ECOSYSTEM-BASED ASSESSMENT OF BIODIVERSITY VALUES AND THREATS IN BULJARICA

Montenegrin Ecologists Society and Environmental Programme

CRITICAL ECOSYSTEM PARTNERSHIP FUND

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CRNOGORSKO DRUŠTVO EKOLOGA

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Acronyms and Abbreviations

CAMP	Coastal Area Management Programme
CEPF	Critical Ecosystem Partnership Fund
CICES	The Common International Classification of Ecosystem Services
EnvPro	Environmental Programme
EU	The European Union
EUNIS	European Nature Information System
IBA	Important Bird Area
ICOMOS	International Council on Monuments and Sites
ICZM	Integral Coastal Zone Management
ID	Identification
IUCN	International Union for Conservation of Nature
KEAs	Key Ecological Attributes
MAP	Mediterranean Action Plan
MARISCO	Adaptive MAnagement of vulnerability and RISk at COnservation sites
MES	Montenegrin Ecologists Society
MONSTAT	Statistical office of Montenegro
MPA	Marine protected area
NGO	Nongovernmental organisation
NSDS	National sustainable development strategy
NSDS	National Sustainable Development Strategy
OBIS	Ocean Biogeographic Information System
QGIS	Free and Open Source Geographic Information System
SEA	Strategic Environmental Assessment
SPA	Special Protection Areas
SPAMI	Specially Protected Areas of Mediterranean Importance
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme

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EXECUTIVE SUMMARY

Buljarica cove is one of the few remaining brackish marshes on the Adriatic coast, accompanied with *Posidonia* beds in marine area. Many of the species of animals and plants present in this area are protected at national and international levels, with highly valuable ecosystems, especially in light of Natura 2000 ecological network and marine protected areas.

Nevertheless, this part of the Montenegrin coast is exposed to numerous threats. The most serious is the possibility that majority of the area is granted for long-term concession, followed by construction plans for mixed-use tourism facilities, golf courses and marina. Such development would destroy natural values of this area. Important marine ecosystems, which are already under a range of pressures, would also suffer.

The key spatial planning and strategic documents related to the area of Buljarica cove differently and often contradictorily define directions for the development of the site.

According to the Special Purpose Spatial Plan for the Coastal Zone (2007) and Spatial plan of the Municipality of Budva (2009), Buljarica cove is planned to be transformed into a luxury tourist complex with villa resorts, marina, golf courses and other tourism-related facilities, in the near future. At the same time, both spatial planning documents also support the preservation of ambient value, wetland and Mediterranean vegetation. In addition, according to the Spatial plan of Montenegro until 2020, Buljarica is listed as a Monument of Nature (4 ha of the beach has been protected ever since 1968). However, contradictorily, Buljarica is at the same time identified by this plan as an unexploited area with high potential for marine and exclusive tourism development.

Two other key documents (National strategy for integrated coastal zone management for Montenegro and Master plan for tourism of Montenegro until 2020) allow urbanisation only in areas of low ecological sensitivity and conclude it is necessary to protect the wetland, estuary, marine habitats and coastal forest. The first mentioned document indicates plans for designation of **Marine Protected Area** (MAP) to be set on the wider territory of Island Katič, which encompasses a marine area of Buljarica cove.

In April 2016, *Montenegrin Ecologists Society* joined with *Environmental Programme* and *Society for Ecological Development*, who were supported by Professor Pierre Ibisch from the Centre for Econics and Ecosystem Management at the Eberswalde University, in order to set a scientific base for the protection of Buljarica cove using the **MARISCO**[1] ecosystem-based methodological approach for field research, workshops and analyses. The team, consisted of experts in different fields and taxonomic groups (habitats, marine ecosystems, entomology, herpetology, ichthyology, theriology, ornithology and GIS), was guided to work on ecosystem dynamics and changes, with a strong focus on biodiversity objects, key ecosystem attributes, stress, threats and contributing factors. Socio-economic and cultural heritage assessment followed, complementing the application of interdisciplinary research.

Both the analysis of the biodiversity of Buljarica and the social survey results confirmed that it is fully justified to invest in its conservation and restoration, as well as in steering sustainable development. The urgent measures have to be placed toward halting construction and unsustainable use of the resources. Determining biodiversity objectives in the ecosystem-based approach means identifying the entire system, and main processes, structures and dynamics within. Following this principle, the main biodiversity objects were identified and analysed. These were grouped into three main categories, consisted of specific ecosystems inhabited by various species.

The first category is **Marine and coastal ecosystems**, i.e. the portion of the seafloor and open water adjacent to Buljarica, which is to be protected and further investigated. This category encompasses benthic and littoral zones, and sandy/gravel beaches. Each is characterised by specific abiotic conditions, habitat types, and species of plants and animals. In spite of restricted time and resources, numerous habitats and species were recorded: a total of 94 species of animals (fish, molluscs, echinoderms, etc.); of those, 16 are protected at some level (national or international). Among the marine plants, *Posidonia oceanica* stands out as one of only few marine flowering plants, a Mediterranean endemic, which is highly important for forming (micro) habitats for numerous other forms of life, and in biogeochemical cycles. In addition, it protects the shallows from strong currents and beaches from erosion.

The second category of biodiversity objects is **Freshwater and brackish systems**, which is, in fact, the core of the study area and in the strongest need for conservation. Brackish coastal marshland ecosystems are at risk from various human activities. In previous times, they were being dried out so the land could be used for cultivation, and nowadays they are at risk of being converted to mixed-use tourism facilities infrastructure ground. Ecosystems of Burljarica marshland house rich flora and fauna; also, numerous freshwater springs exist in this area, which is essential for human wellbeing and wildlife population in Buljarica. Among the animal species present here many are protected. Buljarica is a hot-spot for dragonflies and butterflies

1 Adaptive MAnagement of vulnerability and RISk at COnservation sites

(41 and 66 species, respectively), which are the most numerous among the 175 species of insects registered here. The 11 species of amphibians registered in Buljarica make 79% of all Montenegrin amphibians. All are protected at some level. In Montenegro, Buljarica is the best-preserved habitat for the Balkan terrapin, *Mauremys rivulata*. It upholds 22 species of reptiles in the entire studied area (61% of all reptiles present in Montenegro); most of them are protected. The fauna of birds is especially rich in Buljarica: of 178 species listed in literature and confirmed during recent investigations, 93 breed here. With the addition of migratory and/or wintering species, the number of bird taxa rises to 220–250. Other than providing nesting and feeding grounds, Buljarica is a part of the "**Adriatic Flyway**" migratory route for many species. Among mammals, bats are the most interesting group: all seven recorded species are protected.

The third category is **Terrestrial and karstic habitats**, with as much as 36 types of habitats (17 of which are protected). Here, more than 250 species of vascular plants were recorded, with several rare and/or protected species. Numerous animal species are also dependent on these habitats, especially various insects, reptiles, and birds. Two of the four types of habitats resulted from human intervention, i.e. changes in land use: tall hay meadows, and rocky pastures and arborescent matorral appeared after the abandonment of mowing and/or traditional livestock breeding. Nevertheless, nowadays they provide habitats for numerous wildlife species. The remaining two habitat types naturally occurring are thermophilous oak woods, and cliffs and rocky outcrops. The forests were significantly exploited and degraded to macquis, which are nevertheless important from the conservational point of view. Various inaccessible rocky formations provide shelter for many endemic and/or relict species.

Not only the wildlife in Buljarica is threatened: the existence of people there is subordinated to uncertainty, causing migrations, values, lifestyle and land use changes. The majority of inhabitants of Buljarica rely on their own business. One-half of the residents practices agriculture but produces only for their own needs. During the past 10 years, a marked decline in agricultural production was noted. The main causes of such a trend were insufficient profitability, inadequate incentives by the state, and the increasing orientation of residents towards tourism. The inhabitants of Buljarica claimed that the biggest obstacles to sustainable tourism development are as follow: land selling trends, unplanned construction, pollution, and harmful national and local planning policies. As the main potential for economic development of Buljarica, they perceived tourism. Some think this can be combined with conservation of the landscape. Overall, the inhabitants are not optimistic regarding the sustainable development of Buljarica and a half of them would consider selling their properties, which represents another risk to successful conservation of this area.

The development of Buljarica directly depends on the preservation of its non-urbanised area which has a unique ecological value. Touristic development will be successful to the extent to which the landscape, cultural and ecological values of this area are preserved and respected.

In order to achieve purposeful development, it is necessary to establish, as soon as possible, a conservation management regime that will enhance the ecosystem services, tourist facilities and living standard of the local population.

The ecosystem services and human wellbeing dependent on it are identified. However, further research and analyses are required to qualitatively and quantitatively present them.

The following nine **Key Ecological Attributes** (KEAs) are considered as important properties of the Buljarica cove ecosystems that maintain its function as well as adaptability and resilience to disturbance and change: water quality, soil stability, freshwater flow regime, species diversity, hydrological regime, continuous forest cover, the abundance of food resources, connectivity among ecosystems and habitat types.

The manifestation of the ecosystem conversion, indirect ecosystem effects and ecosystem degradation have been analysed and explained through stress, indicating the following: natural succession in cultural ecosystem, habitat fragmentation, low soil quality, changing of water interaction regime (between sea and lagoon water), reduction of habitat area, decrease of species population size, eutrophication. These are directly related to threats that are many, where the biggest strategic relevance from conservation and management point of view rest with the following: intensive urban development and the associated pollution (untreated communal and illegal solid waste disposal), sea level rise, landslides and erosions, abandonment of agricultural fields / hay meadows, invasive species, immigrations and emigrations of people, construction of marina.

According to the ranking of the contributing factors, in the group of those most significant for the strategic relevance stand: the weak culture of communication, expansion in real estate markets by enabling an environment for both national and foreign capital influx, uncontrolled expansion of touristic activities at Montenegrin coasts in general. The issue here is that most of the named factors are very hard to be managed, requiring additional resources for both improving the knowledge and intervention.

Regardless of numerous problems listed above, Buljarica still has the potential to be both a protected natural good and economically developed, dynamic community. Conservation of nature and development of human society and activities are not necessarily in conflict, on the contrary: well-preserved nature pro-

vides numerous opportunities for social and economic development. This dual objective can be achieved if the area of Buljarica is soundly investigated and protected by national law, in accordance with international propositions and criteria. Importantly, several urban planning documents have to be revised and changed in parts regarding the preservation of certain areas (including Buljarica) which are attractive for building of huge accommodation complexes. Such large resorts could provide short-term benefits to their owners but would permanently degrade and destroy numerous already fragile ecosystems. Therefore, building activities should be strongly controlled and restricted to already urbanised areas or to those which are not too sensitive. Nature conservation has to be accompanied with education and inclusion of local inhabitants into decision-making processes, but in conservation and managing activities as well. Some of the achievable goals are sustainable all-year-round tourism, use of natural building materials and renewable sources of energy, active involvement of tourists and volunteers in e.g. agricultural production and conservation of Buljarica, education of locals and visitors about the rich history of the area. All these require serious commitment and time, but once established, the new system can be self-sustainable in long term.

To this end of analysing complex interaction and dynamics, values and threats in the place, it has been concluded that it is necessary to strive for a comprehensive and holistic approach to sustainable development of the area. This should be implemented through:

- The overarching participatory research, monitoring and communication of the current situation of Buljarica ecosystems
- Short to mid-term abatement of critical contributing factors that drive the threats to biodiversity, through developing and implementing a conservation management regime,
- The treatment of ecosystemic stresses and mitigation of direct threats to biodiversity by enhancing or restoring the functionality of harmed ecosystems and their components,
- Exploration of and investment in alternative development models.

To be truly meaningful, efficient and with long-lasting positive effects, all future measures regulating the issues mentioned throughout this document should be incorporated into the appropriate legislation. In this sense, the existing regulations should be changed, improved and harmonised (mutually and with other legal acts) in order to enable sustainable development and use of the area in subject. To facilitate the implementation of the above-mentioned, strategic and spatial planning documents are necessary to be harmonised. Also, the conflicts in land use have to be eliminated, and the principle of integrated planning should be applied.

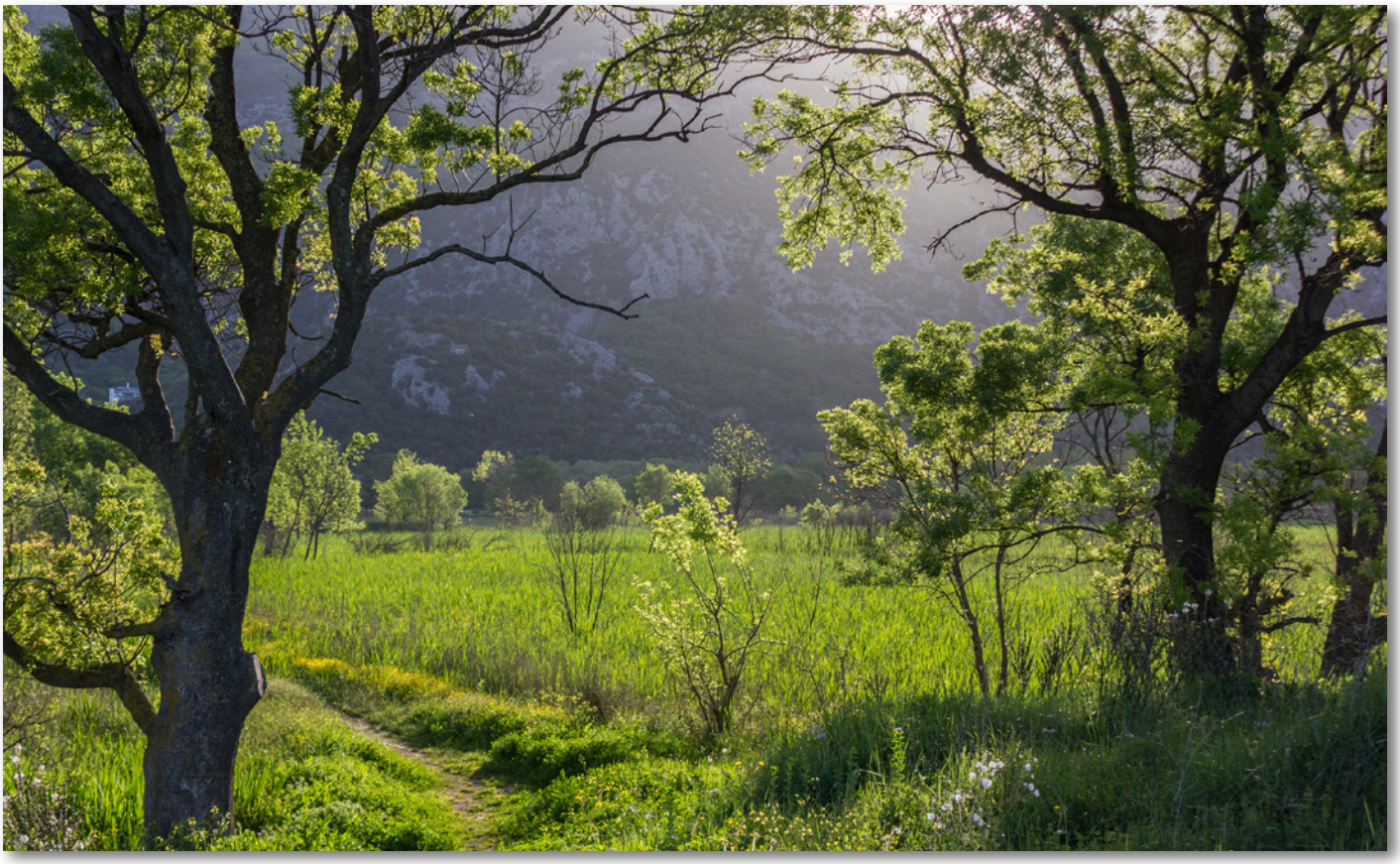


Photo 1:Brackish marshland of Buljarica cove

Photographer: Mihailo Jovićević

INTRODUCTION

Buljarica lies in the central part of Montenegrin coast, between two hills, Resovo brdo and Dubovica (Map 1). It is the biggest cove at the Montenegrin part of the Adriatic coast and administratively belongs to the Municipality of Budva. Buljarica complex consists of a 2,250 m long sandy beach, a semi-naturally irrigated marshland, and of hills and steep slopes of the Paštrovska gora (a part of Mt. Sutorman) in its hinterland. Geographical coordinates that define its centre are 18.9721324072 E, 42.1923395737 N.

Buljarica is one of the few remaining brackish marshland complexes on the Adriatic coast. It is unique for its relatively well-conserved ecosystems and a number of restricted-range and/or threatened animal and plant species that occur there, either as residents or during migrations. A major part of the Buljarica cove is a wetland ecosystem. This type of habitats is rapidly disappearing at the Montenegrin coast, mostly due to the expansion of urban development. In order to prevent inconsiderate degradation of biodiversity values the Buljarica cove with its marine zone sustains, it is of the highest importance to define the biological and cultural significance of this site, and to present it to the local community and the public, and also to decision makers at local, national and international levels.

In addition to rich and diverse wildlife, the area of Buljarica sustains more than 180 households engaged mainly in extensive agriculture and in tourism service activities. The protection of Buljarica cove may lead, in the near future, to the expansion of livelihood opportunities, with the long-term sustainable development established around this area.

BACKGROUND TO CONSERVATION NEEDS

The shoreline of Buljarica (4 ha of the Buljarica beach) is protected under national legislation since 1968 (Decision on the protection of natural objects, Official Gazette of Montenegro no. 30/68). It is now regarded as a Reserve of Natural Landscape[2] i.e. the Monument of Nature[3]. Since the adoption of the Law on Protection of Nature in 2016 (Off. Gazette no. 54/16), Public Enterprise for Coastal Zone Management is tasked with the management of 22 protected areas (mostly Monuments of Nature) in the coastal zone, and therefore of the Buljarica beach, too. However, for this area (as for many others proclaimed in 1968), borders were not clearly defined, zoning was not established, there is no assessment or feasibility study that would define biodiversity values and conservation objectives, and no management plans were developed. Due to the lack of management activities and de facto protection, revalidation of the site remains necessary for the evaluation of the state of its biodiversity.

At the beginning of 2006, Buljarica cove was designated as an Emerald habitat under the Bern Convention, as a unique, virgin and biodiversity-rich area. It has also been included in the list of key sites in Montenegro for future inclusion in the Natura 2000 network. It was recognised as a potential Important Bird Area (IBA), in size of 300 ha, especially due to its importance as the stopover site for birds during their spring migration. The flora of Buljarica is largely unexplored; however, so far several species were found which are protected under the Montenegrin law. Within the study prepared by the University of Montenegro in 2012 (Mrdak et al. 2012), it was noted that Buljarica, together with few other places, should be explored for designation as Marine Protected Area (MPA), the category that is under-represented in Montenegro. In another study, developed under the lead of the Ministry of sustainable development and tourism[4], a wider area of the islet Katič, encompassing Buljarica, was also proposed to be declared as MPA. Although significant efforts were made in this respect, no MPA has yet been designated in Montenegro.

