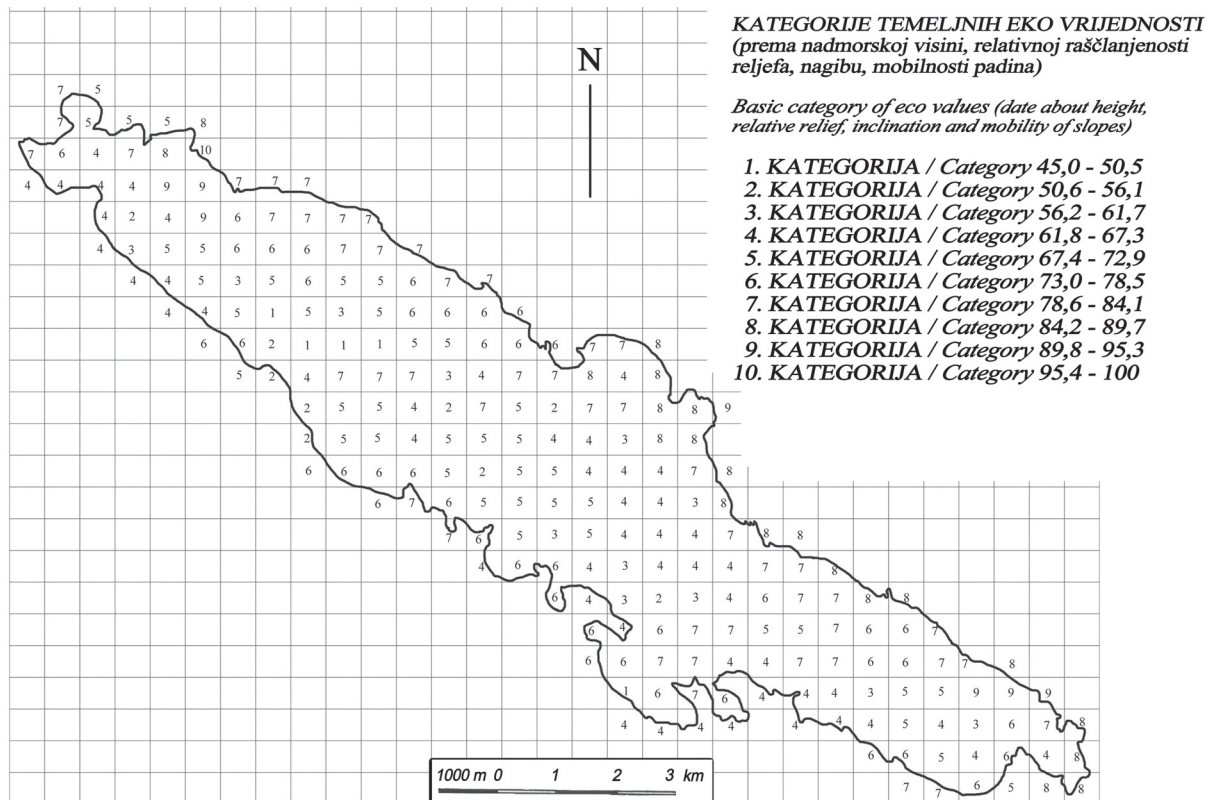
Temeljna vrijednost reljefa određena je na osnovi apsolutne visine, vertikalne raščlanjenosti, nagiba i mobilnosti padina pojedinog dijela reljefa iskazanog na jediničnu površinu. Veličina jedinične površine u okviru koje je provedeno vrjednovanje reljefa otoka Pašmana je površina 1 cm × 1 cm na karti 1 : 50 000, što znači da je veličina jedinične površine 0,25 km². U prvoj fazi svakoj jediničnoj površini dodijeljen je određen broj bodova za kategoriju nagiba koja je u okviru nje zastupljena, za kategoriju vertikalne raščlanjenosti, za hipsometrijski kat u kom se određena jedinična površina nalazi te za stupanj mobilnosti padina. Bodovanje za prva četiri razreda izvršeno je preklapanjem mreže jediničnih površina preko karte nagiba, karte vertikalne raščlanjenosti i hipsometrijske karte, dok je mobilnost padina bodovana prema potencijalnoj mobilnosti uvjetovanoj određenim nagibom padina (Uputstvo za izradu detaljne geomorfološke karte SFRJ 1 : 100 000 (1985)).

Osnovna postavka u predvrjednovanju (bodovanju) bila je ta da područja najmanjih nagiba, najmanje visine, najmanje vertikalne raščlanjenosti i stabilnih padina sa životnog aspekta vrijede najviše, odnosno dobivaju najveći broj bodova – 100, točnije po 25 bodova za svaki pokazatelj (25 × 4 = 100). Tih je 25 bodova u okviru svakog od ova četiri pokazatelja podijeljeno na šest kategorija, pa je svaka kategorija u okviru

determines the bonity category of evaluated relief form – element. An isolated relief form – element evaluated in such a manner is entered on the map.

The basic relief value is determined based on absolute height, vertical articulation, inclination and mobility of slopes of certain relief expressed per unit area. The size of unit area within which the evaluation of Pašman Island relief was conducted is the area of 1 cm × 1 cm on the map 1 : 50 000 which means that the unit area size is 0.25 km². In the first phase, each unit area is allocated a certain number of points for the inclination category which is represented within it, for the vertical articulation category, for hypsometric level on which this unit area is located and for the degree of slopes mobility. Scoring for the first four categories was realised by overlapping the network of unit areas with the inclination map, vertical articulation map and hypsometric map, while the mobility of slopes was scored according to the potential mobility conditioned by a certain inclination of slopes (Instruction for the elaboration of a detailed geomorphologic map of SFRY 1 : 100 000, 1985).

The basic assumption in pre-evaluation (scoring) was that the area of minor inclinations, of the least height, least vertical articulation and stable slopes, from the life aspect are the most valuable, i.e. are allocated the most points – 100, more accurately 25 points per each indicator



Slika 1. Temeljne ekovrijednosti reljefa otoka Pašmana
Figure 1 Basic eco-values of Pašman Island relief

pojedinih pokazatelja dobila broj bodova kako je prikazano u tablici 2.