Annex I of the Habitats Directive, which provides the framework for Natura 2000 ecological network of protected areas, includes well-presented vegetation of coastal dunes and salt meadows[5], inter alia. The brackish marsh of Buljarica begins at the sea level and slowly rises towards the mainland. A natural depression and intertwined drainage channels form a network of shallow lagoons. This habitat is essential for amphibians and reptiles that live here, especially for the Balkan Terrapin (*Mauremys rivulata*). Numerous insect species are also tightly related to this complex. In the hinterland of the Buljarica beach there is a thick reed belt that gradually transforms into meadows, and further to a forest of oak, swamp ash, elm and olive trees. The hills surrounding the valley are covered with maquis and cultivated olive groves. The considerable biodiversity in such a small coastal area illustrates the ecological complexity in Buljarica, but also its vulnerability. This area is also significant given the presence of various

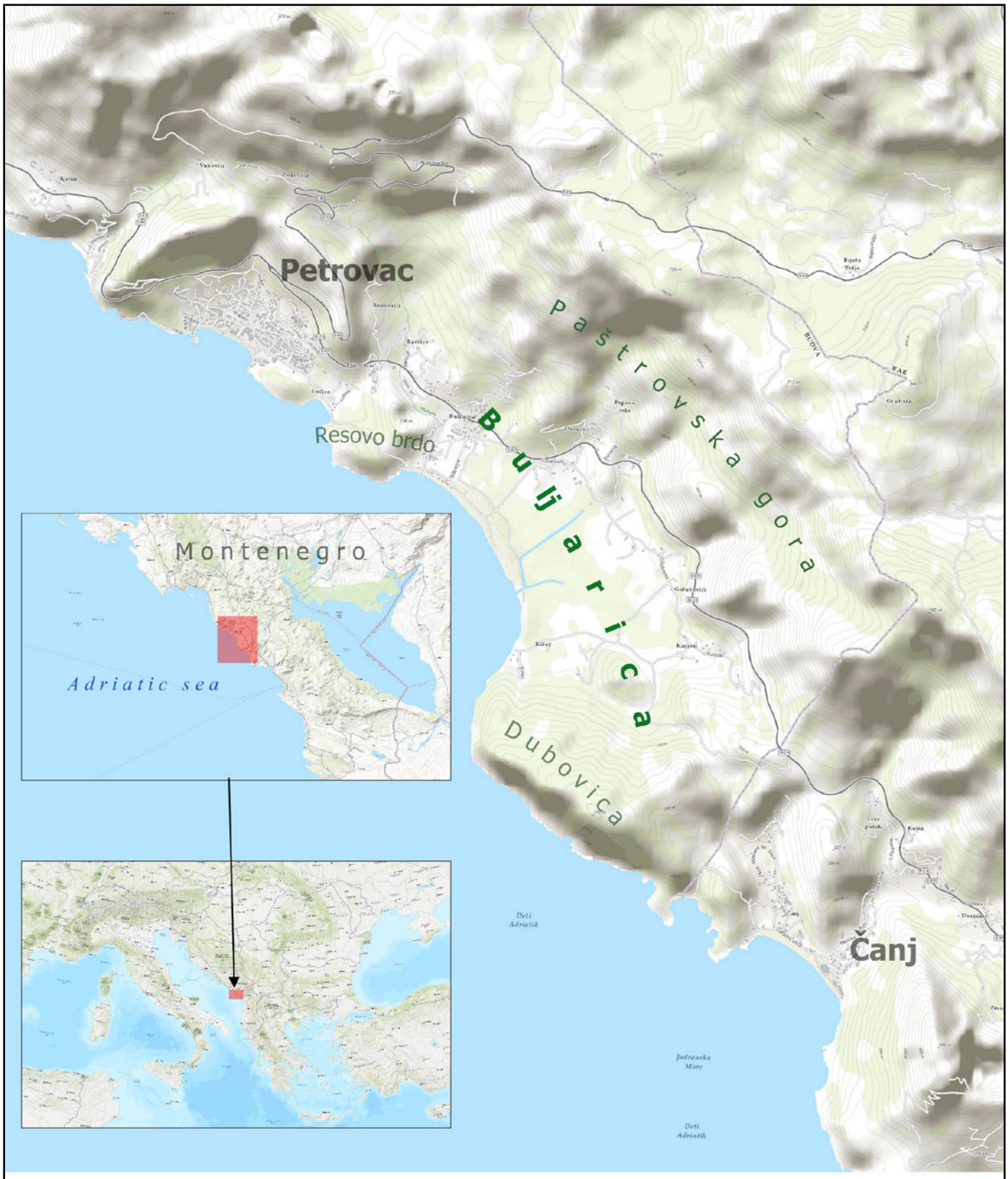
2 Official website of the Montenegrin Public Enterprise for Coastal Zone Management "Morsko dobro": www.morskodobro.com/index.php/odrivi-razvoj/zatiena-prirodna-dobra.

3 Fourth national report of Montenegro to Convention on Biological Diversity: www.cbd.int/doc/world/me/me-nr-04-en.pdf.

4 Start-up of Katič Marine Protected Area in Montenegro and assessment of marine and coastal ecosystems along the coast (Task 4 – Screening of Coastal Area), DFS, 2012.

5 Interpretation Manual of European Union Habitats, version EUR 28, 2013.

MAP 1: GEOGRAPHICAL POSITION OF THE BULJARICA COVE



0 500 1000 1500 2000 2500 m

Map created by Montenegrin Ecologists Society
Date: September 2016

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species of invertebrates, birds and bats, many of which are listed on both Annex II and IV of the Habitats Directive and Appendices II and III of the Bern Convention.

Considering marine ecosystems, the habitat of *Posidonia oceanica* meadows, that covers the biggest part of the shallow portions of the sea, is of utmost protection importance[6], essential for ensuring richness and diversity of life forms.

ISSUES AND CONCERNS

According to the Spatial plan of Montenegro until 2020 (Ministry of economic development of Montenegro 2008), Buljarica is listed as a Monument of Nature. However, contradictorily, it is at the same time identified as an unexploited area with high potential for nautical and exclusive tourism development. According to the guidelines given in the Spatial plan of the Municipality of Budva (Institute for the development of Budva, JSC[7] 2009), this area is proposed to be drained and used for development of exclusive tourism facilities with a total capacity of 13,000 beds.

According to the National Spatial Plan to 2020 (issued in 2008) and Special Purpose Spatial Plan for the Coastal Zone until 2030 (draft, Dec. 2015), Buljarica is under immediate threat of being transformed into a luxury tourist complex with villa resorts, marina, golf courses and other tourism-related facilities, in the near future. Besides, the Special Purpose Area Spatial Plan for Costal Zone (PE "Morsko dobro") from 2007, states that: "In the case of finding larger amounts of oil, it would be economically justifiable to enter into a project for construction of a domestic refinery, for which the Buljarica field is mentioned as the most suitable location, but that would have to be established on the basis of comprehensive studies of feasibility and impacts on the environment."[8]. At the same time both spatial planning documents, in the background, predict preservation of ambient values, of wetland and Mediterranean vegetation of this area.

It is currently considered (Strategic Environmental Assessment report – draft from 2015[9]) that protection status of Buljarica needs to be withdrawn in the near future, to bypass the conflict with the proposed Special Purpose Spatial Plan for the Coastal Zone (draft Dec. 2015) where the zone of Buljarica (and Jaz beach) is "imposed as zones of special interest for the country, which, with beaches and the pertaining hinterland, should be designated for the broadest possible use for tourism and complementary activities". In the draft Strategic Environmental Assessment report of the above-mentioned Spatial Plan, the conflict was confirmed between the planned touristic zone and the protected natural area in Buljarica.

In a document *Vulnerability Assessment of the Narrow Coastal Zone* (Knežević et al. 2013), which was prepared within the project CAMP – Coastal Area Management Programme[10], in the section regarding Buljarica, it was stated, among other things: "Here proposed is to expand coastal detachment. This area is of great importance for biodiversity conservation for its typical coastal wetland area and specific coastal ecosystem, whose protection is prescribed by the Protocol on Integral Coastal Zone Management (ICZM); in this regard it is questionable intervention in case of construction of new tourism facilities, considering that we should bear in mind the need to protect the most important natural characteristics (surface area: 72.40 ha)." Together with Ada Bojana and Velika plaža, Buljarica is recognised as a "coastal zone site where the greatest number of habitats of international importance occurs" (Knežević et al. 2015). In the same document, there is a list of locations (including Buljarica) with "vulnerable biodiversity which should be protected from negative impacts, particularly by preserving their completeness".

In the National Sustainable Development Strategy (NSDS) to 2030 (Đurović et al. 2016), within the table on protection of the environment, natural resources, cultural heritage and hazards, identified are the problems for the development of large capacities (tourist and others) on multiple sites with valuable biodiversity and specific habitats (Velika plaža beach, Buljarica, Luštica). Some of these pose strong pressure on attractive locations because of commercialization and aspirations to create quick profits, unadjusted construction and insufficient control (problems with the urbanistic and technical conditions and building permits), accommodation of the ambitions and preferences of investors, etc.

In the National Strategy for Integrated Coastal Zone Management (ICZM) to 2030 (Knežević et al. 2015), recognised are the localities in the coastal area at which

6 "Grouped threats to ***Posidonia oceanica*** beds as reported by Mediterranean EU Member States under the EU Habitats Directive", www.eea.europa.eu/data-and-maps/figures/grouped-threats-to-posidonia-oceanica/grouped-threats-to-posidonia-oceanica.

7 Zavod za izgradnju "Budva" A.D.

8 Special Purpose Area Spatial Plan for the Coastal Zone, 2007. Ministry of economic development of the republic of Montenegro and Public Enterprise for Coastal Zone Management. MonteCEP - Center for Urban Development Planning and RZUP – Republic Institute for Urban Planning and Design. Kotor–Podgorica.

9 Proposed within the Strategic Environmental Assessment (SEA) document on Draft of Special Purpose Spatial Plan for the Coastal Zone (draft, 2015), which is pending the adoption due to high volume of comments received during public debate process.

10 CAMP Montenegro. Vulnerability Assessment of the Narrow Coastal Zone. Summary. www.pap-thecoastcentre.org/pdfs/Vulnerability%20Assessment%20of%20the%20Narrow%20Coastal%20Zone.pdf.

the greatest number of habitats of international importance (including wetlands) are to be: the surroundings of Ulcinj with the hinterland, especially the Velika plaža and Ada Bojana, Buljarica and individual, still preserved parts of the bay.

Nevertheless, in May 2016, the land in Buljarica owned by the state has been offered for sale and/or long-term concession in a state land tender process. Tender documents for the area of Buljarica were published on the website of the Privatization Council[11]. This tender envisages intensive construction for mixed use, without first considering the protection status of the area, and without considering its international recognition as a coastal wetland area and specific coastal ecosystem (recognised within the ICZM developed by Government of Montenegro, UNEP/MAP and UNDP), IBA (see the list of acronyms and abbreviations) and Emerald site. Moreover, the published call does not reveal information on the protection status.

On the other hand, no detailed urban planning document at the local or at the state level defines the uses of space that belongs to Buljarica, leaving it without spatial or urban plans.

The planned drainage of the wetland area and its urbanisation may lead to the permanent disappearance of natural values of Buljarica cove and resources that are providing economic safety for the local population, furthermore to loss of important marine habitats that have a great influence on sea ecosystem, resources and those dependent on it.

In addition, neglecting the constitutional commitment of Montenegro as the Ecological state, all planned construction projects would degrade efforts on many levels and sectors:

- Diversification of tourism offer which is identified as important strategic direction within the Master plan for tourism until 2020 and the associated SEA,
- "Wild beauty" national brand carried out by National Tourism Organisation under the Ministry of Sustainable development and tourism,
- Enhancements of sustainable fisheries directions which are to be harmonised with international practices, and which are still lagging behind in terms of EU accession processes (Screening Report for Chapter 13 – Fisheries (2013)[12]; 2016 Communication on EU Enlargement Policy[13]), and
- Mapping and valorisation of the Important Coastal Zone and Marine Protected Areas site which were the focus of several studies and ICZM Strategy.

Moreover, unplanned/illegal construction and active real-estate market caused by poverty, lack of knowledge and awareness of alternative sustainable development opportunities present a serious threat to Buljarica cove ecosystems.

PROJECT OBJECTIVES

The project "Actions for the ecological valorisation of Buljarica cove" implemented from April 2016 to May 2017, by the NGO Montenegrin Ecologists Society (MES), aspires to offer a scientific base for facing the current challenges in the field of nature conservation and decision making in Buljarica cove and in Montenegro.

This project was supported by the Critical Ecosystem Partnership Fund (CEPF), through the small grants financial mechanism.

Undisputable biodiversity values of the Buljarica cove, strategic directions and commitments of Montenegro toward sustainable development and EU accession processes (and the opportunities within), and issues, presented in the preceding chapter, set the baseline for defining the objectives of this project.

The overall objective of the project "Actions for the ecological valorisation of the Buljarica cove" was to:

Build a scientific foundation for consolidating a common knowledge base and its integration into relevant politics, ensuring institutional strengthening and awareness raising.

11 Public invitation for participation in the international tender for valorisation of the Buljarica location. Government of Montenegro. Privatization and Capital Investment Council. www.savjetzaprivatizaciju.me/en/vijest/public-invitation-for-participation-in-the-international-tender-for-valorisation-of-the-buljarica-location/.

12 Screening report Montenegro. Chapter 13 – Fisheries. https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/pdf/montenegro/screening_reports/screening_report_montenegro_ch13.pdf.

13 Montenegro 2016 Report to European Comission. Accompanying the document "Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 2016 Communication on EU Enlargement Policy". https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/pdf/key_documents/2016/20161109_report_montenegro.pdf.

METHODOLOGY AND PLANNING PROCESS

MARISCO METHODOLOGY

Biodiversity assessment of Buljarica cove was structured according to an ecosystem-based, adaptive and participatory approach. The specific method applied during the process was a technique known as MARISCO, which was developed by the Centre for Econics and Ecosystem Management (founded by Eberswalde University for Sustainable Development, Germany) and published in a freely available guidebook (Ibisch & Hobson, 2014).

Apart from focusing on an ecosystem-based approach, MARISCO places great emphasis on system dynamics and change, with a strong focus on the effects and problems related to climate change. This includes additional working steps and activities, such as spatial analysis, ecosystem diagnostics analysis and a detailed assessment of stresses perceived in the ecosystem. The methodology also includes scenario planning and vulnerability assessments in adaptive conservation management (Ibisch & Hobson, 2014).

As illustrated in Figure 1, the MARISCO cycle includes four major phases of management, which are further subdivided into 29 methodological steps:

I - Preparation and initial conceptualisation

II - Systematic vulnerability and risk analysis

III - Comprehensive evaluation, prioritisation and strategy formulation

IV - Implementation and (non-)knowledge management

For the purpose of the assessment here in question, methodological steps 1 to 15 (Figure 1) were followed closely, retaining preparation and initial conceptualisation, systematic vulnerability and risk analyses at the core of this study.

GUIDING PRINCIPLES

The methodology used here facilitates the results that help to promote the conservation of Buljarica cove with up-to-date arguments and in line with umbrella approaches such as the Convention on Biological Diversity's Ecosystem Approach. The team strived for a novel approach that combines elements of adaptive risk management, which is holistic, functional, ecosystem-based and proactive, and provides an opportunity for building knowledge and understanding of contemporary conservation methods. In line with concepts as defined in the Ecosystem Approach or even the Radical Ecosystem Approach (see below), this methodology facilitated results that go well beyond assessments of individual species, or just listing threatened or protected taxa and habitats. The focus is on ecosystem processes, functions, and dynamics. Despite being ecosystem-based, the approach is also people-centered, balancing the views and interests of different relevant stakeholders and actors – from local land users to scientists and the general public. All above was instigated by the MARISCO guide (Ibisch & Hobson, 2014), from where a summary of **The Radical Ecosystem Approach** key principles is taken:

Principle 1: The 'Earth super-ecosystem' is a complex higher-order system of nested and/or overlapping and interacting subsystems.

Principle 2: Human systems (the anthroposystem comprising both humankind's biological population and social systems) are an integral and dependent part of the global ecosystem, and all laws of nature that rule the functioning of this system should equally apply to the anthroposystem.

Principle 3: Naturally complex ecosystems shall be managed with due consideration to emergent properties, non-linearity or feedback loops, as well as to the main drivers of self-organisation and evolution.

Principle 4: The ecosystem approach shall be undertaken at the appropriate spatial and temporal scales. In a socio-economically and politically globalising world that is facing imminent threats related to global environmental change, ecosystem management must be implemented at the local, national and global scale.

Principle 5: Recognising the varying temporal scales and lag effects that characterise ecosystem processes, objectives for ecosystem management should be set for the long term.

Principle 6: Management must recognise that change is inevitable.

Principle 7: Conservation of ecosystem structure and function, as a prerequisite to maintaining ecosystem services, should be a priority target of the ecosystem approach.

Principle 8: Ecosystems must be managed within the limits of their functional capacity, and ecosystem managers or users should consider the effects (actual or potential) of their activities on adjacent and other ecosystems. Ecological deficits created by the human use of ecosystem services shall not be compensated by the externalisation of environmental costs to other sys-

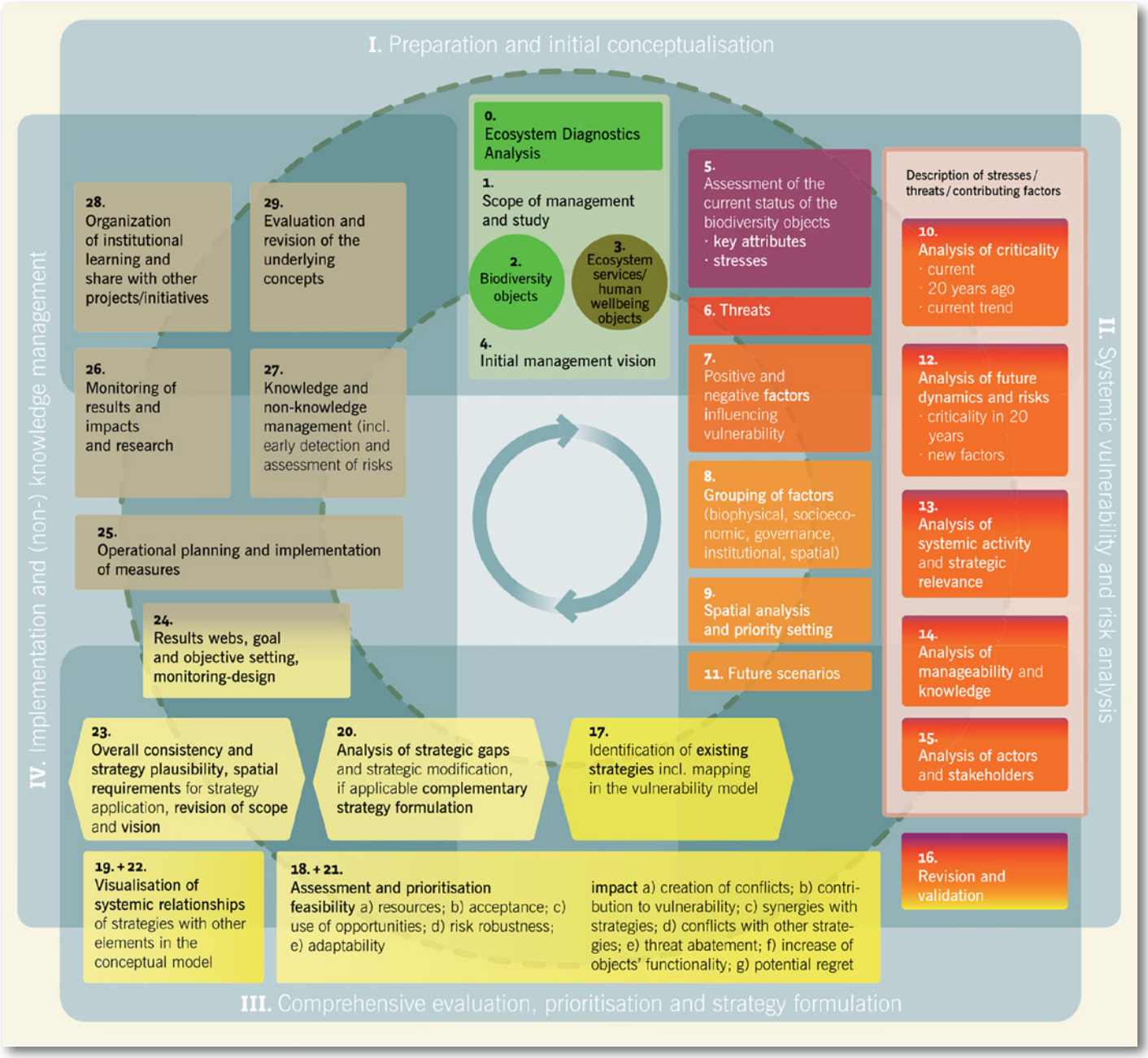


FIGURE 1: MARISCO CYCLE DIAGRAM DEPICTING IMPORTANT METHODOLOGICAL STEPS (SOURCE: IBISCH & HOBSON, 2014)

tems, but shall be reduced by seeking self-sufficiency (comprising strategies of sustainable degrowth in line with the carrying capacity of the ecosystems that are supporting a given social system).

Principle 9: Due consideration must be given to the interlinkages between ecosystems, particularly in the context of global environmental change and human globalisation.

Principle 10: The ecosystem approach should strike an appropriate balance between the conservation and exploitation of biological diversity.

Principle 11: Management objectives for land, water and living resources are a matter of societal choices. Participatory decision-making shall take into account the interests of future generations, irrespective of the constraints to development opportunities for current generations and stakeholders.

Principle 12: Holistic management principles that recognise the virtue and gains of the economic evaluation of ecosystems should be practised. Equally, ethical and practical limits to the economic valuation of biodiversity shall also be respected.

Principle 13: Management should be decentralised to the lowest appropriate level, keeping vertical coherence between higher intervention levels and horizontal coherence between development sectors and scientific disciplines.

Principle 14: The use of local, regional and global ecosystem services shall follow the principle of equitable benefit sharing.

Principle 15: The ecosystem approach shall consider all forms of relevant information, including scientific, indigenous and traditional local knowledge, innovations and practices. In addition, all relevant sectors of society and scientific disciplines should be included in the process. Limits to knowledge, knowledge gaps, uncertainty and blind spots must be factored into all aspects of practice and management.

PLANNING PROCESS AND APPROACH

Project planning process started in April 2016, by forming the core team. *Montenegrin Ecologists Society*, dedicated to the realisation of an efficient and effective model for facing current challenges in nature conservation in Montenegro, joined with the NGO *Environmental Programme* (EnvPro), committed to strategic planning and interdisciplinary analyses. Local NGO Society for ecological development from Buljarica took an active part aiming to halt biodiversity loss and unsustainable development in Buljarica.

Soon after the development of the project work plan, a backstopping consultant was hired (Prof. Dr Pierre L. Ibisch from the Centre for Econics and Ecosystem Management, Eberswalde University for Sustainable Development) to provide guidance on the study design and methodological approach, and to ensure scientific backstopping and revision. Technical support and MARISCO coaching were ensured by the same Centre, and delivered by Axel Schick.

Local biodiversity research expert team was formed in order to conduct desktop and field research and analyses of different taxonomic groups and ecosystems. This team was composed of experts for habitats, marine ecosystems, entomology, herpetology, ichthyology, theriology, ornithology and GIS. Moreover, the interdisciplinary approach was supported by engagement in cultural-historical heritage assessment and socio-economic assessment and analyses conducted by the members of all NGOs involved and supported by the core team members.

Preparation and initial conceptualisation

Ecosystem diagnostic analyses

In May 2016, a three-day workshop was organised in Petrovac and Buljarica in order to conduct the on-site visit with the backstopping consultant and core team and to agree on the methodological approach for the research, analyses and development of the Study.

Rapid assessment, geographical scoping, gaps and overall approach were discussed, based on methodological guidance provided before the visit. Biodiversity objects, their status, vision and issues were analysed through the conceptual MARISCO model. For transparent and participatory knowledge mapping and analysis – comprising the assessment of ecosystems, their functions and services benefitting human well-being as well as stresses, threats and risks – it has been agreed to use the main steps of the first phases of the MARISCO methodology[14].

Scope of the research and the Study

During the preparation and initial conceptualisation and the diagnostic analyses within, done at the workshop held in Petrovac and the on-site visit to Buljarica cove with the backstopping consultant, the following criteria were analysed in order to decide on the geographical scope of research:

- ecosystems' distribution and connectivity,
- natural and anthropogenic barriers,

14 www.marisco.training

- the flow of water and matter, and catchment area,
- species movements (e.g. foraging bats)
- cultural features that add value to the area and represent significant parts of the historical socio-ecological system (e.g., monastery, abandoned houses of old Petrovac in the maquis).

It was concluded that the Study should encompass elements within a wider scope area, and include ecosystems from pelagic zone to the maquis on the higher mountain slopes above the bay.

Data collection and analyses guidance

A working paper elaborated for the interdisciplinary team involved in the ecosystem assessment of Buljarica cove was produced after the field visit by the backstopping consultant. This document supported the field-observation-based Ecosystem Diagnostics Analysis and suggested the documentation relevant to the final report, the analysis and visualisation according to the MARISCO methodology. It was suggested that the field researchers go through the conceptual basics of the MARISCO approach to check out the underlying understanding of ecosystems. Further, the researchers were guided to prepare the data on / perform the following:

1. **Ecosystem inventory, classification and mapping**
2. **Inventory of species per ecosystem type / habitat, of communities, interactions and ecological processes.** A standard table for the presentation of species-related results was provided to the researchers and used to present the data in the standardised Excel form.
3. **Assessment of ecosystem health**. Taxonomic experts gathered the input before the MARISCO workshop in Podgorica, on the following:
   - Key ecological attributes: they identified and listed the properties, i.e. traits of ecosystems (and species) required to maintain their functionality/ viability; requirements for existence and functioning were also reviewed.
   - Stresses: they identified and listed symptoms of dysfunctionality, loss of key ecological attributes (on all levels, related to all biodiversity objects: ecosystems, species, processes).

These were completed by experts in the joint workshop in Podgorica, following the MARISCO manual.

4. **Assessment of ecosystem services** – their assigning to different ecosystems according to the Common International Classification of Ecosystem Services (CICES[15]). This was applied following the given recommendations, i.e. activities needed to be undertaken:
   - Document evidence (in the field) for ecosystem services (ES)
   - Prepare matrix of ecosystem services classes (class types) and ecosystems
   - Collect evidence regarding local people's use and perception of the relevance of ecosystems and ESs.
   - Classify observed/postulated ESs according to user groups (e.g., local people, scientists, tourists, general public).
5. **Documenting findings related to threats**
   - Following the IUCN classification of threats[16]; threats that clearly do not apply have been eliminated from the list.
   - All taxonomic experts were invited to make a corresponding observation in the field.

Final agreement on threats and their rating was done at the joint MARISCO workshop in Podgorica according to MARISCO manual.

All standard tables provided for species/ecosystem-related results, connected with stress, threats and ecosystem services were filled in and are available in the Excel form in the NGO MES database.

Biodiversity field research

The biodiversity field research was conducted by the majority of experts in the period April–July 2016, and in October 2016 by the marine ecosystem researcher, following methodological approach presented in the above chapter. The experts delivered data sheets on biodiversity, ecosystem services, threats and key ecological attributes, GIS files, and written descriptive reports. Concrete survey techniques according to taxonomic groups and ecosystems were used as described below:

Habitat types and vascular plant species

Ecosystem inventory was conducted by combining the interpretation of satellite images (Google Earth, Landsat), 1:25,000 topographic maps, and fieldwork. After the preliminary "uncontrolled habitat mapping" of satellite images, the transects were designed. The species richness of various habitat types was elaborated in the field during May and June 2016 by making the phytocoenological reliefs (Braun-Blanquet 1964) for each type on the transect line, with recording of all impacts and threats to ecosystems in situ. According to that, sample plots, the classification of habitat types and their spatial distribution were defined using GIS. To each recorded habitat type, the European Nature Information System (EUNIS) code was assigned, while special attention was paid to the types of the EU community impor-

15 Official website of the Common Classification Of Ecosystem Services (CICES): https://cices.eu/.
16 www.iucnredlist.org/technical-documents/classification-schemes/threats-classification-scheme

tance (Council of the European Union 2013, European Commission 2013) present in Montenegro (Petrović et al. 2012). Rapid ecosystem assessment of the area, based on the collected data, was performed using the MARISCO methodology (Ibisch & Hobson 2014), adjusted for Buljarica cove.

Invertebrates

Field data about invertebrates were collected during eight field days between May and July 2016. The survey was conducted on the 10 representative census points covering all habitats under the scoping area. Special attention was paid to species important for conservation, whose ecology is related with marshland, springs and streams.

Amphibians and Reptiles

The research on amphibians and reptiles was conducted in May and June and lasted eight days. The recording of species was done along transect lines which represented previously precisely defined routes. The dataset of amphibians and reptiles included the following information: date, time, geographical coordinates, elevation, numbers of individuals and their age category. All species were documented through direct visual observation. Specimens were identified by visual inspection of diagnostic characters according to standard herpetological literature (Arnold & Ovenden 2002). Based on the map produced by the habitat expert, the point data about the species were interpolated. As a final product, a model that shows distribution and species richness was produced.

Birds

Two types of techniques were used in bird surveying during eight field days in April and June 2016. These were line transects and point counts. Both are based on recording of birds along predefined routes or on points within a predefined survey unit. The information about species was entered in an application called ObsMapp[17], configured for this purpose. To every datum entered, the following were assigned: species ID, date, time, geographical coordinates, the number of individuals and their activity status. The application had an incorporated checklist of Montenegrin birds. After storing, the data were exported in the datasheet and analysed through the QGIS programme[18]. Based on these values and map produced by habitat expert, point data about the species were interpolated. As a final product, the model that shows distribution and species richness was produced. Besides the new set of data provided during 2016, all data collected in the previous five years were taken into account. These mainly refer to migratory and wintering aspects of the ornithofauna.

Mammals

For preparing the list of mammal species, the integral approach was used. Namely, the revision of literature data, observations of mammal species presence on transects or ecologically attractive objects (e.g. caves), interviewing local people, taking into consideration ecology of mammal species, and drawing conclusions based on the ecological characterization of investigated area were used. Bats (Chiroptera) survey was conducted during May and June 2016, using the acoustic method on transects and mist-netting, accompanied with literature data about bats distribution in Montenegro. In the Buljarica area, setting of mist-nets was not helpful in open habitats, even when they were put across corridors previously registered with a detector (Pettersson, D240x). Mist-net was also set up in front of the Vilina špilja cave, where two species were registered (Miniopterus schreibersii and Rhinolophus hipposideros). Bat calls were analysed by the Bat sound program and checked by the IUCN expert, since distinguishing some bat calls on a detector is very complex and sometimes hard to be done on lower taxon level.

Fish

Regarding ichthyofauna of the coastal area, field inventory was conducted in July 10th–15th 2016. Two methods were used: a roving transect for fish diversity and stationary point count for determining the relative species abundance. Roving transects were done in random locations upon different types of habitat. Each transect lasted 60 min, divided into 10 min intervals. Species recorded in early intervals were considered as more abundant than those recorded later. Stationary point counts were also performed in randomly chosen places. An initial period of 5 min was left to enable the fish to get accustomed to the divers' presence. After that, during the next 5 min, all individuals of every species were recorded in 5 m water column around the diver.

Marine ecosystems

Field survey of marine ecosystems was conducted during two field days, October 24th and 31st 2016. Four transects[19] were set in order to cover equally the entire area of research encompassing all habitat types, from infralittoral to a lower limit of Posidonia bed. Mapping of habitats and species was conducted using scuba equipment and boat. Floating GPS device was used in a way that it was pulled by one diver who was record-

17 ObsMapp Save flora and fauna observations mobile homepage: obsmapp.org/.
18 Free and Open Source Geographic Information System: www.qgis.org/en/site/.
19 TRANSECT I: Kolač – Hrid Mijuškovića – Oštri Kamen – Hrid Mravinjak – Rt Dubovica; TRANSECT II: Offshore 1,500 m at 27 m of depth to the mouth of the River Jaz; TRANSECT III: Offshore 1,600 m from the coast at 25 m depth – to the coast; TRANSECT IV: Midžorove kuće – Vatulja islet.

ing the route of the transects, while the other was recording the depth and duration (minutes) of the dive associated with habitat change. Following this, the data were exported to a GIS database and used for delineation of habitats using satellite imagery from Landsat 8 Sentinel 2 realised in July and August 2016. Habitats were identified according to the *Handbook for internalisation and monitoring of marine habitats* (Bakran-Petricioli 2007) and species with the use of the *Handbook for identification of marine species of Adriatic* (Parvan & Jakl 2016).

Cultural-historical heritage assessment

Cultural-historical heritage assessment was conducted between July and November 2016. The researchers consulted the scientific and other published and unpublished literature dedicated to the cultural heritage and history of wider area, written mostly by the local authors, historians and researchers. These were more or less representative and reliable sources of information for the selected topics. Due to the lack of archaeological and other explorations of the cultural heritage of Buljarica, this literature review was accompanied by field research involving visits to certain sites. Also, interviews with elderly and well-informed locals of Buljarica and Petrovac were conducted, which enabled collecting of additional, more precise data.

Socio-economic analysis

Following an interdisciplinary approach, the socio-economic analysis was conducted, closely following the methodology and questionnaire prepared for this part. The questionnaire consisted of 24 questions, designed under categories: a) rights holders' profile; b) income, land use, values; c) perceptions and expectations; d) social cohesion. An independent interviewer was engaged to conduct face-to-face structured interviews in Buljarica, supported by the core team. The stakeholders (owners of the land / inhabitants) were approached on the site, randomly. Certain rights users such as the hunters' association, tourists, church representatives, etc., were not targeted due to limited resources (time, financial and human). This task was executed from May to June 2016.

The survey was facilitated through the usage of a digital application that enables easy entering and storing of data, called Fulcrum[20]. Datasets were later imported into Excel. All collected information are treated as strictly confidential (micro-level data will not be published). After the analyses, the report on socio-economic assessment was produced. Its findings were used to accompany the work on the MARISCO matrix, where synthesised multiple data sources (desktop research, expert field research, rights holders' opinion obtained through a questionnaire) supported the identification of land ownership patterns, values, threats and changes. The findings of this assessment are an integral part of this Study.

Systematic vulnerability and risk analysis

In July 2016, a two-day workshop was held in Podgorica, having the majority of the researchers and consultants actively involved in conducting diagnostic, vulnerability and risk analyses. Based on the initial analyses from the MARISCO conceptualisation workshop held in Petrovac, steps two (biodiversity objects) and three (ecosystem services and human well-being) were elaborated in more detail. The next phase, systematic vulnerability and risk analyses, was elaborated in details going through steps 5–15 following closely the instructions from MARISCO guidebook, facilitated by Ms Ana Katnić.

At this stage, communication with backstopping consultants was intensified in order to improve the presentation of comprehensive analyses and to deliver digitalised MARISCO matrix. Biodiversity objects, stresses, threats and contributing factors were assessed, connected and ranked, forming a complex and nested system of mutually interdependent elements. Digitalised MARISCO matrix is presented as **Annex 1** of this Study.

20 A mobile data collection platform that allows to easily build mobile forms and collect data anywhere and anytime: www.fulcrumapp.com.

GEOGRAPHICAL SCOPE

The surface of this scope was determined to be 1,800 ha for the total area of Buljarica cove with the hinterland of Paštrovska gora, where the surface of its plain area is 300 ha (Map 2). The following elements are parts of the investigated area:

- the marine area with Posidonia beds,
- wetland area,
- drainage channels and catchment area of the hinterland of Buljarica (Paštrovska gora),
- species activity ranges (e.g. of foraging bats and birds): mountain slopes, cliffs, etc., and
- cultural features that add value to the area and represent significant parts of the historical socio-ecological system (e.g., monastery, abandoned old houses in the maquis, etc.).

This geographical scope is featured by: the appearance and condition of the whole area defined by human activities in the past; local residents that inhabit the hinterland of the cove and use benefits of the broader area; elements of biodiversity dynamics that constitute key biodiversity attributes identified to have wider geographical distribution; home ranges of many species including several biotopes that are interconnected and interdependent; the habitats and lifestyle of the species conditioned by the availability of shelters, feeding grounds and migrating routes; and the broader landscape connections providing conditions for accomplishing life cycles of many different animals.

GEOMORPHOLOGICAL CHARACTERISTICS OF THE TERRAIN

The Buljarica field is in the central part of this sea-ravine, of which the slope slowly increases from the shore to the edge of the field. Its coastal side is formed of flysch layers (Radojičić 1996), whereas the hinterland consists of steep limestone slopes of Paštrovska gora. The substratum is made out of limestone, dolomite, chert, sandstone, marlstone, shale, eruptives, sand, gravels, clay, loam, silt and debris (Radulović 1968). Limestone can be found on the coastal part, as well as on few other localities in the northwestern and southwestern part.

Along the edge of the field, in several places, gullies cut the hillsides; streams that run through them bestrew the valley with sediments (Radulović 1968). The valley is intersected with numerous channels, which were once used for irrigation and drainage of the land. The terrain surrounding the valley is undulating and made of stiff rock masses. Lower parts of hillsides are predominately made of flysch-clastic sediments, which are mainly covered with rock debris (ibid.).

HYDROGEOLOGY OF THE TERRAIN

The porosity of sediments from Buljarica valley is conditioned by gravel, sandy and clay components. Porosity is higher in parts with larger amounts of gravel and sand, and lower where clay and loam predominate. This is one of the factors that affect the level of groundwater. As this is a coastal land, salt and fresh water mix. Salty groundwaters near the coast, on their way to the hinterland, through brackish, gradually become freshwater (Radulović 1968).