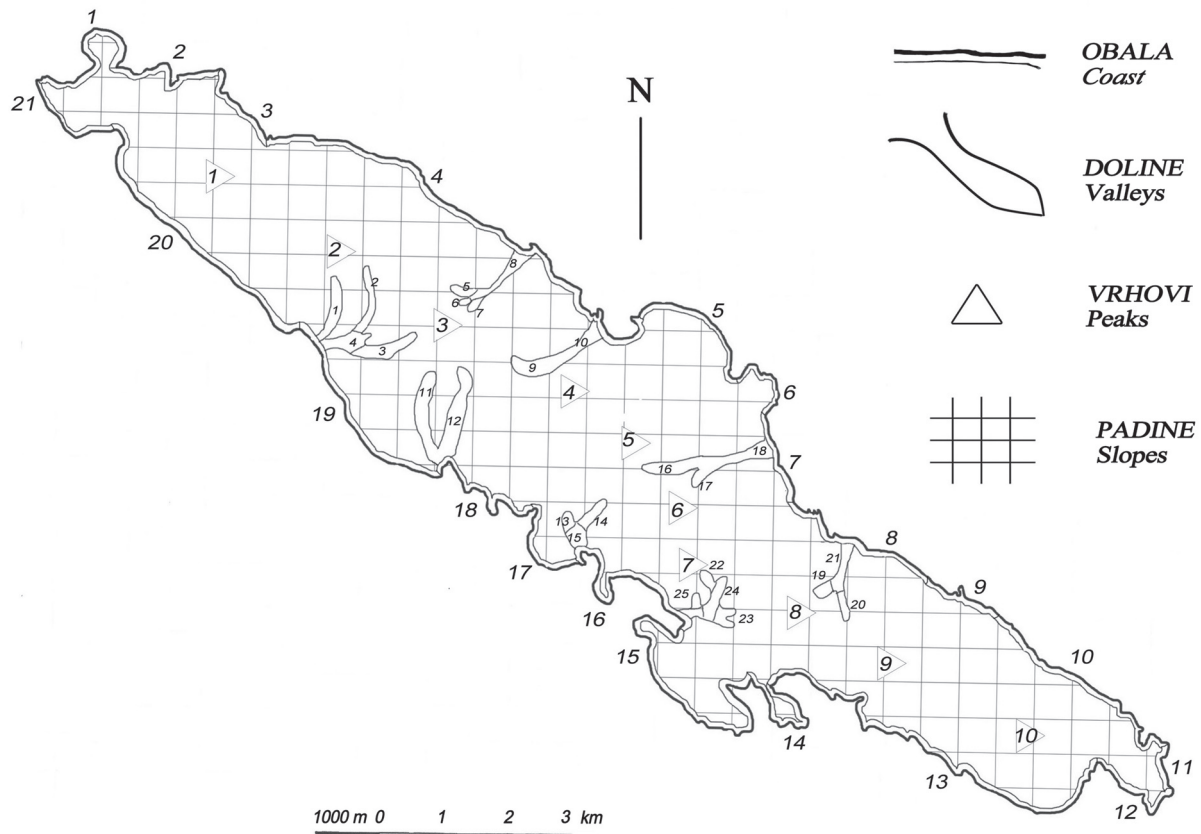
Dakle, svaka jedinična površina može dobiti maksimalno 100 bodova (ako je po sva četiri pokazatelja u prvoj kategoriji), odnosno najmanje 16,4 boda (ako je po sva četiri kriterija u šestom razredu). Na otoku su Pašmanu dobivene vrijednosti u rasponu od 45,3 do 100 bodova po jediničnoj površini (Sl. 1.).

Sljedeća etapa je računanje srednje vrijednosti jediničnih površina po visinskim razredima (na osnovi bodova dobivenih u prethodnoj etapi), odnosno računanje srednje vrijednosti svih jediničnih površina u okviru 1. visinske kategorije (0-50 m), 2. kategorije itd. Na taj su način dobivene ekovrijednosti padina. Takav postupak proveden je i za vrhove, dolinska dna i obale. Naime, nakon što su u prvoj etapi dobiveni bodovi na temelju četiriju pokazatelja, precizno su locirani vrhovi, dolinska dna i obale u okviru mreže jediničnih površina. (Sl. 2.) Svakom vrhu, dijelu dolinskog dna i obale pridružena je vrijednost jedinične površine (iz 1. etape) u kojoj se nalazi.

($25 \times 4 = 100$). Those 25 points are divided into six categories within each of these four indicators, and each category within a certain indicator could be allocated a certain number of points as indicated in Table 2.

So, each unit area can be allocated a max. of 100 points (if it is in the first category, according to all the four indicators), i.e. at least 16.4 points (if it is in the sixth category, according to all four criteria). On Pašman Island allocated values ranged between 45.3 and 100 points per unit area (Fig. 1.).

The next stage is calculating the mean value of unit areas per height categories (based on points allocated in the previous stage), i.e. the calculation of mean value of all unit areas within the height category 1 (0-50 m), category 2, etc. In this manner the eco-values of slopes were obtained. Such a procedure was also conducted for peaks, valley bottoms and coasts, as well. Namely, after points were allocated in the first stage on the basis of four indicators, peaks, valley bottoms and coasts were precisely located within the network of unit areas (Fig. 2). The value of the unit area (from stage 1) in



Slika 2. Vrijednovani reljefni oblici otoka Pašmana (prema morfografskim oblicima)
 Figure 2 Evaluated relief forms of Pašman Island (according to morphographic shapes)

U daljnjem postupku svi vrhovi podijeljeni su po visinskim razredima i izračunata je srednja vrijednost za sve vrhove u okviru 1. visinske kategorije (0-50 m), u okviru 2. kategorije (50-100 m), itd. Na taj su način dobivene temeljne ekovrijednosti za vrhove. Isti je postupak proveden za dolinska dna i obale. Dobiveni bodovi predstavljaju startni broj bodova svakoga vrijednovanog reljefnog oblika. Od njega se oduzimaju, odnosno njemu se dodaju bodovi za korektivne vrijednosti, koje mogu biti pozitivne ili negativne, ovisno o tome povećava li određeni korektiv ili ograničava i smanjuje turističku i rekreativnu vrijednost.

U okviru temeljnih kriterija vrijednosti (fizička pogodnost, dostupnost, estetska vrijednost, odnosno atraktivnost) precizno su definirane korektivne značajke, te se na temelju njih provelo vrjednovanje. Dakle, za svaku morfografsku kategoriju izračunate su temeljne ekovrijednosti po visinskim kategorijama (Tab. 3.) kojima su dodani ili su od njih oduzeti bodovi za korektivne značajke.

which it is located was associated with each peak, part of valley bottom and coast.

In further procedure all the peaks were divided per height categories and the mean value for all the peaks within height category 1 (0-50 m), within category 2 (50-100 m), etc. was calculated. In this manner basic eco-values were obtained for peaks. The same procedure was also conducted for valley bottoms and coasts. Allocated points represent the starting number of points of each evaluated relief form. Points for corrective values are deducted from it, or added to it, which can be positive or negative, depending on whether a certain corrective increases or restricts and reduces the touristic and recreational value.

Within basic value criteria (physical favourability, accessibility, aesthetic value, i.e. attractiveness) corrective characteristics are precisely defined, and evaluation was conducted based on them. Therefore, for each morphographic category the basic eco-values were calculated according to height categories (Tab. 3) and the points of a corrective characteristic were added to them or deducted from.

Tablica 3. Temeljne ekovrijednosti za vrjednovanje reljefa
Table 3 Basic eco-values for evaluating the relief

Visinske kategorije (m/nv)	Temeljne ekovrijednosti ("startni" bodovi)		
	Padine	Vrhovi	Dolinska dna
Height categories (in m/ASL)	Basic eco-values ("starting" points)		
	Slopes	Peaks	Valley bottoms
1. 0-50	80	-	85
2. 50-100	70	-	80
3. 100-150	60	60	75
4. 150-200	50	55	70
5. 200-250	40	50	-
6. 250-300	40	45	-

Padine su vrjednovane samo prema negativnim korektivnim pokazateljima, koji mogu bitno utjecati na pogodnost za korištenje. Ovisno o intenzitetu padinskih procesa, prohodnost može biti otežana ili onemogućena, pa su u skladu s tim padinama dodijeljavani negativni bodovi, ovisno o vrsti padinskih procesa. Kao negativna korektivna značajka vrjednovana je i izloženost padine buri (Tab. 4.).

Vrhovi. Kod vrhova je bodovana apsolutna visina i oblik kao pozitivna korektivna vrijednost pod pretpostavkom da su viši i veći vrhovi privlačniji, a ako se tomu doda i njihov oblik, onda su stožasti vrhovi, prema ovom vrjednovanju, vrjedniji od zaobljenih vrhova. Posebna pozornost pri vrjednovanju vrhova, a i drugih morfografskih kategorija, posvećena je pokazateljima dostupnosti. Negativno su bodovani veći nagibi padina na kojima je staza do određenog vrha, dužina potrebnog puta izražena u satima hoda, te eventualno postojanje sipara na padini kojom prolazi staza. Najveći broj negativnih bodova bilježen je tamo gdje ne postoji staza do određenog vrha (Tab. 5.).

Dolinska dna vrjednovana su prema svojoj širini, izgledu i nagibu pada korita. Veća širina dolinskog dna i postojanje naplavne ravni vrjednovani su pozitivno. S povećanjem nagiba pada korita smanjuje se broj pozitivnih korektivnih bodova, odnosno dodaju se negativni bodovi (za nagibe > 12°) (Tab. 6.).

Za svaki morfografski razred definirane su korektivne značajke s određenim brojem korektivnih bodova koji mogu biti pozitivni ili negativni. Ako je startni broj bodova, odnosno temeljna ekovrijednost, označena sa S_b , korektivni bodovi označeni su s K_b , a V_r je oznaka za ukupni broj bodova odnosno vrijednost pojedinog dijela reljefa, tada vrijedi formula: $S_b + K_b = V_r$.

Slopes are evaluated only according to negative corrective indicators which can significantly influence the favourability for utilisation. Depending on the intensity of slope processes, the negotiability can be rendered difficult or even impossible, so in accordance therewith, slopes were allocated negative points, depending on the type of slope processes. Exposure of the slope to the north-easterly wind (Bora wind) was evaluated as a negative corrective value as well (Tab. 4).

Peaks. Regarding peaks, their absolute height and shape were evaluated as positive corrective values under the assumption that higher and bigger peaks are also more attractive, and if their shape is added, then conical peaks, according to this evaluation, are more valuable than rounded ones. Special attention when evaluating peaks, as well as other morphographic categories, was paid to accessibility. Negative points were allocated to higher inclinations of slopes on which the path to a certain peak, the duration of the necessary trip, is expressed in hours of walk, as well as possible existence of rock creeps on the slope where the path passes. The highest number of negative points was recorded in places where there is no path to a specific peak (Tab. 5).

Valley bottoms were evaluated according to their width, appearance and the inclination of the bed slope. Larger width of the valley bottom and the existence of the alluvial plain were evaluated positively. With the increase of the inclination of the bed slope, the number of positive corrective points is reduced, i.e. negative points are added (for inclinations >12°) (Tab. 6).

Corrective characteristics with a certain number of corrective points, which can be positive or negative, were defined for each morphographic category. If the starting number of points, i.e. the

Uvrštavanjem ukupnog broja bodova u tablicu bonitetnih kategorija reljefa (Tab. 1.) određuje se bonitetni razred vrjednovanog dijela reljefa. Posebno je provedeno vrjednovanje samih obala, i to na temelju morfografskog tipa obala (visoke i niske), litološkog sastava i geološke građe (Tab. 7. i 8.) i posebno antropogene obale (Tab. 9.).

basic eco-value is marked Sp, corrective points are marked Cp, and VI is the designation for the total number of points, i.e. the value of a certain part of relief, then the formula is: $Sp + Cp = VI$. The bonity category of evaluated part of relief is determined by inserting the total number of points in the table of bonity categories of relief (Tab. 1). The evaluation of coasts was conducted separately, based on the morphographic type of coast (high and low), lithological composition and geological structure (Tabs. 7 and 8) and anthropogenic coasts separately (Tab. 9).

Tablica 4. Relativno vrjednovanje padina
Table 4 Relative slopes evaluation

Morfografske kategorije	Startni bodovi	Granični bodovi	Bonitetne kategorije	Korektivne značajke	Korekcijski bodovi
Morphographic categories	Starting points	Bordering points	Bonity category	Corrective characteristics	Corrective Points
a) 0-50 m nv 0-50 m ASL	80	80-51	7-5	Prohodnost / Negotiability - neprohodne / non-negotiable - vrlo slabo prohodne / very poorly negotiable - slabo prohodne / poorly negotiable - prohodne / negotiable Izloženost buri (S i SI eksp.) / Exposure to Bora wind (N and NE exp.)	-19 -15 -10 0 -10
b) 50-100 m nv 50-100 m ASL	70	70-41	6-4	Prohodnost / Negotiability - neprohodne / non-negotiable - vrlo slabo prohodne / very poorly negotiable - slabo prohodne / poorly negotiable - prohodne / negotiable Izloženost buri (S i SI eksp.) / Exposure to Bora wind (N and NE exp.)	-19 -15 -10 0 -10
c) 100-150 m nv 100-150 m ASL	60	60-31	5-3	Prohodnost / Negotiability - neprohodne / non-negotiable - vrlo slabo prohodne / very poorly negotiable - slabo prohodne / poorly negotiable - prohodne / negotiable Izloženost buri (S i SI eksp.) / Exposure to Bora wind (N and NE exp.)	-19 -15 -10 0 -10
d) 150-200 m nv 150-200 m ASL	50	50-21	4-2	Prohodnost / Negotiability - neprohodne / non-negotiable - vrlo slabo prohodne / very poorly negotiable - slabo prohodne / poorly negotiable - prohodne / negotiable Izloženost buri (S i SI eksp.) / Exposure to Bora wind (N and NE exp.)	-19 -15 -10 0 -10
e) 200-50 m nv 200-50 m ASL	40	40-11	3-1	Prohodnost / Negotiability - neprohodne / non-negotiable - vrlo slabo prohodne / very poorly negotiable - slabo prohodne / poorly negotiable - prohodne / negotiable Izloženost buri (S i SI eksp.) / Exposure to Bora wind (N and NE exp.)	-19 -15 -10 0 -10
f) 250-300 m nv 250-300 m ASL	40	40-11	3-1	Prohodnost / Negotiability - neprohodne / non-negotiable - vrlo slabo prohodne / very poorly negotiable - slabo prohodne / poorly negotiable - prohodne / negotiable Izloženost buri (S i SI eksp.) / Exposure to Bora wind (N and NE exp.)	-19 -15 -10 0 -10

Tablica 5. Relativno vrjednovanje vrhova
Table 5 Relative peaks evaluation

Morfografske kategorije	Startni bodovi	Granični bodovi	Bonitetne kategorije	Korektivne značajke	Korekcijski bodovi
Morphographic categories	Starting points	Bordering points	Bonity category	Corrective characteristics	Corrective Points
a) 150-200 m nv 150-200 m ASL	55	90-26	8-2	Visina / Height > 150 m Oblik i veličina / Shape and size: Veliki / Large - stožasti / conical - zaobljeni / rounded Mali / Small - stožasti / conical - zaobljeni / rounded Dostupnost / Accessibility: Plan. staza na padini nagiba (u°) / Mountain path on the slope of the inclination (in °): < 5 5-12 12-32 32-55 - u siparu i sl / in rock creep and similar. Sat hoda od autodostupn. / Hours of walk from car-access.: < 1 1-2 2-3 Bez planinske staze / Without mountain path	+10 +25 +15 +15 +10 0 -5 -10 -15 -4 0 -5 -10 -34
b) 200-250 m nv 200-250 m ASL	50	95-21	9-2	Visina / Height > 200 m Oblik i veličina / Shape and size: Veliki / Large - stožasti / conical - zaobljeni / rounded Mali / Small - stožasti / conical - zaobljeni / rounded Dostupnost / Accessibility: Plan. staza na padini nagiba (u°) / Mountain path on the slope of the inclination (in °): < 5 5-12 12-32 32-55 - u siparu i sl / in rock creep and similar. Sat hoda od autodostupn. / Hours of walk from car-access.: < 1 1-2 2-3 Bez planinske staze / Without mountain path	+20 +25 +15 +15 +10 0 -5 -10 -15 -4 0 -5 -10 -34
c) 250-300 m nv 250-300 m ASL	45	100-16	9-1	Visina / Height > 250 m Oblik i veličina / Shape and size: Veliki / Large - stožasti / conical - zaobljeni / rounded Mali / Small - stožasti / conical - zaobljeni / rounded Dostupnost / Accessibility: Plan. staza na padini nagiba (u°) / Mountain path on the slope of the inclination (in °): < 5 5-12 12-32 32-55 - u siparu i sl / in rock creep and similar. Sat hoda od autodostupn. / Hours of walk from car-access.: < 1 1-2 2-3 Bez planinske staze / Without mountain path	+30 +25 +15 +15 +10 0 -5 -10 -15 -4 0 -5 -10 -34