Surface water flows occur in the flysch zone, while groundwaters form dense and dispersed aquifers. In alluvial sediments (Buljarica field), there are dense aquifers at a depth of 1m. This is why this part of the Buljarica valley has a high level of groundwaters (0–15 m). Dispersed aquifers exist in limestone terrain and instead of open flows, there are cracks, swallow holes, caves, springs, etc.[21]

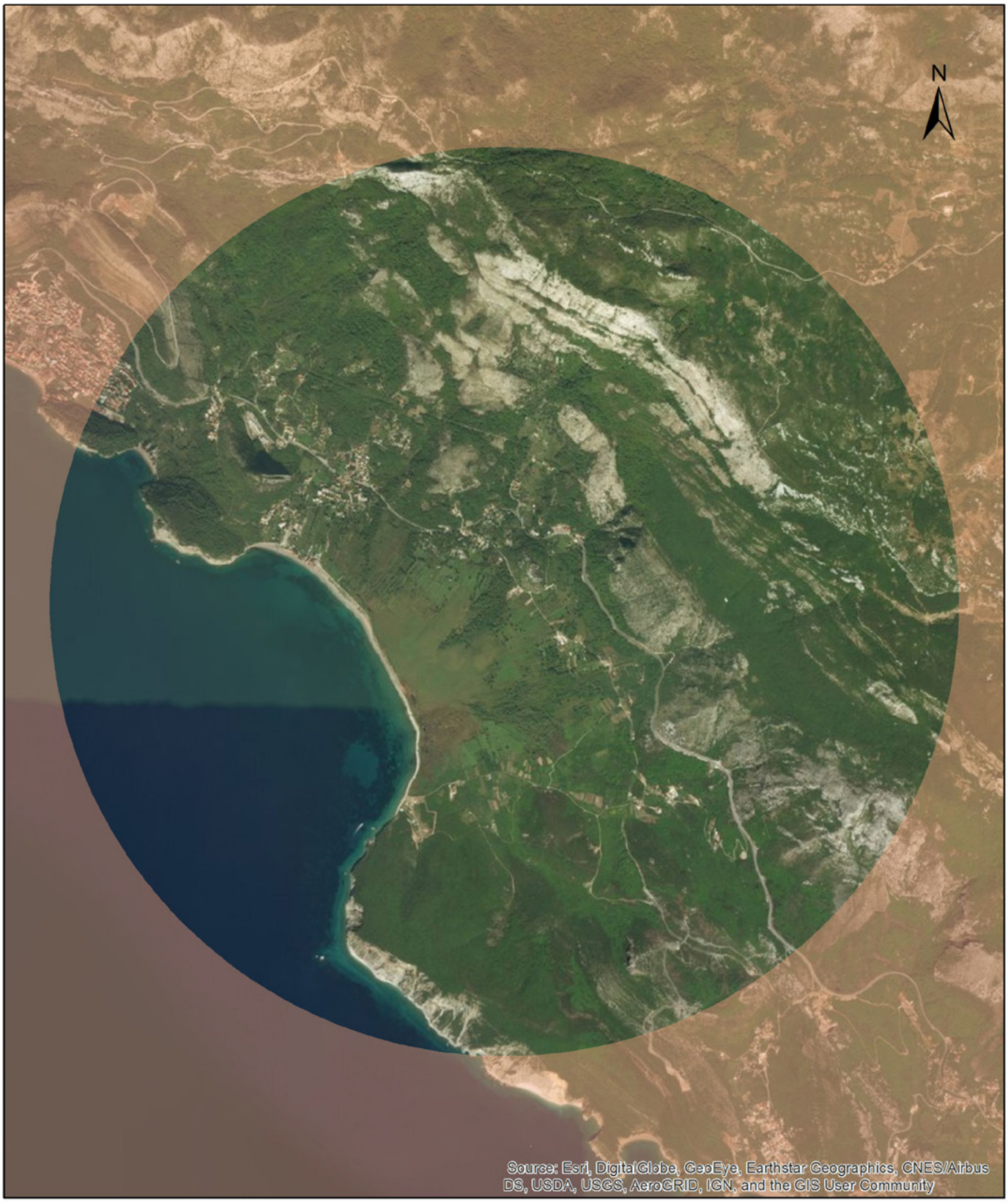
The aquifer of Buljarica valley is located to the southeast of Petrovac, between the hills Đurđevo brdo and Dubovica. Quaternary sediments are less permeable than the surrounding limestone, and that is why on the line of their junction numerous springs can be found. The most important springs are Lončar, at around 25 m a.s.l., with a minimal yield of 2.0 l/s; Sopot, at app. 45 m a.s.l., with a minimal yield of 5.0 l/s; and Gradac spring, on the level of approximately 15 m a.s.l., with a minimal yield of 5.0 l/s (Manojlović & Marić 1996). Water from the well 'Zagradac / Dobra voda' is used for water supply of the Buljarica settlement. It is located in Buljarica cove near Gradac hill. It is 30 m deep and has a minimal yield of 15 l/s (Radulović 2000).

CLIMATE

As in the entire coastal region, annual temperature fluctuations of this area are very small. Budva municipality, same as Buljarica, is characterised by a Mediterranean climate with an average annual air temperature of 15.8 °C. Annual rainfall is about 1,500 mm. The most significant winds are bura, jugo and mistral, and air humidity is between 67 and 79%[22].

21 Zavod za izgradnju "Budva" a.d. – Budva, 2009. Spatial plan of municipality Budva. Municipality Budva.
22 Zavod za izgradnju "Budva" a.d. – Budva, 2009. Spatial plan of municipality Budva. Municipality Budva.

MAP 2: STUDY AREA PRESENTED ON THE SATELLITE IMAGERY MAP



0 0,5 1 2 Kilometers

Map created by Montenegrin Ecologists Society
Date: September 2016

CRITICAL ECOSYSTEM PARTNERSHIP FUND

CRNOGORSKO DRUŠTVO EKOLOGA

BIODIVERSITY OBJECTS

In the ecosystem-based approach, determining biodiversity objectives means looking into ecosystems and species that represent them, but most importantly identifying the whole system, and main processes, structures and dynamics within.

In the Buljarica scoping area, biodiversity objects were grouped into three big categories: Marine and coastal ecosystems, Freshwater and brackish systems, and Terrestrial and karstic ecosystems. Under these, the main ecosystems they are consisted of and important species within are explained below.

MARINE AND COASTAL ECOSYSTEMS

Benthic zone presents one of the most important ecosystems of Buljarica. It consists of four habitat types listed in Annex I of the Habitats Directive (numbers in brackets are Natura 2000 codes; asterisk denotes priority habitat type): Sandbanks (1110), which are slightly but permanently covered by seawater; *Posidonia* beds (*Posidonion oceanicae*) (1120*); Large shallow inlets and bays (1160); and Reefs (1170).

***Posidonia* beds** (*Posidonion oceanicae*) are "meadows" formed by *Posidonia oceanica*, the Mediterranean endemic (Montefalcone 2009), which is one of only four flowering marine plants found in the Adriatic Sea (Bakran-Petricioli & Petricioli 1999). These meadows form on mobile sandy and detritus-covered sea floor at depths between 5 and 27 m. "Posidonia beds in the Mediterranean infralittoral zone" are considered Vulnerable (Gubbay et al. 2016). Up to 12 m of depth Posidonia beds appear very specifically, in forms or smaller or larger patches. In some large parts of the sea bottom, *Posidonia* meadows are substituted with two other habitats: sandbanks and shallow inlets. The fauna of this part of the sea bottom is extremely rich with species, especially with echinoderms, worms, shellfish, snails and fish. From 12 m to 23 m of depth, along the entire bay, Posidonia meadows are representative and nicely grown. At depths of over 23 m, the density of its meadows decreases and Posidonia leaves are much shorter, while below 25 m to 28 m it completely vanishes, and is replaced by a sandy substrate.

Posidonia meadows support a high diversity of habitats that are colonised by various life forms. They provide protection and shelter, a place for spawning and reproduction, a substrate to grow upon, and source of nourishment for numerous animal species found in high numbers and diversity. Other than being net producers of organic matter and oxygen for their surroundings, Posidonia beds also participate in water purification, trapping of sediments and carbon storage, and they contribute to beach protection through waves buffering.

Littoral zone ranges from the coastline up to 1.5 km out in the open sea. In this zone, 51 fish species were recorded along field transects. Among these, 19 are predominately connected to *Posidonia* habitat, 18 species to sandbanks and 14 species to reefs. The most important species are *Epinephelus marginatus*, assessed as Endangered at global, European and Mediterranean levels (IUCN Red List) and *Sciaena umbra*, assessed as Near Threatened at the global level. Both are listed in Appendix III of the Convention on the Conservation of European Wildlife and Natural Habitats and Annex III of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean. Registered in very low abundance is *Dentex dentex*, assessed as Vulnerable globally.

Parts of the littoral zone under the cliffs of Resovo brdo and Dubovica are classified as reefs. The profile of the bottom here is steeply sloped, rocky and covered with communities of infralittoral algae. At these localities several important species were recorded, which are listed in Annexes of the Habitats Directive and in the Specially Protected Areas of Mediterranean Importance (SPAMI) Protocol of the Barcelona Convention: *Lithophaga lithophaga*, *Tonna galea*, *Pinna nobilis*, *Axinella damicornis*, and *Ophidiaster ophidianus*.

In May 2017, we found that Buljarica cove could also be a spawning ground for Blue shark (Prionace glauca). This was assumed after collecting the data about a catch of a newborn individual of this species at the eastern part of the beach, at the depth of approximately 10 meters. As its population in the Mediterranean is Critically Endangered according to the IUCN[23], its presence in Buljarica would be important for the conservation of this habitat. The total length of the individual was 53,5 cm. According to the information obtained from the IUCN official website, Blue shark pups are 35 to 50 cm long at birth and are often born in spring or summer. This corresponds with the collected data about the caught individual, so it can be assumed that this pup was born in the shallows of Buljarica cove.

Vegetated and non-vegetated sandy and gravel beaches are distributed only in the littoral and supralittoral zone, with a relatively small surface. During the summer season, this habitat is under strong pressure from tourists and systematic measures of cleaning of the beaches, which cause typical vegetation to be rather poorly developed, fragmented and limited only to the outermost parts of the beach. Nevertheless, this

23 www.iucnredlist.org/details/39381/3.

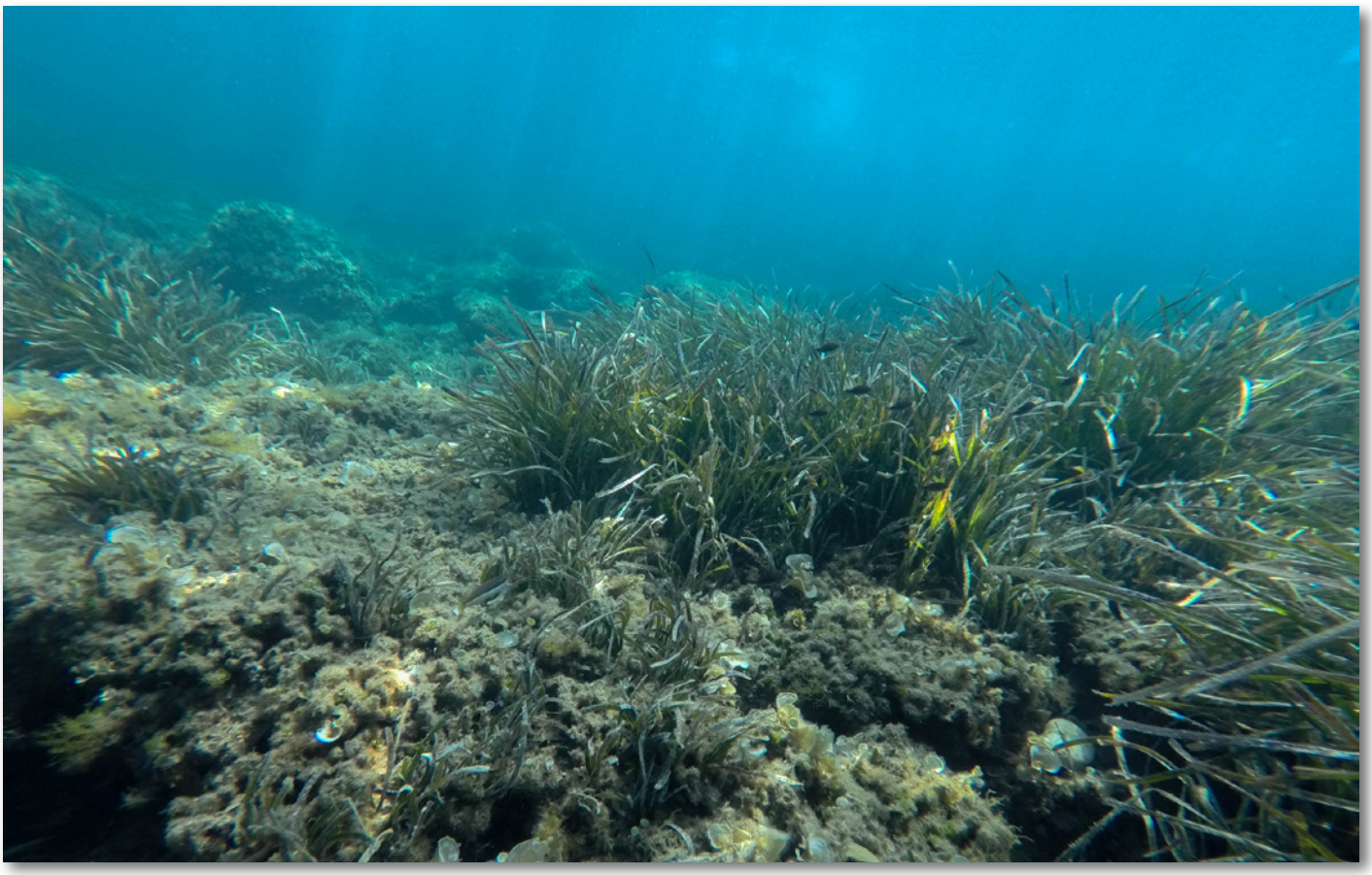


Photo 2: Benthic zone - typical formation of *Posidonia oceanica* meadows

Photographer: Mihailo Jovićević

Photo 3: Littoral and supralittoral zone of gravel beach

Photographer: Mihailo Jovićević

habitat is particularly important for the conservation of some very rare species of algae, molluscs, as well as vascular plants such as *Glaucium flavum, Cakile maritima, Echinophora spinosa*, and *Medicago marina*, which have very limited distribution along the Adriatic coast.

Regarding birds, these ecosystems are important for feeding, resting or roosting of species such as *Haematopus ostalegus, Actitis hypoleucos, Cygnus cygnus, Larus michahellis, Pluvialis apricaria*, and *Sternula albifrons*.

FRESHWATER AND BRACKISH SYSTEMS

Brackish marshlands, lagoons, channels and reed beds build vast open marshland complexes and mosaics in the beach hinterland, occupying ca. 58 ha. The water is slightly salty, and dries out in late summer. Vegetation cover is composed mainly of Phragmites australis and Schoenoplectus lacustris, while lagoons and channels are overgrown with *Ranunculus circinatus* and Callitriche palustris, very rare species in the Mediterranean. The surfaces of today's marshlands were used by local people for growing crops and now are abandoned and partially revitalised in their primaeval floristic composition. This ecosystem supports animal species of which some are listed on the IUCN Red List: *Aythya ferina, Pelophylax shqipericus*, and *Emys orbicularis*. This habitat is especially important for the freshwater turtle Balkan terrapin (*Mauremys rivulata*) because it is one of the five best-preserved habitats of this species in Montenegro. Lagoons and marshland are the most important site for feeding of seven bat species (all protected) but also for breeding, roosting and wintering of dozens of bird species, such as *Acrocephalus melanopogon, Botaurus stellaris, Circus aeruginosus, Ardeola ralloides, Ixobrychus minutus,* and *Rallus aquaticus*, all listed in the Annex I of the Birds Directive.

Springs and streams. Buljarica is one of the areas richest with springs in the entire coastal zone of Montenegro, and it provides the marshland with fresh water. This ecosystem, characterised by high water clarity, relatively constant water temperature and good chemical composition, is vital for the aquatic food chain that includes numerous primary producers and smaller numbers of primary and secondary consumers, of which most are endemic. Inappropriately, this ecosystem is mainly unexplored. Considering some invertebrate species, two species of Odonata (*Cordulegaster bidentata* and *Cordulegaster heros*) that are endemic to the Balkan Peninsula and listed under Annex II of the Habitats Directive are dependent on the good ecological state of springs and streams. Streams also play an important role, as corridors, in connecting fragmented habitats and thus in conserving biodiversity. Here *Rana graeca* and *Lissotriton vulgaris* find ideal conditions for completing their life cycles.

Remnants of gallery and floodplain forests potentially have a wide distribution on the edge of the marshland. As we mentioned previously, they had mainly been converted to arable lands or meadows, so now they are significantly degraded and have limited distribution. Remnants of forests of *Fraxinus angustifolia ssp. oxycarpa* or *Salix alba* galleries were confirmed in a very restricted area in villages Golubovići and Kanjoši and should be the objects of the revitalization process.

TERRESTRIAL AND KARSTIC HABITATS

Tall hay meadows have appeared due to land use changes. They have limited distribution, scattered alongside the marshland edge. After amelioration of marshlands and cutting of riparian forests, these were converted to hay meadows which have been regularly mown one or two times a year for the hay for cows or sheep. Following the decrease in traditional livestock breeding, most of these grasslands were not being mown during the last 20–30 years and were left to a strong natural succession of vegetation from shrub stage to the forest climax. According to this, their floristic composition is modified, still keeping the presence of some rare species: *Alopecurus rendlei, Gladiolus illyricus, Narcissus tazetta, Orchis laxiflora, Ranunculus neapolitanus,* and *Serapias vomeracea*. Several species from the order Lepidoptera listed under Annexes II and IV of the Habitats Directive depend on this ecosystem: *Papilio alexanor, Hipparchia fagi, Euphydryas maturna,* and *Zerinthia polyxena*.

Rocky pastures and arborescent matorral are widely distributed in altitude range 30–800 m, occupying open and semi-open rocky habitats on steep slopes which are sometimes strongly eroded. These present-day or former pastures were the main habitats for goats grazing, which was a dominant kind of livestock in the Mediterranean part of Montenegro. These pastures are very rich in rare and endemic plants (*Euphorbia fragifera, Fritillaria gracilis, Gladiolus illyricus*), especially orchids (*Orchis simia, O. provincialis, Ophrys sphegodes*), as well as in some traditionally used medicinal and/or melliferous plants (*Salvia officinalis, Satureja montana*, etc.). Following the decline in livestock breeding, the pastures are often burned and overgrown with scrub vegetation. Regarding fauna, this ecosystem is crucial for insects, reptiles and birds. Species that are significant according to the Birds and Habitats directives are *Alectoris graeca, Accipiter brevipes* and *Bubo bubo*. Key reptile species are *Testudo hermanni, Vipera ammodytes, Hierophis gemonensis,* and *Elaphe quatuorlineata*.

Thermophilous oak woods are a climazonal vegetation type present 50 m above the sea. Due to long-term use of these forests for fuelwood and building material,

they were degraded or converted to maquis, pastures or scrub, occupying large areas today. *Quercus virgiliana* (variety of *Quercus pubescens*) forests, with many evergreen bushes within the shrub layer, are especially important for conservation as they have a priority in protection, according to the Habitats Directive. *Quercus ilex* maquis occupies lower, while *Quercus cerris* grows on higher altitudes on slightly exposed habitats. Some important plants such as *Epipactis microphylla*, *Neottia nidus-avis, Orchis simia*, etc., were found in these forest ecosystems.

Cliffs and rocky outcrops (screes, rocky outcrops, inland and coastal cliffs) are most important for the conservation of endemic and relict species, which usually occupy limited, inaccessible areas where they are well developed and representative due to the absence of competition. These species, strongly limited to rock crevices and outcrops, are *Campanula austroadriatica, Putoria calabrica, Phagnalon rupestre, Centaurea glaberrima, Euphorbia dendroides* and others. Cracks in cliffs provide nesting places for alpine swifts (*Tachymarptis melba*), and holes and ledges for Eleonora's Falcon (*Falco eleonorae*).