Tablica 6. Relativno vrjednovanje dolinskih dna i korita
Table 6 Relative evaluation of valley bottoms and beds

Morfografske kategorije	Startni bodovi	Granični bodovi	Bonitetne kategorije	Korektivne značajke	Korekcijski bodovi
Morphographic categories	Starting points	Bordering points	Bonity category	Corrective characteristics	Corrective Points
a) dijelovi dol. dna 0-0 m nv parts of valley bottoms 0-50 m ASL	60	100-31	9-3	Dolinsko dno / Valley bottom - šire od 25 m / wider than 25 m - uže od 25 m / narrower than 25 m - s naplavnom ravni / with alluvial plain Korito / Bed - stjenovito, pristupačno / rocky, accessible - stjenovito sa slapovima i brzacima, pristupačno / rocky with cascades and rapids, accessible - stjenovito, nepristupačno / rocky, inaccessible Nagib pada korita (u°) / Inclination of the bed slope (in $^\circ$)	+10 - 9 +10 +10 +20 - 5 0-2 +10 2-5 + 5 5-12 0 12-32 -10 > 32 -15
b) dijelovi dol. dna 50-100 m nv parts of valley bottoms 50-100m ASL	55	95-26	9-2	Dolinsko dno / Valley bottom - šire od 25 m / wider than 25 m - uže od 25 m / narrower than 25 m - s naplavnom ravni / with alluvial plain Korito / Bed - stjenovito, pristupačno / rocky, accessible - stjenovito sa slapovima i brzacima, pristupačno / rocky with cascades and rapids, accessible - stjenovito, nepristupačno / rocky, inaccessible Nagib pada korita (u°) / Inclination of the bed slope (in $^\circ$)	+10 - 9 +10 +10 +20 - 5 0-2 +10 2-5 + 5 5-12 0 12-32 -10 > 32 -15
c) dijelovi dol. dna 100-150 m nv parts of valley bottoms 100 – 150m ASL	50	90-21	8-2	Dolinsko dno / Valley bottom - šire od 25 m / wider than 25 m - uže od 25 m / narrower than 25 m - s naplavnom ravni / with alluvial plain Korito / Bed - stjenovito, pristupačno / rocky, accessible - stjenovito sa slapovima i brzacima, pristupačno / rocky with cascades and rapids, accessible - stjenovito, nepristupačno / rocky, inaccessible Nagib pada korita (u°) / Inclination of the bed slope (in $^\circ$)	+10 - 9 +10 +10 +20 - 5 0-2 +10 2-5 + 5 5-12 0 12-32 -10 > 32 -15
d) dijelovi dol. dna 150-200 m nv parts of valley bottoms 150 – 200m ASL	45	85-16	8-1	Dolinsko dno / Valley bottom - šire od 25 m / wider than 25 m - uže od 25 m / narrower than 25 m - s naplavnom ravni / with alluvial plain Korito / Bed - stjenovito, pristupačno / rocky, accessible - stjenovito sa slapovima i brzacima, pristupačno / rocky with cascades and rapids, accessible - stjenovito, nepristupačno / rocky, inaccessible Nagib pada korita (u°) / Inclination of the bed slope (in $^\circ$)	+10 - 9 +10 +10 +20 - 5 0-2 +10 2-5 + 5 5-12 0 12-32 -10 > 32 -15

Tablica 7. Relativno vrednovanje visokih obala
Table 7 Relative evaluation of high coasts

Oblik obale i kriterij uvrštavanja	Bodovne granice	Bonitetne kategorije	Ograničavajuća obilježja	Korekcijski bodovi
Coast shape and criteria of insertion	Bordering points	Bonity category	Restrictive characteristics	Corr.ective points
A. Visoke obale / High coasts (nagib / inclination 32-35, > 55)				
I. Klifovi / Cliffs (nagib / inclination >55)				
a. U čvrstim stijenama – stjenovite (podmorje: kamenito, blokovi) / In hard rock – rocky (sea bed: rocky, blocks)				
1. U vapnencima / In limestones	30-0	2-0	a. prometno ograničena dostupnost / traffic-restricted accessibility b. veoma izražena abrazija / very pronounced abrasion	-10 -20
2. U dolomitima / In dolomites	20-0	1-0	a. prometno ograničena dostupnost / traffic-restricted accessibility b. veoma izražena abrazija / very pronounced abrasion c. izraženo spiranje / pronounced washing	-10 -20 -10
3. U klastitima (podmorje: šljunci, pijesci, mulj) - fliš / In clastites (sea bed: gravel, sand, silt) - flysch	20-0	1-0	a. prometno ograničena dostupnost / traffic-restricted accessibility b. veoma izražena abrazija / very pronounced abrasion c. izraženo urušavanje, osipanje i klizenje / pronounced cave in, loosening, and sliding	-10 -20 -20
4. U konsolidiranim klastitima (cementirano kršje, pijesci, šljunak) / In consolidated clastites (cemented debris, sand, gravel)	20-0	1-0	a. prometno ograničena dostupnost / traffic-restricted accessibility b. veoma izražena abrazija / very pronounced abrasion c. izraženo spiranje / pronounced washing	-10 -10 -10
II. Klifaste / Clifty (nagib / inclination 32-55)				
a. U čvrstim stijenama – stjenovite (podmorje: kamenito, blokovi, šljunak) / In hard rock – rocky (sea bed: rocky, blocks, gravel)				
5. U vapnencima / In limestones	40-20	3-1	a. prometno ograničena dostupnost / traffic-restricted accessibility b. veoma izražena abrazija / very pronounced abrasion	-10 -10
6. U dolomitima / In dolomites	40-10	3-0	a. prometno ograničena dostupnost / traffic-restricted accessibility b. izražena abrazija / pronounced abrasion c. izraženo spiranje / pronounced washing	-10 -10 -10

Tablica 8. Relativno vrjednovanje niskih obala
Table 8 Relative evaluation of low coasts

Oblik obale i kriterij uvrštavanja	Bodovne granice	Bonitetne kategorije	Ograničavajuća obilježja	Korekcijski bodovi
Coast shape and criteria of insertion	Bordering points	Bonity category	Restrictive characteristics	Corrective points
B. Niske obale / Low coasts (nagib / inclination 0-2°, 2-5°, 5-12°, 12-32°)				
a. U čvrstim stijenama - stjenovite (podmorje: kamenito, blokovi, šljunak) In hard rock – rocky (sea bed: rocky, blocks, gravel)				
7. U vapnencima / In limestones a. konsekvantne / consequential	100-50	9-4	a. prometno ograničena dostupnost / traffic-restricted accessibility b. abrazija / abrasion - izražena / pronounced - slabo izražena / weekly pronounced c. N ekspozicija / N exposure	-10 -15 -5 -20
b. monoklinalne / monoclinal	90-30	8-2	a. prometno ograničena dostupnost / traffic-restricted accessibility b. abrazija / abrasion - izražena / pronounced - slabo izražena / weekly pronounced c. korozija / corrosion - izražena / pronounced d. N ekspozicija / N exposure	-10 -15 -5 -10 -20
8. U dolomitima / In dolomites a. konsekvantne / consequential	100-40	9-3	a. prometno ograničena dostupnost / traffic-restricted accessibility b. abrazija / abrasion - izražena / pronounced - slabo izražena / weekly pronounced c. korozija / corrosion - izražena / pronounced d. N ekspozicija / N exposure	-10 -15 -5 -10 -20
b. monoklinalne / monoclinal	90-30	8-2	a. prometno ograničena dostupnost / traffic-restricted accessibility b. abrazija / abrasion - izražena / pronounced - slabo izražena / weekly pronounced c. korozija / corrosion - izražena / pronounced d. N ekspozicija / N exposure	-10 -15 -5 -10 -20
b. U klastitima (podmorje u nevezanim stijenama) In clastites (sea bed in loose rocks)				
9. Pješčane / Sandy	100-60	9-5	a. prometno ograničena dostupnost / traffic-restricted accessibility b. spiranje prisutno / washing present c. N ekspozicija / N exposure	-10 -10 -20
10. Šljunkovite / Gravelly	90-50	8-4	a. prometno ograničena dostupnost / traffic-restricted accessibility b. spiranje prisutno / washing present c. N ekspozicija / N exposure	-10 -10 -20

Tablica 9. Relativno vrjednovanje antropogenih obala
Table 9 Relative evaluation of antropogenous coasts

Oblik obale i kriterij uvrštavanja	Bodovne granice	Bonitetne kategorije	Ograničavajuća obilježja	Korekcijski bodovi
Coast shape and criteria of insertion	Bordering points	Bonity category	Restrictive characteristics	Corrective points
III. Antropogene / Antropogenous				
1. U lukama / In ports				
11. obložene čvrstim vezivom / lined with hard binder	100-30	9-2	a. Otvorene udaru valova / open to waves impact b. ograničenoga kapaciteta prijma putnika i robe / of limited capacity of reception of passengers and cargo c. Prometno relativno izolirane / relatively isolated, traffic-wise	-30 -20 -20
12. izgrađene nekonsolidiranim materijalom / built in unconsolidated material	80-10	7-0	a. Otvorene udaru valova / open to waves impact b. ograničenoga kapaciteta prijma putnika i robe / of limited capacity of reception of passengers and cargo c. Prometno relativno izolirane / relatively isolated, traffic-wise	-30 -20 -20
2. Izvan luka / Outside ports				
13. stambena izgradnja / residential construction	50-20	4-1	a. nepristupačne turističkom korištenju b. ograničene širem turističkom korištenju	-30 -20

Rezultati geokološkog vrjednovanja reljefa s aspekta turizma i rekreacije

Prema ranije navedenom sustavu bodovanja provedeno je vrjednovanje za svaku morfografsku jedinicu zasebno. Vrjednovane su sve padine otoka Pašmana, vrhovi viši od 150 m nv, dolinska dna (podijeljena na manje segmente) i obale otoka (podijeljene na segmente prema tipu obale) (Tab. 10).

Vrhovi. Metodom relativnog vrjednovanja reljefa vrhovi otoka rangirani su u bonitetne razrede 4-7 (Tab. 11.). Prema ovom istraživanju, razmjerno su vrijedni i u najvišoj bonitetnoj kategoriji vrhovi Komornjak (196 m) i Somića vrh (199 m), relativno visoki i privlačni za ovaj razmjerno niski otočni prostor te u turističkom pogledu lako dostupni. Ostali vrhovi čine pretežno manje vrijedne dijelove reljefa (6.-4. bonitetna kategorija). Veliki Bokolj (272 m), najviši vrh otoka Pašmana, zbog svoje visine je atraktivan, ali slabija dostupnost (nedostupnost) ipak ga čini manje vrijednim za šetnju i pripada u 5. bonitetni razred. Značajan ograničavajući faktor koji je umanjio turističku i rekreativnu vrijednost pojedinih vrhova je dostupnost, odnosno nedostupnost. Naime, do nekih vrhova od mjesta autodostupnosti nema

Results of relief evaluation

According to the earlier mentioned scoring system, evaluation was conducted for each morphographic unit separately. All the slopes of Pašman Island, peaks higher than 150 m ASL, valley bottoms (divided into smaller segments) and island coasts (divided into segments according to coast type) were evaluated (Tab. 10).

Peaks. Using the method of relative relief evaluation, island peaks were classified into bonity categories 4-7 (Tab. 11). According to this research, peaks Komornjak (196 m) and Somića Peak (199 m), relatively high and attractive for this relatively low island area, and easily accessible in touristic sense, are relatively valuable and in the highest bonity category. The other peaks represent prevalently minor valuable parts of relief (6-4 bonity category). Veliki Bokolj (272 m), the highest peak on Pašman Island, is attractive due to its height but poorer accessibility (inaccessibility) makes it less valuable for walks, and therefore it belongs into bonity category 5. A significant restrictive factor which reduced the touristic and recreational value of certain peaks is their accessibility, or better said inaccessibility. Namely, there are no marked paths from car-accessibility points leading to some

Tablica 10. Segmenti vrjednovane obale otoka Pašmana
Table 10 Segments of evaluated coast of Pašman Island

Oznaka na karti	Segment obale
Designation on the map	Coast segment
1	U. Ždrelašćica – U. Polača / Bay Ždrelašćica – Bay Polača
2	U. Polača – Rt Zverina / Bay Polača – Cape Zverina
3	Rt Zverina – L. Banj / Cape Zverina – L. Banj
4	L. Banj – U. Taline / L. Banj – Bay Taline
5	U. Taline – U. Lučina / Bay Taline – Bay Lučina
6	U. Lučina – U. Jagenica / Bay Lučina – Bay Jagenica
7	U. Jagenica – Kraj / Bay Jagenica – Kraj
8	Kraj – Tkon / Kraj – Tkon
9	Tkon / Tkon
10	Tkon – Rt Gnal / Tkon – Cape Gnal
11	Rt Gnal – Rt Borovnjak / Cape Gnal – Cape Borovnjak
12	Rt Borovnjak – U. Triluke / Cape Borovnjak – Bay Triluke
13	U. Triluke – U. Landin / Bay Triluke – Bay Landin
14	U. Landin – U. Žinčena / Bay Landin – Bay Žinčena
15	U. Žinčena – U. Soline / Bay Žinčena – Bay Soline
16	U. Soline – U. sv. Antona / Bay Soline – Bay Sv. Antona
17	U. sv. Antona – U. Kobiljak / Bay Sv. Antona – Bay Kobiljak
18	U. Kobiljak – U. Čelina / Bay Kobiljak – Bay Čelina
19	U. Čelina – U. Čerenje / Bay Čelina – Bay Čerenje
20	U. Čerenje – Pećinska u. / Bay Čerenje – Pećinska Bay
21	Pećinska u. – Mali Ždrelac / Pećinska Bay – Mali Ždrelac

Tablica 11. Vrjednovanje vrhova otoka Pašmana metodom relativnog vrjednovanja reljefa
Table 11 Evaluation of peaks of Pašman Island by relative relief evaluation method

Vrhovi	Startni bodovi	Korektivne značajke						Korekcijski bodovi	Ukupni bodovi	Bonitimi razred
		Visina	Dostupnost				Veličina i oblik			
			Nagib	Škrapar i sl.	Sati hoda	Bez staze				
Peaks	Starting points	Corrective Characteristics						Corrective points	Total points	Bonity category
		Height	Accessibility				Size and form			
			Inclination	Karrenfield and similar	Hours of walk	No path				
1. M. Bokolj 174 m	55	+10	-10	0	0	0	+15	+15	70	6
2. V. Bokolj 272 m	50	+30	-10	0	-5	0	+25	+10	60	5
3. Komornjak 196 m	55	+10	0	0	0	0	+10	+20	75	7
4. Somića vrh 199 m	55	+10	-10	0	0	0	+10	+20	75	7
5. V. Moravja 202 m	50	+20	-5	0	-5	0	+10	+20	70	6
6. Kamešnjak 180 m	55	+10	-5	0	-5	0	+10	+10	65	6
7. Tiboj 173m	55	+10	0	0	0	-34	+10	-14	41	4
8. Križ 174 m	55	+10	-5	0	0	0	+10	+15	65	6
9. V. Prvanj 184 m	55	+10	0	0	0	-34	+10	-14	41	4
10. Jakovljevi vrh 180 m	55	+10	0	0	0	-34	+10	-14	41	4