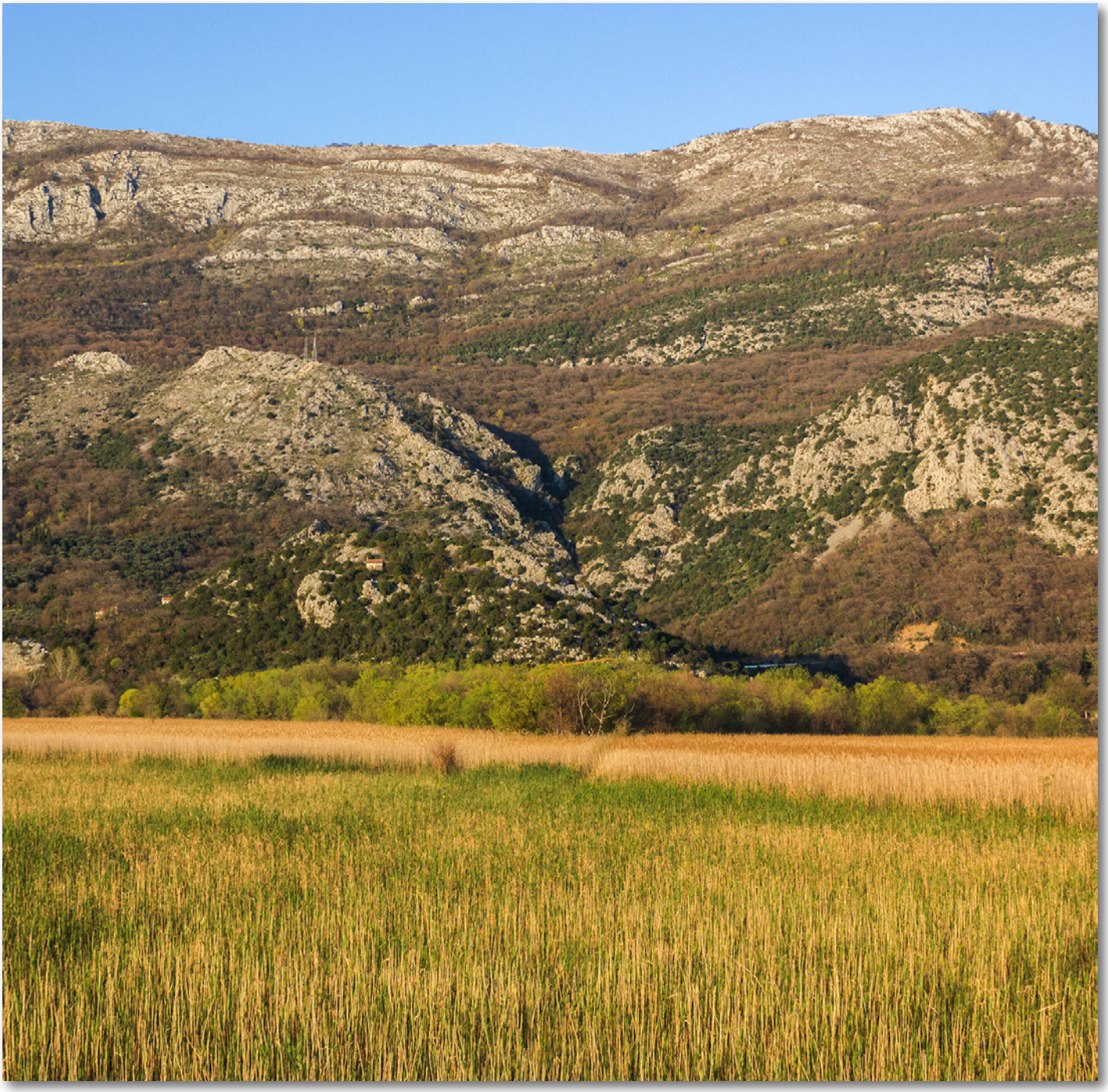


Photo 4: Brackish marshland, reed bed, *Fraxinus* woods rocky pastures, thermophilous oak woods and rocky outcrops

Photographer: Mihailo Jovićević

SPATIAL ANALYSIS OF BIODIVERSITY GROUPS

MARINE HABITAT TYPES AND SPECIES

Posidonia meadows, *Posidonia* on rocky bottom, a mosaic of *Posidonia* and "matte"[24], sandy bottom, rocky bottom and photophilous algae on the rocky bottom are registered as different biocenoses. They are classified, according to the EUNIS Habitats Classfication, as A5.53 Sublittoral seagrass beds (coresponds to *Posidonia* beds, 1120* according to EU Habitat Directive), A5.26 Circalittoral muddy sand, A2.4 Littoral mixed sediments and A3 Infralittoral rock and other hard substrata.

In Table 1, results of the two-day fieldwork on four transects are presented. The focus was on species listed in Annex II (Endangered or threatened species) and Annex III (List of species whose exploitation is regulated) from the Specially Protected Areas of Mediterranean Importance (SPAMI) Protocol of the Barcelona Convention.

Interpretation of satellite imagery Sentinel-2 from July 2016 with the use of the input data taken from the sea bottom was used to produce the map of marine habitat types distribution in the scope area.

At depths of 10 to 23 m, the most widespread is Posidonia, which forms a habitat in the form of characteristic meadows.

These are mixing mostly with Sandbanks at the middle of the bay and with Coralligenous habitats and reefs at its edges. Posidonia meadows are here mainly well-developed, dense and very rich with benthic species and fish.

Despite limited resources and insufficient survey of the bottom by our team, seven species were recorded that are significant from the conservational point of view. Some of them are mollusc species *Tonna galea* and *Pinna nobilis*, and starfish, *Ophidiaster ophidianus*, present in fairly large numbers, all listed in Annex II of the Barcelona Convention.

Below presented is the map of four different biocenoses identified during field research (Map 3).

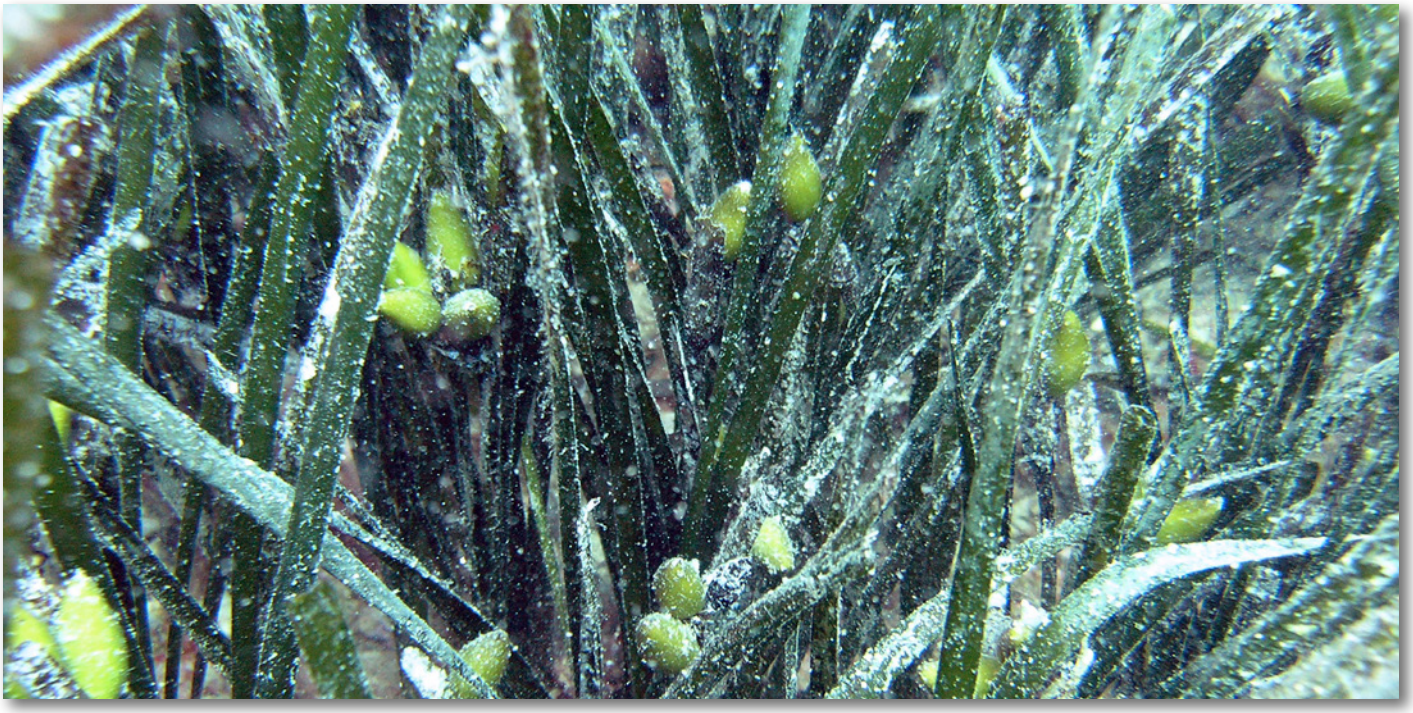


Photo 5: Leaves and fruits of *Posidonia oceanica*

Photographer: Dušan Varda

24 Mattes (or mats) of Posidonia are terrace-like structures formed of its intertwined horizontal rhizomes and vertical shoots, which make a dense net that easily gets lled with (inorganic) sediment. Matte is the result of the balance between material accretion (detritus and sediment), decomposition and erosion. Rhizomes at the bottom of a matte can be several thousand years old. There is a record that near Bar the Posidonia matte (dead and alive) was 14 m thick (Varda 2015).
Mattes are highly organic and provide a habitat for numerous species.
"Facies of dead 'mattes' of Posidonia oceanica without much epi ora" was recognised as important on the international level: Bern Convention – Included in a Resolution 4 habitat type at a higher level (A5).

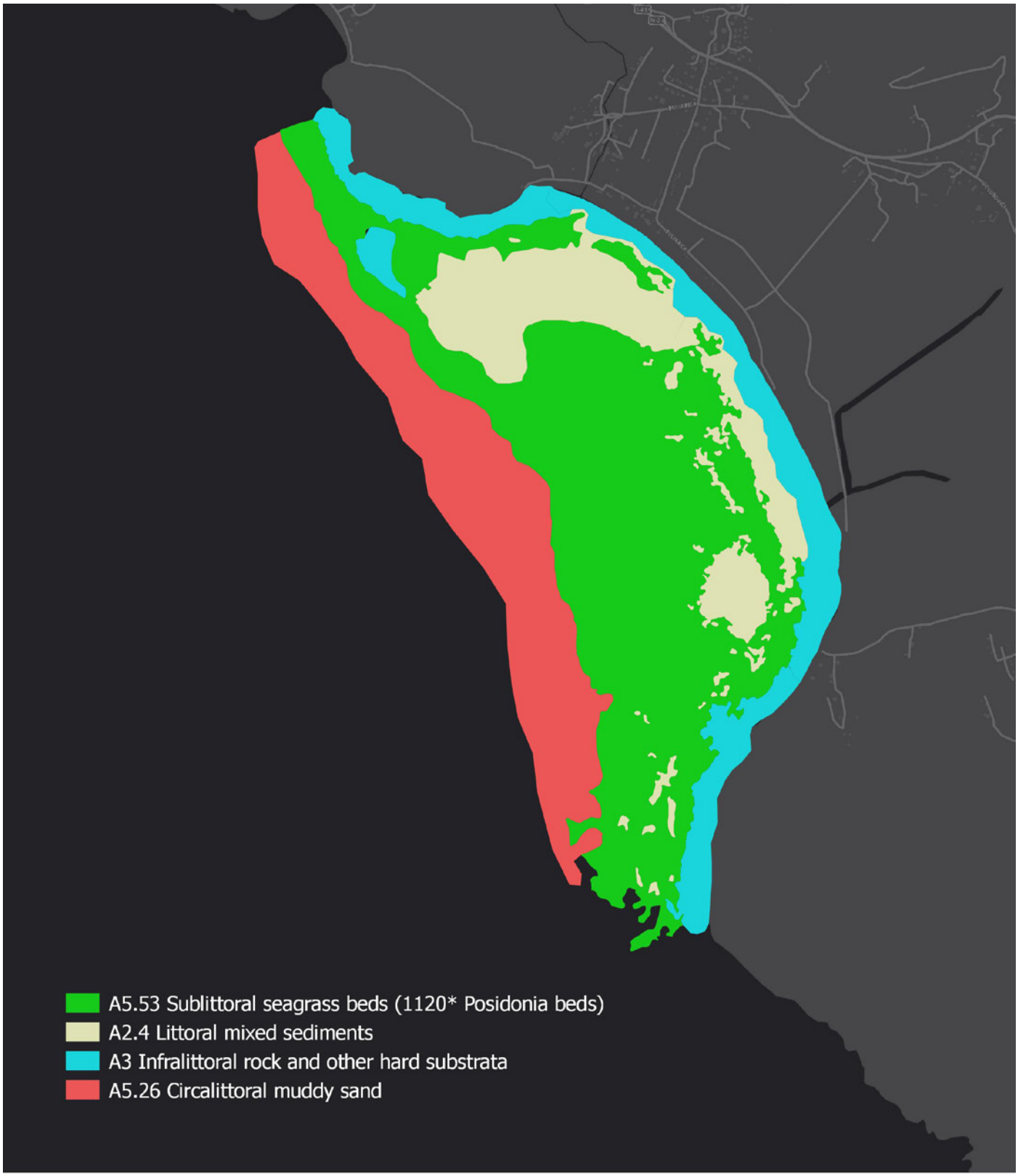
TABLE 1: MARINE SPECIES LISTED ON EUROPEAN CONVENTION OR HAVE UNFAVOURABLE IUCN STATUS

SPECIES	HABITAT TYPE	BERN CONVENTION	BARCELONA CONV.	IUCN
Posidonia oceanica	sand, rock	Appendix II	Annex II	LC
Osmundaria volubilis	rocks			
Cystoseira amentacea	rocks		Annex II	
Cystoseira spinosa	rocks		Annex II	
Pinna nobilis	*Posidonia* beds	Appendix II	Annex II	
Lithophaga litophaga	rocks	Appendix II	Annex II	
Tonna galea	stones, rocks	Appendix II	Annex II	
Luria lurida	rocks	Appendix II	Annex II	
Paracentrotus lividus	stones, roks, *Posidonia* beds	Appendix III	Annex III	
Ophidiaster ophidianus	stones, rocks	Appendix II	Annex II	
Axinella polypoides	rocks	Appendix II	Annex II	
Axinella cannabina	stones, rocks		Annex II	
Scyllarus arctus	mud, rocks, *Posidonia* beds	Appendix III	Annex III	LC
Sciaena umbra	in all ecosystem	Appendix III	Annex III	NT
Epinephelus marginatus	in all ecosystem	Appendix III	Annex III	EN
Dentex dentex	in all ecosystem			VU
Coryphaena hippurus	in all ecosystem			
Sarda sarda	in all ecosystem			
Merluccius merluccius	in all ecosystem			VU
Umbrina cirrosa	in all ecosystem			VU
Raja asterias	in all ecosystem			NT
Prionace glauca	in all ecosystem	Appendix III	Annex III	CE_{med}
Isurus oxyrinchus	in all ecosystem	Appendix III	Annex III	VU

Photo 6: Facies of banks of dead leaves of *Posidonia oceanica*

Photographer: Mihailo Jovićević

MAP 3: BIOCENOSIS OF THE SEA BOTTOM CLASSIFIED ACCORDING TO THE EUNIS HABITAT CLASSIFICATION



0 400 800 1200 m

Map created by Montenegrin Ecologists Society
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Photo 7: Date mussel, *Lithophaga lithophaga*

Photographer: Dušan Varda

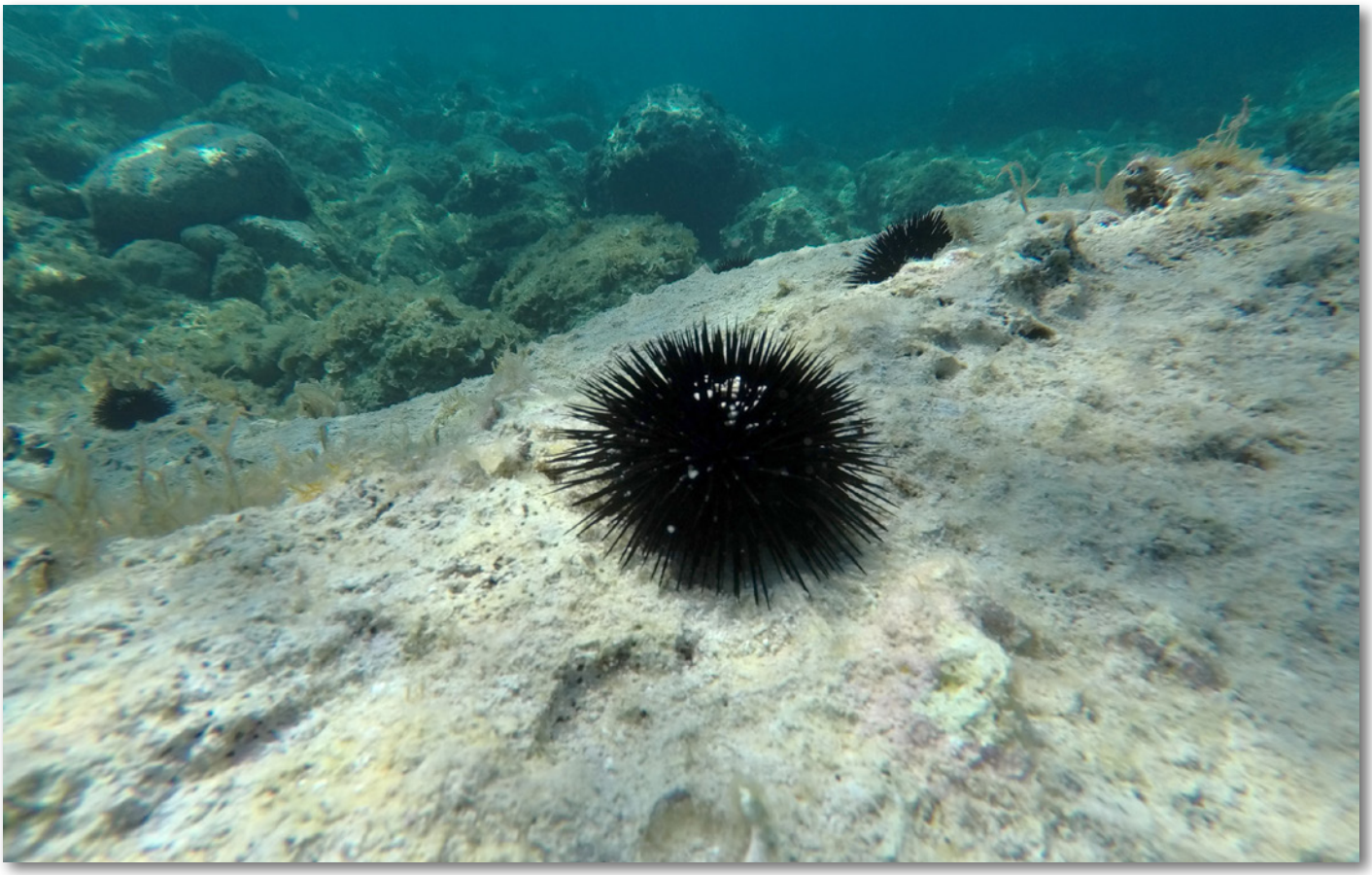


Photo 8: Biocenosis of infralittoral rock and hard substrata

Photographer: Mihailo Jovićević

Photo 9: Horned poppy, *Glaucium flavum*

Photographer: Mihailo Jovićević

Photo 10: Brackish system of ponds and irrigation channels

Photographer: Mati Kose

TERRESTRIAL HABITAT TYPES AND VASCULAR PLANT SPECIES

Thirty-six terrestrial habitat types were registered within the geographical scope of the Buljarica cove area. As many as 17 terrestrial habitats are important at the EU level considering that they are listed in Annex I of the Habitats Directive. The presence of typical Mediterranean galleries of white willow is still doubtful in Balkan countries, so in this review, they were marked with "?". Although the habitat type 91F0 – Riparian mixed forests with Fraxinus, Quercus etc. was not elaborated in the "*Catalogue of habitat types of EU importance of Montenegro*", we consider that the presence of these forests is not doubtful in Montenegro: they are typically developed in the Bojana River plain (Mrdak et al. 2012). On the other side, this habitat is very fragmented in the Buljarica cove area. Petrifying springs with tufa formation (code 7220, conservation status in the Mediterranean: Unknown or Unfavourable – Inadequate or Bad) occupy very small areas on the steep slopes near Popovo selo hence this was not mapped as a polygon on the vegetation map.