Tablica 12. Vrijednovanje dolinskih dna i korita otoka Pašmana metodom relativnog vrijednovanja reljefa
 Table 12 Evaluation of valley bottoms and beds of Pašman Island by relative relief evaluation method

Dolinska dna i korita	Startni bodovi	Korektivne značajke				Korekcijski bodovi	Ukupni bodovi	Bonitetni razred
		Širina	Izgled	Naplavna ravan	Nagib			
Valley bottoms and beds	Starting points	Corrective characteristics				Corrective points	Total points	Bonity category
		Width	Appearance	Alluvial plains	Inclination			
1	80	-9	+10	0	+10	+11	91	9
2	75	-9	-5	0	0	-14	61	6
3	75	-9	-5	0	0	-14	61	6
4	75	-9	-5	0	0	-14	61	6
5	85	+10	-5	0	0	+5	90	8
6	80	-9	-5	0	0	-14	66	6
7	80	-9	-5	0	-10	-24	56	5
8	80	-9	-5	0	0	-14	66	6
9	85	-9	+10	0	+10	+11	96	9
10	75	-9	+10	0	0	+1	76	7
11	85	+10	-5	0	+5	+10	95	9
12	75	-9	-5	+5	0	-9	66	6
13	80	-9	-5	0	0	-14	66	6
14	80	-9	-5	0	0	-14	66	6
15	80	-9	-5	0	0	-14	66	6
16	85	-9	-5	0	0	-14	71	7
17	75	-9	+10	0	0	+1	76	7
18	80	-9	+10	0	0	+1	81	8
19	85	-9	+10	+5	+5	+11	96	9
20	80	-9	-5	0	0	-14	66	6
21	80	-9	-5	0	+5	-9	71	7
22	85	-9	+10	+5	+5	+11	96	9
23	80	-9	-5	0	-10	-24	56	5
24	85	-9	-5	0	+5	-9	66	6
25	85	-9	-5	0	+5	-9	66	6
26	80	-9	-5	0	-5	-19	61	6
27	85	-9	-5	0	+5	-9	76	7

markiranih staza, što ih s aspekta šetnje, pa i planinarenja, čini manje vrijednim. Škraping, kao razmjerno noviji oblik rekreacije, uvodi se u turističku ponudu otoka Pašmana, što će pridonijeti i povećanju privlačnosti slabije pristupačnih dijelova otoka.

Dolinska dna i korita tokova podijeljena na manje dijelove, prema provedenom vrednovanju, vrijedni su dijelovi reljefa otoka Pašmana. Nepristupačnost je glavni ograničavajući čimbenik, koji umanjuje potencijalnu vrijednost tih dijelova reljefa. Naime, to su uglavnom suhe okršene doline do kojih nema pristupnih staza. Daljnji ograničavajući pokazatelj je njihova širina, koja je

peaks, which from the aspect of walks, or even climbing, render them less valuable. "Škraping", as a relatively newer form of recreation is introduced in the touristic offer of Pašman Island which shall contribute to the increase of attractiveness of parts of the island which are less accessible.

Valley bottoms and beds of water flows divided into minor segments, according to conducted evaluation, are valuable parts of Pašman Island relief. The major restrictive factor, which reduces the value of those parts of relief, is inaccessibility. Namely, these are mostly dry karstified dolines with no access paths leading to them. A further restrictive factor is their width which is larger than

Tablica 13. Predvrjednovanje obala otoka Pašmana
Table 13 Pre-evaluation of Pašman Island coasts

Dio obale	VISOKE OBALE					NISKE OBALE				ANTROPOGENE OBALE			Maksimum bodova	Boniterna kategorija
	KLIFOVI			KLIFASTE		STJENOVITE				U lukama		Izvan luka		
	vapnenci	dolomiti	klastiti	vapnenci	dolomiti	vapnenci		dolomiti		U KLASTITIMA	Čvrsto vezivo			
Part of the coast	HIGH COASTS					LOW COASTS					ANTROPOGENOUS COASTS			Max. points
	CLIFFS			CLIFFY		ROCKY				In ports		Outside ports		
	Limestone	Dolomites	Clastites	Limestone	Dolomites	Limestones		Dolomites		IN CLASTITES	Hard binder		unconsolidated material	
					Consequential	Obsequential	Consequential	Obsequential						
1									x				90	8
2									x				90	8
3									x				90	8
4										x			90	8
5											x		90	8
6										x			100	9
7										x			90	8
8											x		90	8
9				x									100	9
10				x									30	2
11										x			30	2
12									x				90	8
13									x				90	8
14									x				90	8
15									x				90	8
16									x				90	8
17									x				90	8
18									x				90	8
19									x				90	8
20									x				90	8
21									x				90	8

Tablica 14. Vrijednovanje obala otoka Pašmana metodom relativnog vrijednovanja reljefa
Table 14 Evaluation of the coasts of Pašman Island by relative relief evaluation method

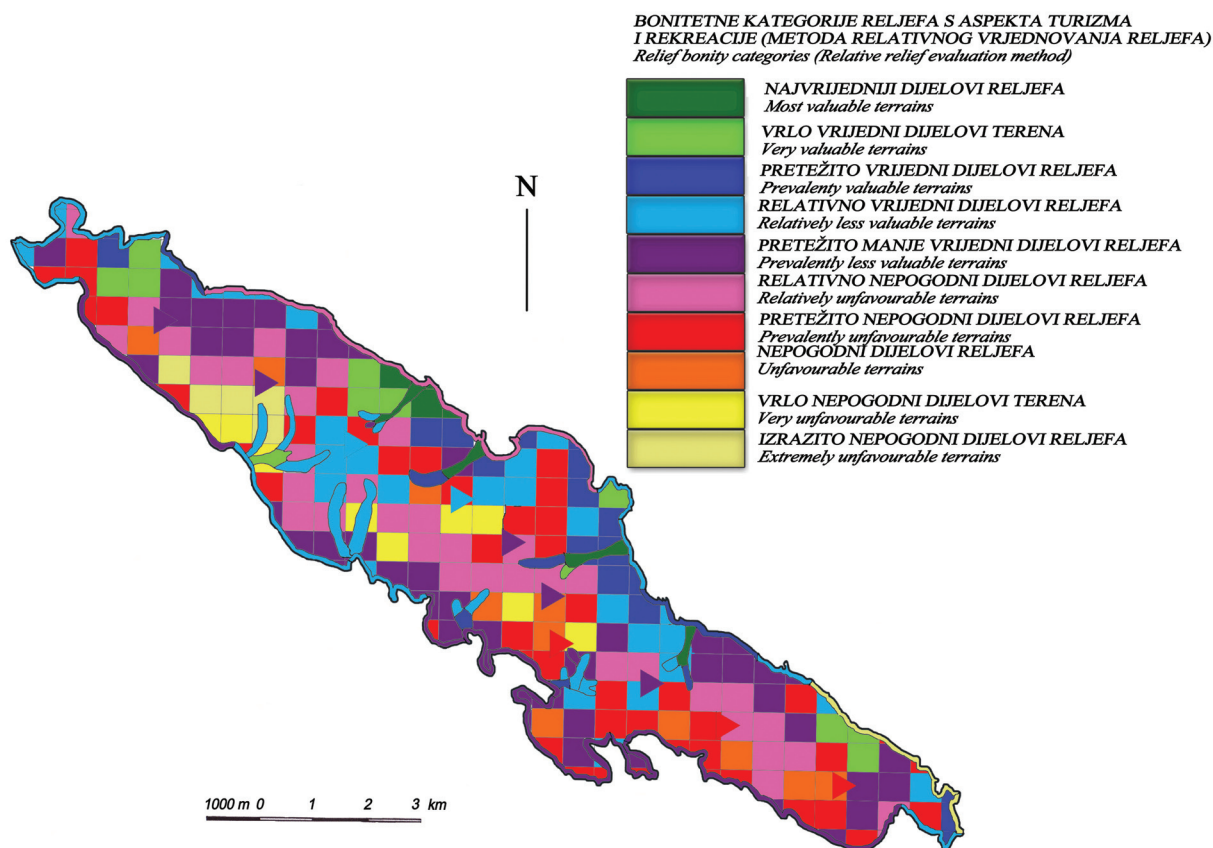
Dio obale otoka	Startni bodovi	Korektivne vrijednosti			Negativni bodovi	Ukupni bodovi	Bonitetni razred
		mobilnost	dostupnost	N ekspozicija			
Part of the island coast	Starting points	Corrective Values			Negative points	Total points	Bonity category
		Mobility	Accessibility	N exposure			
1	90	-20			-20	70	6
2	90	-5		-20	-25	65	6
3	90	-10			-10	80	7
4	90	-10	-10	-20	-40	50	4
5	90	-10	-10	-20	-40	50	4
6	100	-10		-20	-30	70	6
7	90	-10	-10		-20	70	6
8	90	-10			-10	80	7
9	100	-10		-20	-30	70	6
10	30	-10	-10		-20	10	1
11	30	-10	-10		-20	10	1
12	90	-10	-10		-20	70	6
13	90	-20	-10		-30	60	5
14	90	-20	-10		-30	60	5
15	90	-20	-10		-30	60	5
16	90	-20	-10		-30	60	5
17	90	-20	-10		-30	60	5
18	90	-10	-10		-20	70	6
19	90	-10	-10		-20	70	6
20	90	-20	-10		-30	60	5
21	90	-20			-20	70	6

samo na dvije lokacije (segment 5 i 11) veća od 25 m, zbog čega im je pribrojeno 10 bodova. Svim ostalim dijelovima dolinskih dna i korita startni bodovi umanjani su za 9 bodova zbog male širine korita. Od 27 dijelova dolinskih dna jednoga korita, koliko ih je vrijednovano na otoku Pašmanu, gotovo je 50% (njih 13) u bonitetnom razredu 6. Najvrjedniji dijelovi dolinskih dna i korita na otoku Pašmanu ulaze u 9. bonitetni razred i nalaze se na SI starni otoka (Tab. 12.).

Obale otoka s gledišta turizma trebale bi biti najvrjedniji dijelovi reljefa, što je pokazalo i predvrijednovanje ovih dijelova reljefa, prema čemu je 80,9% vrijednovanih segmenata obale otoka Pašmana u visokom 8. bonitetnom razredu. Najvrjednijim segmentom pokazao se dio obale od U. Lučina do U. Jagenica i obala uz Tkon.

25 m in just two locations (segment 5 and 11), and due to it +10 points were added to them. For all other parts of valley bottoms and beds starting points were reduced by 9 points due to small width of the bed. Out of 27 segments of valley bottoms and beds, which were evaluated on Pašman Island, almost 50% (13 of them) are in bonity category 6. The most valuable parts of valley bottoms and beds on Pašman Island are in bonity category 9 and are located on the NE facade of the island (Tab. 12).

Island *coasts*, from the aspect of tourism, are supposed to be the most valuable parts of relief, which was proven also by the pre-evaluation of those parts of relief, according to which 80.9% of evaluated segments of Pašman Island coast are in the high bonity category 8. The most valuable segment is proven to be the part of the coast from



Slika 3. Bonitetni razredi reljefa otoka Pašmana
Figure 3 Bonity categories of Pašman Island relief

Predvrjednovanjem obala najniža bonitetna kategorija pripala je dijelu obale od Tkona do Rta Borovnjak (Tab. 13.).

Kako su elementi vrjednovanja bili dostupnost i mobilnost, zbog razmjerno slabije prometne dostupnosti te izražene abrazije i korozije, dijelovima obala umanjena je vrijednost i time bonitetni razred pa su obale otoka Pašmana u bonitetnim razredima od 1 do 7. Ovom metodom pokazalo se da je najvrjedniji dio obale Pašmana od Kraja do Tkona (Tab. 14.).

Padine su prema provedenom vrjednovanju raspoređene u sve bonitetne kategorije. Glavni ograničavajući faktor je izloženost buri, dok je mobilnost na većem dijelu otoka slabije izražena zbog relativno manjih nagiba na jediničim površinama. Svakoj bonitetnoj kategoriji određena je boja te je izrađena karta bonitetnih kategorija reljefa otoka Pašmana (Sl. 3.)

Bay Lučina to Bay Jagenica and the coast along Tkon. In pre-evaluation, the part of the coast from Tkon to Cape Borovnjak was classified in the lowest bonity category (Tab. 13).

Since the elements of evaluation were accessibility and mobility, due to relatively poorer traffic accessibility and pronounced abrasion and corrosion, value of certain parts of coasts was reduced, and therewith the bonity category, so the coasts of Pašman Island belong to bonity categories ranging from 1 to 7. The most valuable part of Pašman Island coast was proven to be the part from Kraj to Tkon according to this method (Tab. 14).

Slopes, according to conducted evaluation, belong to all bonity categories. The main restrictive factor is exposure to Bora wind, while mobility is more poorly expressed in a large part of the island, due to relatively smaller inclinations in unit areas. A colour was allocated to each bonity category and a map was elaborated showing bonity categories of Pašman Island relief (Fig. 3).

Turističko-geokološki potencijal reljefa otoka Pašmana

Provedeno geokološko vrjednovanje reljefa otoka Pašmana vrlo je značajno za planiranje turističkog razvoja otoka jer je definiralo neke ograničavajuće značajke koje bitno ili manje bitno umanjuju turističku vrijednost pojedinih dijelova prirodnog otočnog reljefa. Definiranjem glavnih ograničavajućih elemenata stvaraju se preduvjeti za njihovo uklanjanje, a time, eventualno, i povećanje turističke vrijednosti određenih dijelova reljefa. To, naravno, ovisi o mogućnosti (i opravdanosti!) njihova uklanjanja. Dakle, postavlja se pitanje je li određeni ograničavajući faktor moguće ukloniti i na koji način. Pritom je posebno važno procijeniti kakve bi bile posljedice određenog zahvata. Moguće je, naime, da se uz očekivane pozitivne učinke, pojave i neki negativni.

U slučaju otoka Pašmana, glavni ograničavajući element, koji je bitno umanjio vrijednost pojedinih dijelova reljefa, slaba je prometna dostupnost, a kod obala i manji dio turistički uređenih plaža. Naime, na otoku pojedini reljefni oblici (npr. obale) zadovoljavaju većinu zahtjeva fizičke pogodnosti i estetske vrijednosti, no zbog svoje neprilagođenosti turistima do sada nisu adekvatno vrednovani. Škraping, kao noviji vid rekreacije, polako ulazi u sve organiziraniju ponudu otoka, jer reljef Pašmana zadovoljava preduvjete za razvoj ovog oblika rekreacije. Naime, takvom obliku "šetnje" pogoduje manjak uređenih staza i bogatstvo netaknutih i neuređenih dijelova krških reljefnih oblika kakvih na Pašmanu ne nedostaje. Provedeno vrjednovanje upozorilo je i na neke dijelove reljefa otoka koji su, premda nisu najatraktivniji, zbog svoje dostupnosti, potencijalna odredišta turističkih šetnji. Vrlo je važno je i pitanje uređivanja staza do pojedinih vrhova ili padina sa specifičnim suhozidinama, te uređenje zapuštenih maslinika u kršu, kao zanimljivost sredozemnog prostora. Ovako bi se, dijelom, još upotpunila turistička ponuda otoka Pašmana i zadarskog arhipelaga uopće.