Habitat type 3260 (*Calltiricho-Batrachion* plant community) is developed only in amelioration channels, so we did not elaborate it as important and well developed within the area.

In the analysed area, the presence of 253 vascular plant species was confirmed. This is certainly not a final number of taxa taking into account the short time of the investigation. Three of the registered plant species (*Daphne laureola, Euphorbia dendroides, Orchis simia*) are protected in Montenegro, while the final number of such plants is surely greater. It is assumed that some other protected species such as Colchicum hungaricum, Hermodactylis tuberosus, Hyacinthella dalmatica and Ophrys sphegodes are also present in the area, but they were not directly observed during our visits, because they are early-flowering hence hardly observable in the larger part of the year.

List of recorded terrestrial habitat types in the area is presented in the table below, followed by map 4.

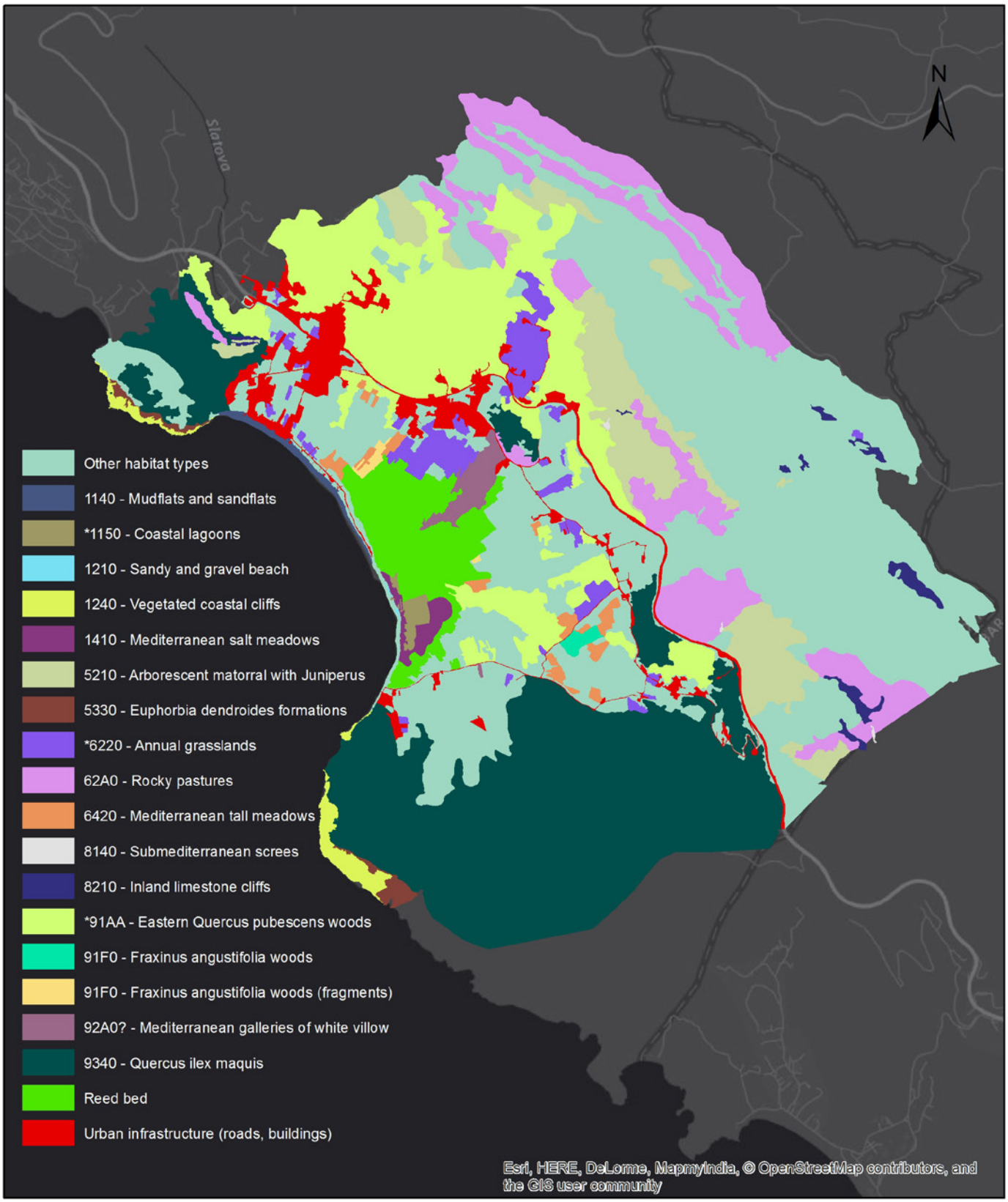
Photo 11: Vegetated gravel beach with *Crithmum maritimum*

Photographer: Mihailo Jovićević

TABLE 2: TERRESTRIAL HABITAT TYPES

No	HABITAT TYPE	EUNIS CODE	N2000 CODE	AREA (ha)
1	Mudflats and sandflats connected to the sea	A2	1140	3,56
2	Gravel beaches without vegetation	B2.2	-	1,45
3	Ruderal habitats	-	-	43,7
4	Vegetated coastal cliffs		1240	9,2
5	*Quercus ilex* maquis	F5.116	9340	204,46
6	Coastal lagoons	C3.421	*1150	3,19
7	Sandy and gravel beach with annual vegetation	B2.34	1210	0,14
8	Urban infrastructure (roads, buildings etc.)	J1.6	-	26,17
9	*Spartium junceum* scrubs	F5.4	-	12,4
10	*Fraxinus angustifolia* woods	G1.33	91F0	3,45
11	Annual grasslands – *Thero-Brachypodietea*	E1.333	*6220	29,53
12	Mediterranean tall meadows	E3.11	6420	8,98
13	Mediterranean galleries of white willow	G1.112	92A0?	8,05
14	Forests degraded by urbanisation	I2.23	-	31,68
15	*Carpinus orientalis* scrubs	G1.7C2	-	206,61
16	Abandoned arable land	I1.53	-	11,64
17	Reed beds	C3.21	-	44,8
18	*Pteridium aquilinum* stands	E5.33	-	29,15
19	Scrubs on fire sites	G5.81	-	3,24
20	Eastern *Quercus pubescens* woods	G1.75	*91AA	158,82
21	*Euphorbia dendroides* formations	F5.52	5330	4,49
22	*Pinus halepensis* woods	G3.74	-	16,59
23	Inland limestone cliffs	H3.25	8210	7,26
24	Arborescent matorral with Juniperus sp.	F5.13	5210	70,6
25	Rocky pastures – *Scorzoneretalia villosae*	E1.513	62A0	106,39
26	Subnitrophilous crofts with olives	E1.61	-	2,4
27	Hygrophilous scrubs and shrubs	G5.2	-	1,81
28	Subnitrophilous crofts with orchards	E1.61	-	0,63
29	Arable lands	I1.13	-	1,25
30	Limestone pavement – Karren (shkrape)	H3.6	-	1,51
31	Submediterranean screes	H2.6C	8140	0,33
32	Quercus pubescens – *Carpinus orientalis* woods	G1.7375	-	97,61
33	Submediterranean *Quercus cerris* woods	G1.7421	-	14,94
34	*Ostrya carpinifolia* woods	G1.7C1	-	13,84
35	Mediterranean salt meadows	42764	1410	5,08
36	Petrifying springs with tufa formation (*Cratoneurion*)	C2.1	*7220	0,01
TOTAL	36		17	1185

MAP 4: TERRESTRIAL HABITAT TYPES CLASSIFIED ACCORDING TO THE EU HABITAT DIRECTIVE



0 0,5 1 2 Kilometers

Map created by Montenegrin Ecologists Society
Date: September 2016

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Photo 12: Balkan Goldenring, *Cordulegaster heros*

Photographer: Miloš Popović

Photo 13: Bladetail, *Lindenia tetraphylla*

Photographer: Miloš Popović

INSECTS

In total, 175 species of insects were registered. Of these, there are 41 species of dragonflies (Odonata), and 66 species of butterflies plus 13 species of moths (Lepidoptera); also 12 species of aquatic bugs (Hemiptera), 27 species of beetles (Coleoptera), and 16 species of grasshoppers and crickets (Orthoptera). Based on these data, we can conclude that this area represents a hot spot for dragonflies and butterflies due to the fact that numbers of registered species for each group represent, respectively, more than 40% and 61% of all species of these orders registered in Montenegro. This report considered 14 key species and their relations with ecosystems where they meet optimal ecological attributes for feeding and reproduction. Based on them, the model was generated which shows species richness and their distribution through the area of investigation (Map 6).

Four of 41 species of Odonata have special significance from the aspect of conservation biology and ecosystem services: *Cordulegaster heros, Cordulegaster bidentata, Caliaeschna microstigma*, and *Lindenia tetraphylla*. Except for the last species, springs and streams are the main habitats of Odonata. They are threatened mainly by habitat loss and fragmentation, by the development of tourism, human settlements, drying out of rivers, and impounding of springs for irrigation purposes.

Forest destruction through logging and forest fires present at Buljarica contribute to these threats. All tree species are assessed as Near Threatened on a European level by the IUCN. In addition, *Cordulegaster heros* is listed in Annexes II and IV of the European Habitats Directive.

The population of *Lindenia tetraphylla* is recorded in small ponds, channels and reed beds. Pollution of water by wastewater is a significant threat to this species. It is assessed as Vulnerable at European level and listed in Annexes II and IV of the Habitats Directive.

Thermophilous Eastern-oak woods serve as an important habitat for several species of beetles (order Coleoptera): *Cerambyx cerdo* and *Lucanus cervus*. Both are listed in Annexes II and IV of the EU Habitats Directive and assessed as Near Threatened at European level. The main threat to their persistence is degradation or loss of habitat quality that mainly refers to old trees of *Quercus pubescens* where the majority of populations are present.

Regarding the fauna of butterflies and moths (order Lepidoptera), as much as seven registered species are regarded as “umbrella” species of high importance for conservation. These are *Callimorpha quadripunctaria, Papilio alexanor, Euphydryas aurinia, Euphydryas maturna, Proserpinus proserpina, Zerynthia polyxena*, and *Hipparchia fagi. Callimorpha quadripunctaria* is recorded at grasslands where it is relatively common.

The population of this Mediterranean species is declining because of loss of suitable habitats due to urbanisation. A similar situation is with two more species natively related with grasslands, slopes, habitats with scarce oak trees: *Papilio alexanor* and *Euphydryas aurinia*. All three species are listed in Annexes II and IV of the Habitats Directive or/and Appendix II of the Bern Convention. The life cycle of another representative of the order, *Proserpinus proserpina* is related with marshland and *Quercus ilex* forests. This species is scarce in Buljarica but still plays an important role in sustaining its ecosystem structure.

The species with the highest threat/conservation status is Euphydryas maturna, which is considered Vulnerable on the IUCN Red List and presented in Annex II of the Habitats Directive and Appendix II of the Bern Convention. This species is related mainly to tall hay meadows and riparian forests but occurs also in surrounding habitats. Main threats for this species in Buljarica are eutrophication of the marshland and afforestation of meadows.

Insect species distribution and richness are presented on the map 5.

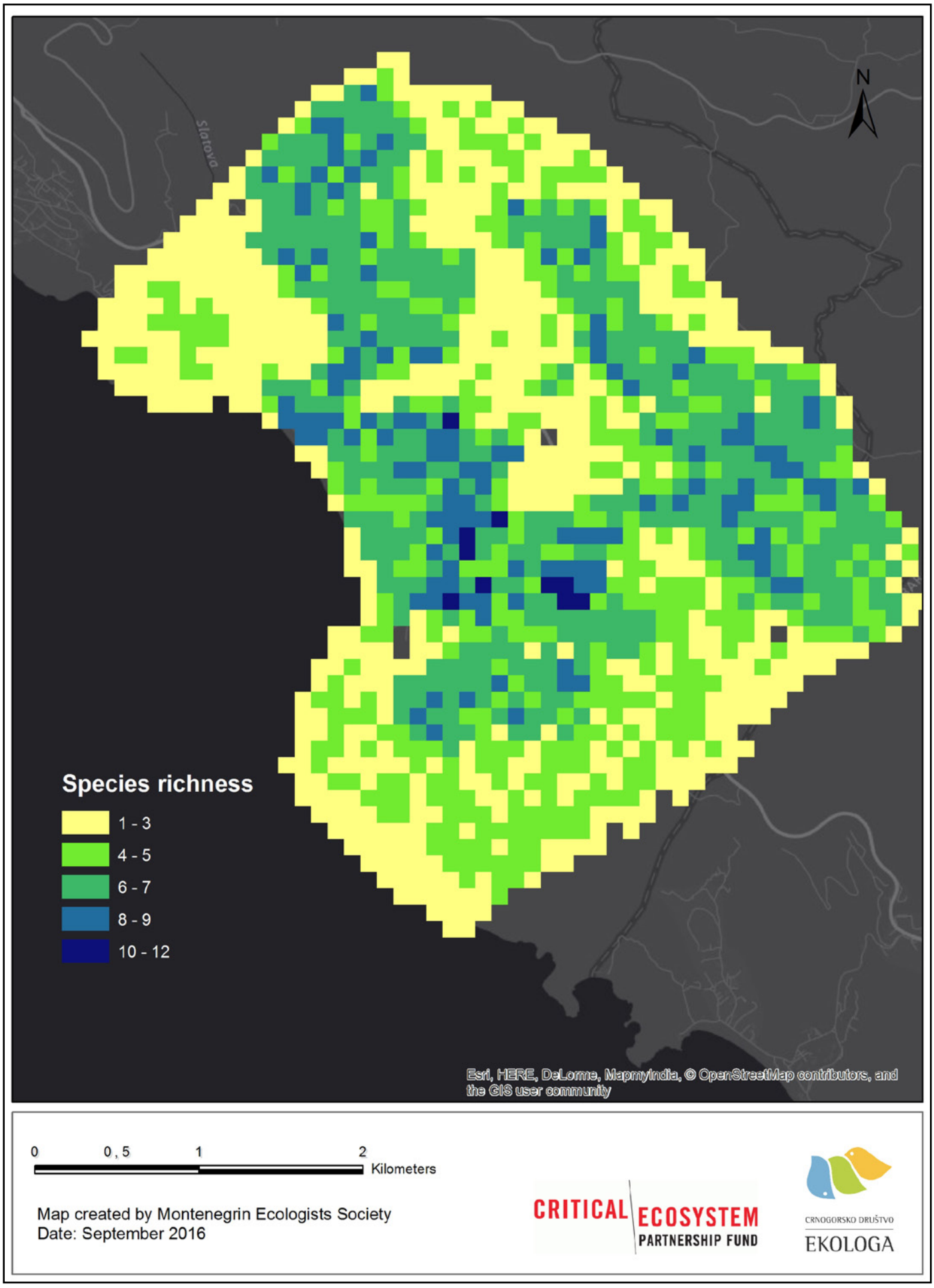
TABLE 2: INSECT SPECIES, THEIR HABITATS AND THEIR CONSERVATION STATUS

SPECIES	HABITAT DIRECTIVE	BERN CONVENTION	IUCN	HABITAT
Cordulegaster heros	Annex II, Annex IV		VU	Streams
Cordulegaster bidentata			NT	Springs and streams
Caliaeschna microstigma			NT	Springs and streams
Lindenia tetraphylla	Annex II, Annex IV	Appendix II	NT	Swamp
Callimorpha quadripunctaria	Annex II		N/A	Oak woods
Proserpinus proserpina	Annex IV	Appendix II	N/A	Oak woods
Papilio alexanor	Annex IV	Appendix II	LC	Meadows
Hipparchia fagi			NT	Meadows
Euphydryas maturna	Annex II, Annex IV	Appendix II	VU	Meadows
Euphydryas aurinia	Annex IV	Appendix II	LC	Rocky grasslands
Zerinthia polyxena	Annex IV	Appendix II	LC	Meadows
Cerambyx cerdo	Annex IV	Appendix II	NT	Oak woods
Lucanus cervus	Annex II, Annex IV	Appendix III	NT	Oak woods
Saga natoliae				Oak woods

Photo 14: Southern swallowtail, *Papilio alexanor*

Photographer: Mihailo Jovićević

MAP 5: DISTRIBUTION AND SPECIES RICHNESS OF 14 KEY SPECIES OF INSECTS



Map created by Montenegrin Ecologists Society
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Photo 15: Tree frog, *Hyla arborea*

Photographer: Mihailo Jovićević

Photo 16: Marsh frog, *Pelophylax shqipericus*

Photographer: Mihailo Jovićević

AMPHIBIANS

Eleven species of amphibians were recorded in Buljarica, which makes 79% of all amphibian species present in Montenegro. The highest number of species is related with brackish and freshwater habitats such as a lagoon, reed bed, irrigation channels, streams, but also with tall humid meadows and riparian habitats. Three frog species, *Pelophylax ridibundus*, *Pelophylax shqipericus* and *Hyla arborea* had the largest populations while the least numerous populations were those of *Triturus macedonicus* and *Rana dalmatina*. Regarding their occurrence in ecosystems, Macedonian crested newt (*Triturus macedonicus*), Smooth newt (*Lissotriton vulgaris*), Greek stream frog (*Rana graeca*), Yellow-bellied toad (*Bombina variegata*), and Fire salamander (*Salamandra salamandra*) were found in streams and springs. Other species are mostly related to marshland area. Populations of all species were estimated as stable, in spite of many threats that have been registered. The most common are overgrowing of wetlands, sedimentation of dead plant material in irrigation channels, and fragmentation of habitats, which leads to isolation of populations.

Analysis of conservation status of 11 amphibian species present in Buljarica revealed that six of them are listed in Annexes II and IV of the Habitats Directive, all species are listed in Appendices II and III of the Bern Convention and one (*Pelophylax shqipericus*) has unfavourable status at the IUCN Red List and is assessed as Endangered. All species were included in the model which shows their richness and distribution across habitats. According to this, the most important ecosystems for amphibians are streams, marsh with channels, lagoons and humid grasslands (see the table below). Large populations of true frogs and European tree frog have significant role in trophic chain, but also contribute to maintenance of optimal ecological conditions for three more species: Macedonian crested newt, Smooth newt and Greek stream frog, known as indicators of clean water. The key contribution of amphibians is reducing the abundance of mosquitoes, some other pest species and predators of insect pollinators. In Table 3 and Map 6 that follow, the list of the species is given, with their conservation status and preferred habitats.

TABLE 3: AMPHIBIAN SPECIES AND HABITATS

SPECIES	HABITATS DIRECTIVE	BERN CONVENTION	IUCN	HABITAT
Lissotriton vulgaris		Appendix III	LC	streams, rivers, marshland
Triturus macedonicus	Annex IV	Appendix II	LC	streams, rivers, marshland
Salamandra salamandra	Annex IV	Appendix III	LC	springs, streams, rivers
Hyla arborea	Annex IV	Appendix II	LC	marshland
Bombina variegata	Annex II, Annex IV	Appendix II	LC	springs, marshland
Bufo bufo		Appendix III	LC	marshland, humid grasslands
Bufotes viridis	Annex IV	Appendix II	LC	marshland, humid grasslands
Pelophylax shqipericus		Appendix III	EN	marshland
Pelophylax ridibundus		Appendix III	LC	marshland
Rana dalmatina		Appendix II	LC	humid grasslands
Rana graeca	Annex IV	Appendix III	LC	rivers, streams

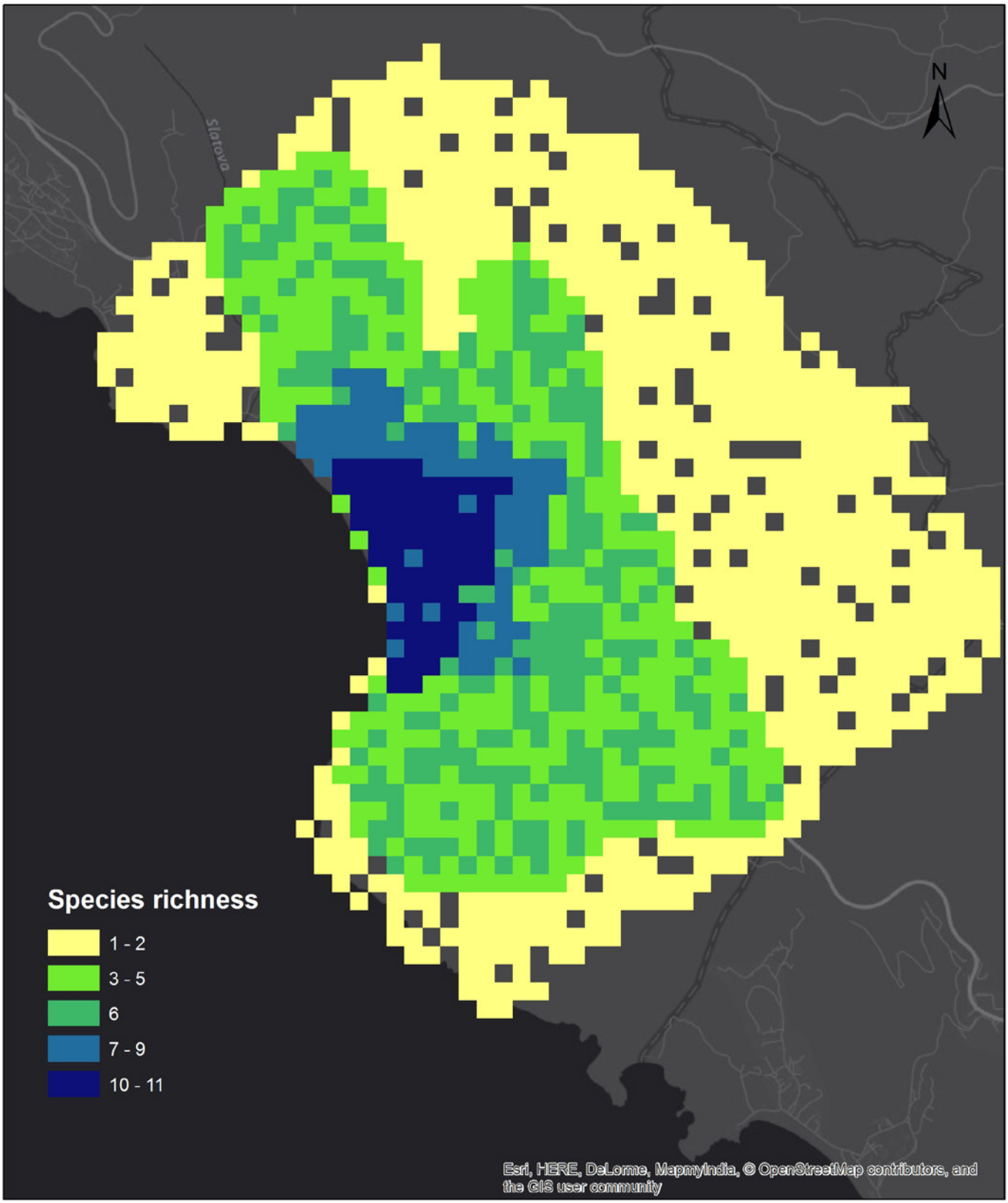
Photo 17: Greek stream frog, *Rana graeca*

Photographer: Aleksandar Simović

Photo 18: Yellow-bellied toad, *Bombina variegata*

Photographer: Aleksandar Simović

MAP 6: DISTRIBUTION AND SPECIES RICHNESS OF 11 SPECIES OF AMPHIBIANS



0 0,5 1 2 Kilometers

Map created by Montenegrin Ecologists Society
Date: September 2016

CRITICAL ECOSYSTEM PARTNERSHIP FUND

CRNOGORSKO DRUŠTVO EKOLOGA

Photo 19: Four-lined snake, *Elaphe quatuorlineata*

Photographer: Aleksandar Simović

Photo 20: Nose-horned Viper, *Vipera ammodytes*

Photographer: Aleksandar Simović

REPTILES

In total, 22 reptile species were recorded in Buljarica. That makes 61% of all reptiles present in Montenegro. With four species of chelonians, nine species of lizards and nine species of snakes, Buljarica represents a typical herpetological reserve. Populations of all species are estimated as stable in spite of the threats that are partially similar to the ones related to amphibians. However, reptiles are threatened with additional kinds of anthropogenic influences such as fires, deforestation, the introduction of mongoose (*Herpestes auropunctatus*), poisoning of small rodents, intentional killing, etc.

Analysing their conservation status, it can be concluded that 19 of the present reptile species are listed in Annexes II and IV of the Habitats Directive, all species are listed in Appendices II and III of the Bern Convention, and four have unfavourable status (Near Threatened and Vulnerable) on the IUCN Red List. The presence of reptile species was recorded in all three ecosystem categories. Thanks to the OBIS (Ocean Biogeographic Information System) database, it was possible to track a Loggerhead sea turtle (*Caretta caretta*) from Albanian to Montenegrin coast. Scarce data were obtained in 2010 when one geo-tagged individual was registered in the Buljarica bay.

During the research period, another individual was recorded, but, unfortunately, it was found dead on the beach. Regarding brackish marshland, channels, reed bed and ponds, the investigation revealed high numbers of semi-aquatic species such as European pond turtle (*Emys orbicularis*), Balkan terrapin (*Mauremys rivulata*), Grass snake (*Natrix natrix*), and Dice snake (*Natrix tessellata*). Special emphasis should be placed on freshwater turtles whose populations here seem to reach their maxima and probably they are the most abundant at Montenegrin coast.

Strictly protected reptile species that are in Appendix II and III of Bern Convention were analysed in terms of their relation to habitat type. All species were considered in the model, which showed their richness and distribution in various habitats. According to this, the most important ecosystems for reptiles are maquis and Eastern white oak forests (see Map 6). In addition, this area encompasses important habitats for nesting and hibernation of many lizard and snake species. Reptile species (with their conservation status and preferred habitats) are presented in Table 4 below and on Map 7 that follows.

Photo 21: European ratsnake, *Zamenis situla*

Photographer: Aleksandar Simović

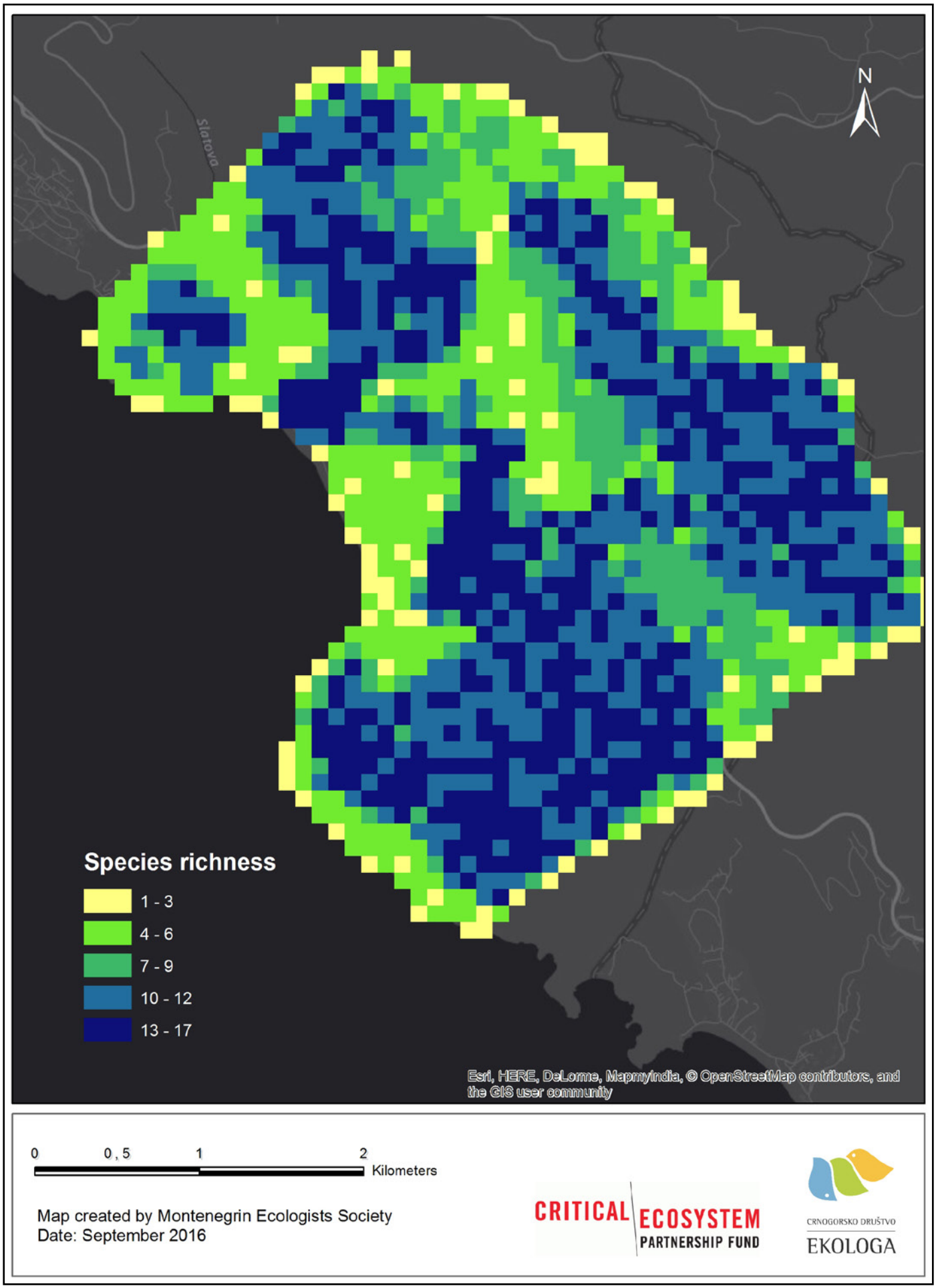
TABLE 4: REPTILE SPECIES AND THEIR HABITATS

SPECIES	HABITATS DIRECTIVE	BERN CONVENTION	IUCN	HABITAT
Caretta caretta	Annex II, Annex IV	Appendix II	VU	Sea
Testudo hermanni	Annex II, Annex IV	Appendix II	NT	maquis, oak forest
Emys orbicularis	Annex II, Annex IV	Appendix II	NT	marshland, stream
Mauremys rivulata	Annex II, Annex IV	Appendix II	LC	marshland, stream
Anguis fragilis		Appendix III	LC	humid grasslands
Pseudopus apodus	Annex IV	Appendix II	LC	maquis, oak forest
Lacerta trilineata	Annex IV	Appendix II	LC	maquis, oak forest
Lacerta viridis	Annex IV	Appendix II	LC	maquis, oak forest
Podarcis melisellensis	Annex IV	Appendix II	LC	maquis, slopes
Podarcis muralis	Annex IV	Appendix II	LC	maquis, oak forests
Algyroides nigropunctatus	Annex IV	Appendix II	LC	maquis
Dalmatolacerta oxycephala	Annex IV	Appendix III	LC	maquis, oak forest
Hemidactylus turcicus		Appendix III	LC	maquis, oak forest
Vipera ammodytes	Annex IV	Appendix II	LC	slopes, forests, grasslands
Natrix natrix	Annex IV	Appendix III	LC	stream, marshland
Natrix tessellata	Annex IV	Appendix III	LC	stream, marshland
Zamenis situla	Annex II, Annex IV	Appendix II	LC	maquis, oak forests
Zamenis longissimus	Annex IV	Appendix II	LC	mixed forest, grasslands
Hierophis gemonensis		Appendix II	LC	maquis, slopes, grasslands
Elaphe quatuorlineata	Annex II, Annex IV	Appendix II	NT	maquis, forests, grasslands
Platyceps najadum	Annex IV	Appendix II	LC	maquis, grasslands
Telescopus fallax	Annex IV	Appendix III	LC	maquis, slopes

Photo 22: Balkan Tarrapin, *Mauremys rivulata*

Photographer: Aleksandar Simović

MAP 7: DISTRIBUTION AND SPECIES RICHNESS OF 22 SPECIES OF REPTILES



Map created by Montenegrin Ecologists Society
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Photo 23: European turtle dove, *Streptopelia turtur*

Photographer: Mihailo Jovićević

Photo 24: European roller, *Coracias garrulus*

Photographer: Jiri Bohdal

BIRDS

By its ecological and geographical characteristics, Buljarica is a very specific ecosystem and therefore unique on the Adriatic coast. Along with the exceptionally rich ornithological reserves of the Bojana River delta and Tivat salinas, Buljarica is one of the last natural and semi-natural ecosystems that maintains high importance for birds.

A mosaic of ecosystems consisted of different biotopes (marine, coastal, wetland, forest, and rocky and grassland hill slides), provides vital conditions for nesting and feeding of many species of birds. The configuration of terrain that has an amphitheatre appearance, bordered by high and steep sides of the Paštrovska gora, provides emergency shelter and resting site for numerous birds that migrate along the so-called Adriatic Flyway[25]. Its brackish wetland, although overgrown with reeds, still provides good conditions for wintering birds from the group of ducks and waders.

More importantly, the sea rich with food attracts divers and shag, cliffs are visited by Eleanor's falcon, pastures by rock partridges, Levant sparrowhawk and eagle owl, reed beds by moustached warbler, coastal drift by oystercatcher, lagoons by wintering flocks of common pochard, grazed meadows and pastures by rollers, etc. All populations reach such abundances that this area undoubtedly deserves the IBA or future Special Protected Area (SPA) status and Natura 2000 habitat.

Due to many stresses present during the past 30 years, Buljarica urgently needs management and concrete measures that should sustain its populations and diversity. Among many stresses, the leading are poaching, intensive urbanisation, tourism pressure, destruction and overgrowing of important habitats, and fires.

According to available data, the bird fauna of Buljarica with surrounding hills consists of 178 species. During eight field days, breeding status was confirmed for 93 species. Due to the limitations of resources, only the status of possible breeders was given to 12 species. The most important are Egyptian vulture, *Neophron percnopterus*, Griffon vulture, *Gyps fulvus* and Bonelli's eagle, *Aquila fasicata*. The end of the XX century was the last time when two vultures were breeding in a nearby locality (village Brca near Sutomore). It is realistic to expect them again in future if the habitat is preserved. Moreover, a program of their reintroduction would be a desirable active conservation measure.

The data for migratory and wintering aspects, recorded during five years (between 2010 and 2015) are based on infrequent and unsystematic observations. These indicate that huge part of the bird fauna is migratory and wintering. These two aspects should be investigated in depth to confirm the assumption that ornithofauna of Buljarica consists of between 220 and 250 bird species.

Analysing conservation status of 178 confirmed bird species, it was found that 39 are listed in Annexes I and II of the Birds Directive and four species have unfavourable status on the IUCN Red List. For the list of bird species present in Buljarica, their conservation and presence status and preferred habitats see Table 5. Strictly protected bird species that are in the Appendix of Bern Convention were analysed in terms of their relation to habitat type. Sixty-two breeders were included in the model which shows their distribution related to habitats, and species richness. According to this, the most important ecosystems for birds are marsh with channels and lagoons, and also slopes with forests (Map 8).

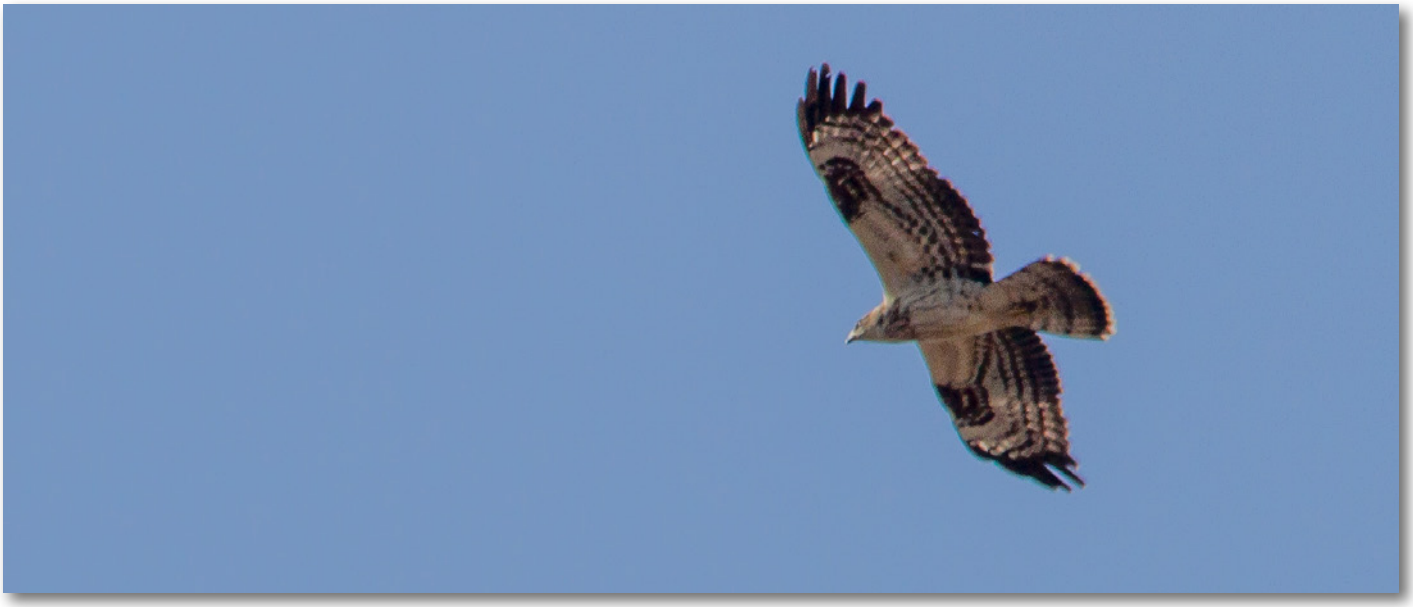

Photo 25: Honey-buzzard, *Pernis apivorus* Photographer: Mihailo Jovićević

25 EuroNatur – Nature conservation without borders, www.euronatur.org/endangered-species/migratory-birds/campaign-on-bird-hunting/adriatic-flyway/.