Provedeno geokološko vrjednovanje reljefa otoka Pašmana uputilo je na značajke i vrijednost otočnog prostora, odnosno potencijalnu vrijednost za potrebe turizma. Budući da je pri vrjednovanju estetske vrijednosti reljefa korištenom metodom neizbježna prisutnost subjektivnog stava, pri turističkom gospodarenju i planiranju otocima, trebalo bi uzeti u obzir još neke pokazatelje

Touristic-geocological potential of Pašman Island relief

The conducted geocological evaluation of Pašman Island relief is of great significance for planning touristic development of the island, since it defined certain restrictive characteristics which significantly, or less significantly reduce the touristic value of certain parts of the natural island relief. By defining the main restrictive elements, prerequisites are created for their removal, and therewith, possible increase of touristic value of certain parts of relief. This, naturally, depends on the possibility (and justifiability!) of their removal. Therefore, the question is raised of whether a certain restrictive factor can be removed, and in which way. Thereat, it is especially important to evaluate what the consequences might be of a certain intervention. Namely, it is possible that along with expected positive effects, negative ones also appear.

In case of Pašman Island, the main restrictive element, which significantly reduced the value of certain parts of relief is poor traffic accessibility and in case of coasts, a smaller number of beaches arranged for tourism. Namely, certain relief forms on the island (such as coasts) satisfy most of the requirements of physical favourability and aesthetic value, but due to their lack of adaption to tourists, so far they have not been appropriately evaluated. "Škraping", as a newer form of recreation slowly become a part of a more organised offer of the island, since Pašman Island relief satisfies the prerequisites for the development of this type of recreation. Namely, the lack of arranged paths and the richness of untouched and unarranged parts of karst relief forms, which are abundant on Pašman Island, are favourable for this type of "walk". The conducted evaluation pointed also to some parts of island relief which, although not the most attractive, present potential destinations for tourist walks due to their accessibility. The question of arranging paths to certain peaks or slopes with specific dry stone walls, and arrangement of abandoned olive groves in karst, as peculiarities of Mediterranean region is of great importance. In this manner, the tourist offer of Pašman Island, and Zadar archipelago in general, would be further enriched.

The conducted geocological evaluation of Pašman Island relief pointed to characteristics and values of island area, i.e. potential value for the needs of tourism. Since subjective attitude is inevitable during the evaluation of the relief aesthetic value with applied method, some other indicators, like

kao relativno objektivne čimbenike te provesti anketiranja na različitim uzorcima.

Zaključak

Provedeno vrjednovanje reljefa otoka Pašmana potvrdilo je da su detaljne geomorfološke analize vrlo potrebne za geokološka istraživanja. Posebno se to odnosi na geokološko istraživanje reljefa, no jednako tako i na istraživanje cjelokupnog okoliša, odnosno krajolika (reljef kao veza između litosfere, pedosfere, atmosfere, hidrosfere i biosfere!). Budući da istraživanje reljefa podrazumijeva njegovu detaljnu geomorfološku analizu, prijeko je potrebno provesti geomorfološko kartiranje i analizu egzomorfoloških procesa, te obaviti i neke druge analize koje upotpunjuju potrebnu bazu podataka na temelju kojih se vrši vrjednovanje. Od provedenih analiza (morfometrijskih i morfostrukturnih) iznimno korisnima za potrebe geokološkog vrjednovanja s aspekta turističke valorizacije pokazale su se analiza visinskih odnosa (hipsometrija), analiza nagiba padina i analiza vertikalne raščlanjenosti reljefa. Podatci dobiveni kartiranjem i provedenim analizama, predstavljaju temelj za odabir kriterija vrjednovanja, odnosno za definiranje pozitivnih i ograničavajućih značajki za turističko korištenje otoka. Bilo je prijeko potrebno precizno definirati tip turizma i rekreacije za koji se vrjednovanje provodi, a prema kome se određuju relevantne značajke reljefa (plivanje, sunčanje, šetnja). Poznavajući zahtjeve svakog od definiranih oblika turizma, moguće je precizirati kriterije vrjednovanja. Izabrani temeljni kriterij (fizička pogodnost, estetska vrijednost i dostupnost) pokazali su se pogodnima za vrjednovanje turističkog potencijala reljefa istraživanih područja, iako u vrjednovanju estetske vrijednosti nije bilo moguće sasvim izbjeći subjektivan stav osobe koja obavlja taj posao.

Vrjednovanje reljefa otoka Pašmana provedeno je prema temeljnim postavkama metode relativnog vrjednovanja reljefa, koja je djelomično prerađena i prilagođena zahtjevima zadatka i specifičnostima vrjednovanog reljefa. Bitno je naglasiti da ova metoda predviđa predvrjednovanje, čime se određuju temeljne ekovrijednosti i nakon toga slijedi vrjednovanje pojedinih dijelova reljefa prema utvrđenim kriterijima. Provedeno vrjednovanje uputilo je na vrijedne i potencijalno vrijedne dijelove reljefa otoka te na neke ograničavajuće

relatively objective factors, should be taken into consideration, and surveying different subjects.

Conclusion

The conducted evaluation of Pašman Island relief confirmed the need for further geomorphologic analysis for the needs of geocological researches. This especially refers to the geocological research of relief, but also to the research of the entire environment, i.e. landscape (relief, as a bond among lithosphere, pedosphere, atmosphere, hydrosphere and biosphere!). Since the research of relief implies its detailed geomorphologic analysis, it is essential to conduct geomorphologic mapping and analysis of geomorphologic processes and to undertake some other analyses as well, which would supplement the essential database, based on which evaluation is conducted. From conducted analyses (morphometric and morphostructural) the analysis of height relations (hypsoetry), analysis of inclinations of slopes and analysis of the vertical articulation of the relief have proven to be extremely useful for the needs of geocological evaluation from the aspect of touristic evaluation. Data obtained by mapping and conducted analysis represent a basis for the choice of evaluation criteria, i.e. for defining positive and restrictive characteristics for touristic exploitation of the island. It was indispensable to define precisely the type of tourism and recreation for which evaluation is conducted, according to which relevant characteristics of the relief are determined (swimming, sunbathing, walks). Knowing the requirements of each of the defined forms of tourism renders it possible to specify evaluation criteria. Chosen basic criteria (physical favourability, aesthetic value and accessibility) have proven good for the evaluation of touristic potential of the relief of a researched area although in the evaluation of aesthetic value the subjective attitude of the person conducting the valuation could not have been completely avoided.

Evaluating the relief of Pašman Island was conducted according to basic assumptions of the relative relief evaluation method, which was partially revised and adapted to the requirements of the tasks and the specificities of evaluated relief. It is important to point out that this method foresees pre-evaluation, whereby basic eco-values are determined after which evaluation of certain parts of relief follows according to evaluation criteria. Conducted evaluation pointed to valuable and potentially valuable parts of the island relief

elemente zbog kojih pojedini dijelovi otoka nisu dovoljno turistički vrednovani. Geokološka analiza (vrjednovanje) reljefa, provedena na temelju detaljnih geomorfoloških istraživanja i kartiranja, predstavlja temelj kompleksnom, multidisciplinarno temeljenom, gospodarenju prirodnim okolišem (krajolikom).

and to some restrictive elements due to which certain parts of the island are not sufficiently touristically evaluated. The geocological analysis (evaluation) of relief conducted on the basis of detailed geomorphologic researches and mapping, represents the basis for the complex, multi-disciplinary based, management of natural environment (landscape).

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