TABLE 5: BIRD SPECIES AND THEIR HABITATS

SPECIES	BIRDS DIRECTIVE	BERN CONVENTION	STATUS	IUCN	HABITAT
Gavia stellata	I	I	wintering		sea
Botaurus stellaris	I	I	wintering		marshland
Ixobrychus minutus	I	I	breeding		marshland
Nycticorax nycticorax	I	I	possible breeding		marshland
Ardeola ralloides	I	I	breeding		marshland
Egretta garzetta	I	I	breeding		marshland
Ardea alba	I	I	wintering		marshland
Aythya ferina	II	I	wintering	VU	marshland
Aythya nyroca	I	I	wintering		marshland
Pernis apivorus	I	I	migrating		slopes
Milvus migrans	I	I	migrating		slopes
Milvus milvus	I	I	migrating		slopes
Circaetus gallicus	I	I	breeding		slopes
Circus aeruginosus	I	I	breeding		marshland
Circus cyaneus	I	I	migrating		marshland
Circus pygargus	I	I	migrating		slopes
Circus macrourus	I	I	migrating		slopes
Accipiter brevipes	I	I	breeding		slopes
Falco eleonorae	I	I	possible breeding		slopes
Falco vespertinus	I	I	migrating		slopes
Falco peregrinus	I	I	wintering		slopes
Grus grus	I	I	migrating		slopes
Haematopus ostralegus	II	I	migrating	NT	beach
Charadrius alexandrinus	I	I	migrating		beach
Hydrocoloeus minutus	I	I	migrating		sea
Chlidonias hybridus	I	I	migrating		sea
Chlidonias niger	I	I	migrating		sea
Streptopelia turtur	II	I	breeding	VU	slopes, forests
Bubo bubo	I	I	breeding		slopes
Caprimulgus europaeus	I	I	breeding		slopes, beach
Alcedo atthis	I	I	wintering		marshland
Coracias garrulus	I	I	breeding		meadows
Picus canus	I	I	breeding		forests
Dendrocopus syriacus	I	I	breeding		forests
Leiopicus medius	I	I	breeding		forests
Anthus pratensis		I	migrating	NT	meadows
Acrocephalus melanopogon	I	I	migrating		reedbed
Hippolais olivetorum	I	I	breeding		maquis
Lanius collurio	I	I	breeding		marshland
Lanius minor	I	I	breeding		meadows

MAP 8: DISTRIBUTION AND SPECIES RICHNESS OF 62 SPECIES OF BIRDS

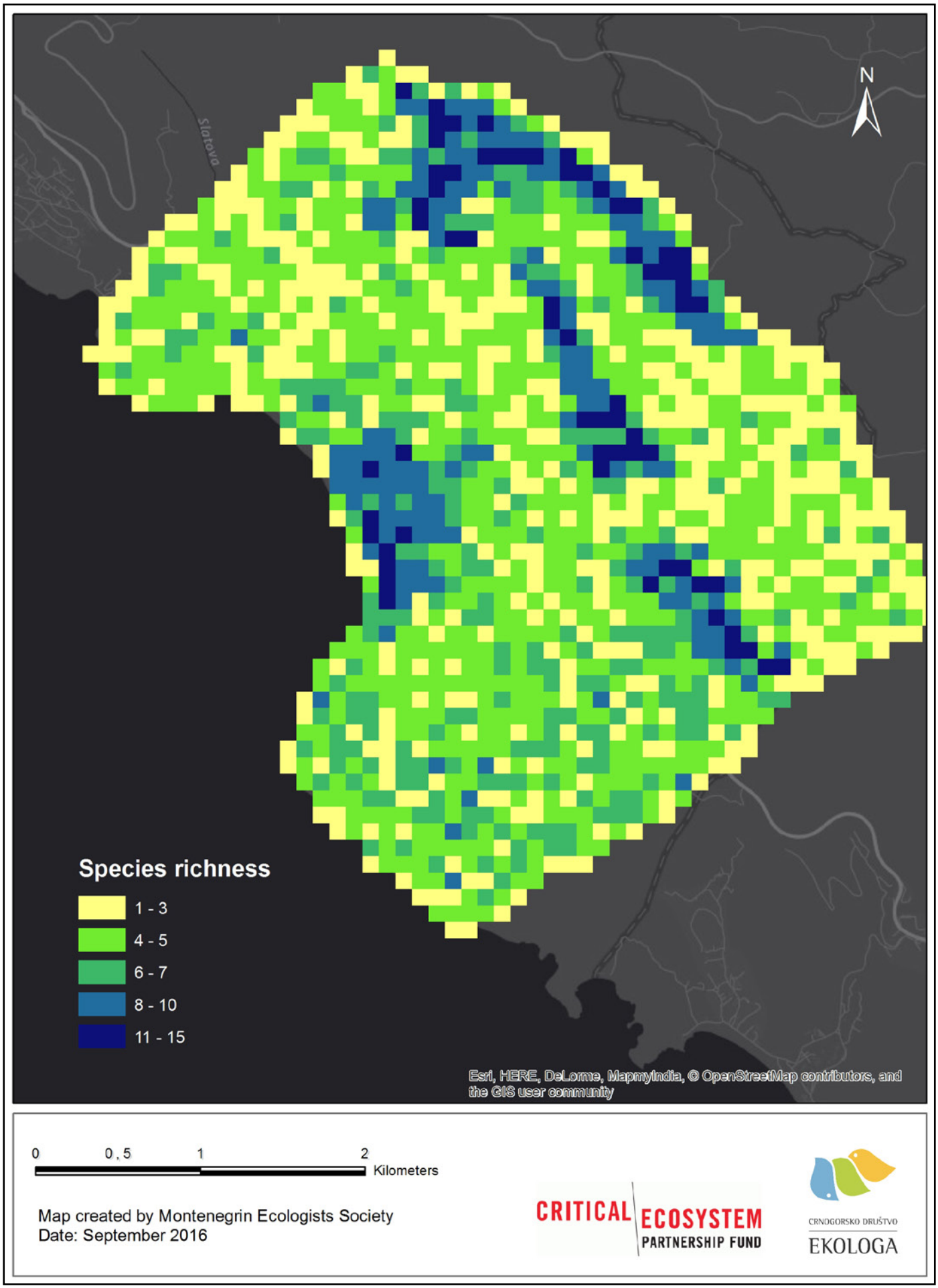

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Photo 26: Common Bentwing Bat, *Miniopterus scheibersii*

Photographer: Jasmin Pašić

Photo 27: Kuhl's pipistrelle, *Pipistrellus kuhlii*

Photographer: Jasmin Pašić

MAMMALS

The remarkable diversity of mammals was noted in two of the ecosystem types present in Buljarica. The presence was confirmed of Golden jackal (*Canis aureus*), Fox (*Vulpes vulpes*), Wild boar (*Sus scrofa*), Hare (*Lepus europaeus*), Fat dormouse (*Glis glis*), Stone marten (*Martes foina*), Hedgehog (*Erinaceus europaeus*) and Mongoose (*Herpestes auropunctatus)*, mainly at hill slopes, forests and cultivated areas such as abandoned orchards and gardens.

To the above listed, several small-bodied species can be added, which were recorded during Monitoring of Biodiversity in 2011: Wood mouse (*Apodemus sylvaticus*), Brown rat (*Rattus norvegicus*), House mouse (*Mus musculus*), Mediterranean mole (*Talpa caeca*), Pygmy white-toothed shrew (*Suncus etruscus*), Bicolored shrew (*Crocidura leucodon*), and Lesser shrew (*C. suaveolens*).

Appropriate attention could not be dedicated to marine mammal species, due to the lack of time and capacities. Nevertheless, on 7th of June 2016, close to the Hrid Mijuškovića, one group of bottle-nosed dolphins (*Tursiops truncatus*) was observed, the species listed in Annex II of the Habitats Directive.

Still, the greatest attention was paid to bats due to the fact that all bat species are protected (on both national and international levels) and represent a very important group in terms of conservation. Seven bat species were confirmed during our investigation: *Tadarida teniotis, Pipistrellus kuhlii, P. pygmaeus, P. pipistrellus, Hypsugo savii, Miniopterus schreibersii,* and *Rhinolophus hipposideros*.

All registered bat species are on the Habitats Directive or Appendices II and III of the Bern Convention; they are also nationally protected. Among them, there are two species assessed as Near Threatened by the IUCN: *Miniopterus scheibersii* and *Rhinolophus hipposideros* (Table 7).

Analysing bat ecology, it was found that the main roosting site for bats is the cave Vilina špilja situated at the northernmost point of the scope area. Also, the veteran Eastern-oak trees, distributed regularly around the marsh and close to urbanised areas, are used for roosting by forest bat species. Results also showed that the highest number of recordings, as well as the level of activity, was present in the brackish marshland, agricultural land, tall humid meadows and channels because all species use these ecosystems as feeding areas.

Based on the data collected during night censuses, combined with previous knowledge regarding the ecology of the species and their relative abundances, a spatial model was developed, showing which ecosystem is the most important for bats. It highlights the presumption that brackish marshland and its belt of agricultural land has the highest bat species richness, but it also assumes the presence of flight corridors that connect their roosting and feeding sites. In other words, for bats, the most important are two ecosystems: hill slopes and lowland area (Map 9).

Photo 28: Soprano pipistrelle, *Pipistrellus pygmaeus*

Photographer: Jasmin Pašić

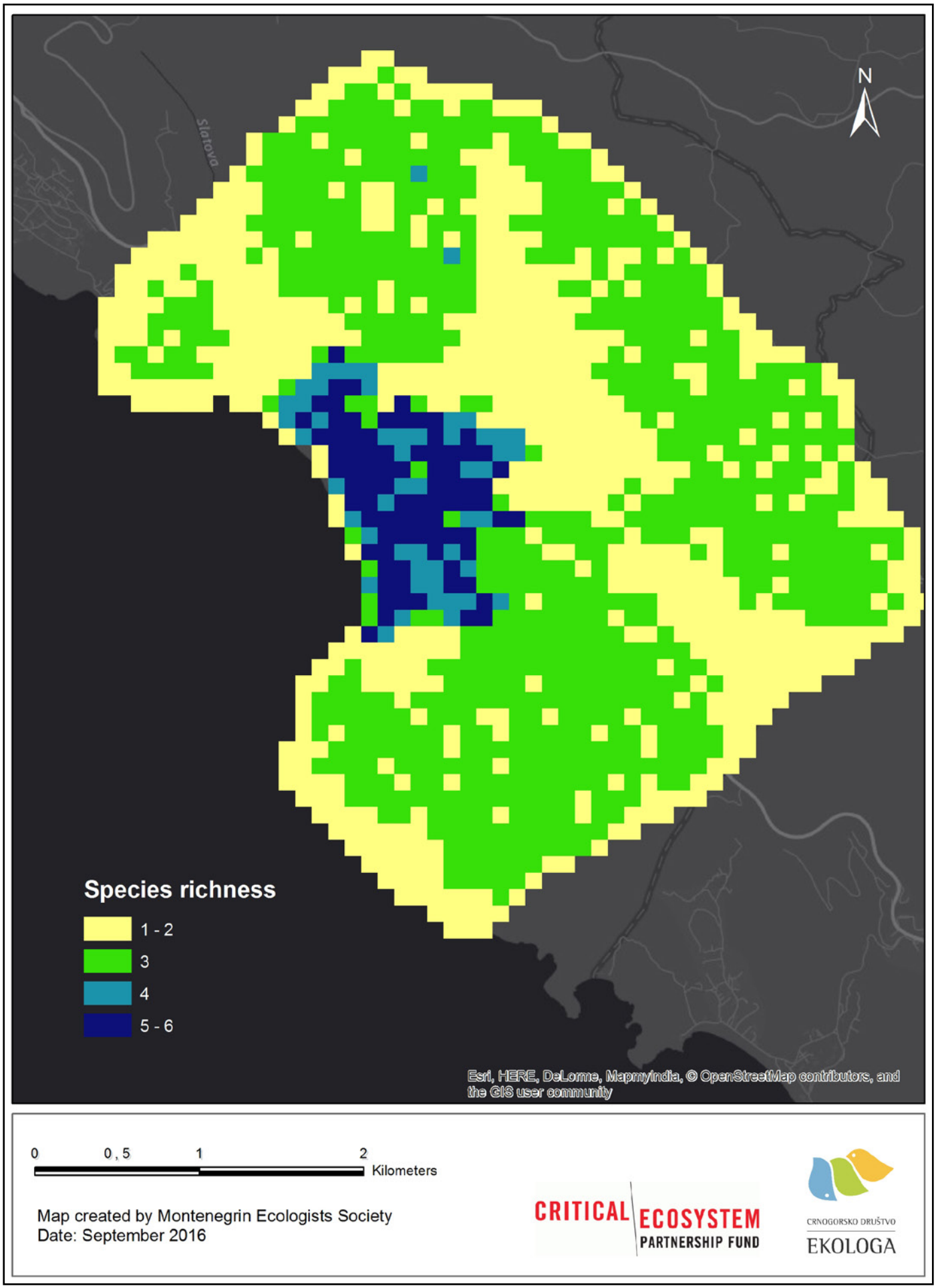
TABLE 6: MAMMAL SPECIES AND THEIR HABITATS

SPECIES	HABITAT DIRECTIVE	BERN CONVENTION	IUCN	HABITAT
Tursiops truncatus	Annex II	Appendix II	LC	costal/pelagial
Pipistrellus pipistrellus	Annex IV	Appendix III	LC	forest and meadows
Pipistrellus pygmaeus	Annex IV	Appendix II	LC	Remnants of floodplain forest
Pipistrellus khulii	Annex IV	Appendix II	LC	Remnants of floodplain forest
Hypsugo savii	Annex IV	Appendix II	LC	rock outcrops, maquis and forest
Miniopterus schreibersii	Annex II, Annex IV	Appendix II	NT	meadows, cave Vilina spila
Tadarida teniotis	Annex IV	Appendix II	LC	rock outcrops, maquis and forest
Rhinolophus hipposideros	Annex II, Annex IV	Appendix II	NT	meadows, cave Vilina spila
Glis glis		Appendix III	LC	maquies, forest and meadows
Martes foina		Appendix III	LC	open and rocky areas, oak forests
Herpestres javanicus	Appendix III		LC	mediteran shurbland

Photo 29: Small Asian mongoose, *Herpestres javanicus*

Photographer: Mihailo Jovićević

MAP 9: DISTRIBUTION AND SPECIES RICHNESS OF 6 SPECIES OF BATS



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MAP 10: ADMINISTRATIVE BORDERS OF BULJARICA AND MUNICIPALITY OF BUDVA

0 0,5 1 2 Kilometers

Map created by Montenegrin Ecologists Society
Date: September 2016

CRITICAL ECOSYSTEM PARTNERSHIP FUND

CRNOGORSKO DRUŠTVO EKOLOGA

ECOSYSTEM SERVICES AND HUMAN WELL-BEING OBJECTS

SOCIO-ECONOMIC ANALYSIS

Buljarica is a village in the municipality of Budva, situated close to Petrovac settlement. In the administrative respect, Buljarica consists of two units: Buljarica I and Buljarica II (Map 10).

According to the last census, conducted in 2011 (source: MONSTAT[1]), Buljarica I had a population of 106 people (number of households: 34, number of apartments for tourists: 94), and Buljarica II of 97 (33 households, 136 apartments).

Censuses in Buljarica from 1991 and 2003 enlisted 183 and 160 inhabitants, respectively (these did not differentiate between the two parts of the settlement). This illustrates demographic fluctuations in the given area (Table 7 and Figure 2[2]).

TABLE 7: DEMOGRAPHIC DATA IN PREVIOUS TWO CENSUSES (2003, 2011, SOURCE MONSTAT)

Census Year	No. of households	No. of apartments	No. of inhabitants
2003	49	60	160
2011 (BI+BII)	67	230	203

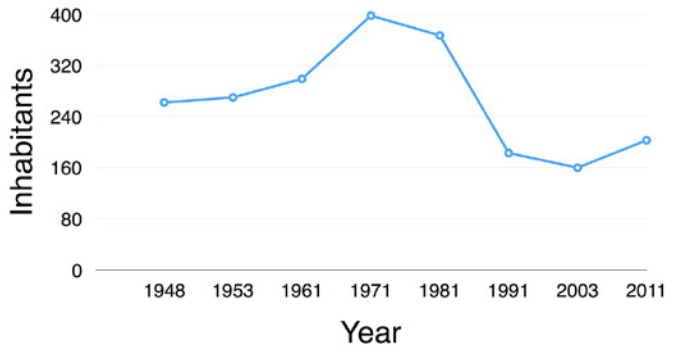


FIGURE 2: CHANGES IN POPULATION DURING THE SECOND HALF OF THE 20TH CENTURY

In Buljarica I (387 ha), the land mostly belongs to private owners, irrespective of whether they inherited the land (56%), or bought it (10%) (Figures 3 and 4). A portion of the land is still under litigation, and some restitution processes are still not concluded.

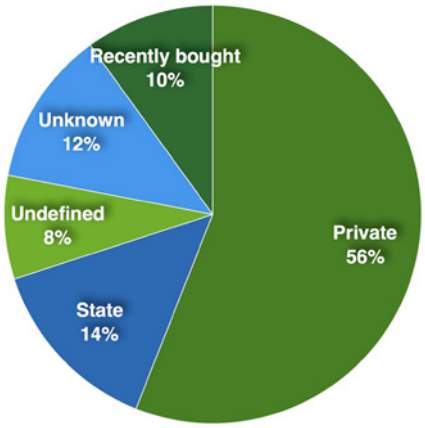


FIGURE 3: LAND OWNERSHIP IN BULJARICA I

However, in Buljarica II (1,316 ha) the situation differs. Most of the properties here belong to the state (66%). The detailed percentages of ownership is presented in the Figure 4.

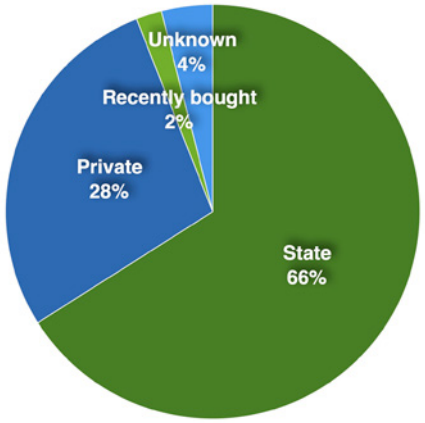


FIGURE 4: LAND OWNERSHIP IN BULJARICA II

Socio-economic data collected for the purpose of this study were obtained from a pool of 28 responders belonging to 27 households (out of 67). The interviewees were mainly men (18); women were fewer (10).

The ages of the interviewees were distributed as follows: one early adulthood (20–35 years old), six middle-aged inhabitants (35–50 years old), and most, i.e. 21 were in late adulthood (50–80 years old). The majority of the responders were born in Buljarica (18), and 10 have moved to Buljarica from some other place. Out of 28, seven lived abroad in some period of life, and five lived in some other part of the former Yugoslavia; four lived in Montenegro but in places other than Buljarica, 12 have never left Buljarica to live elsewhere.

1 Statistical office of Montenegro.

2 Book 9, Population, comparative population statistics 1948, 1953, 1961, 1971, 1981, 1991, 2003, data by settlements, Republic Institute for Statistics, Podgorica, September 2005, COBISS-ID 8764176

Out of the 16 that have spent some period of life outside of Buljarica, the reasons for moving back to Buljarica were as follows: inheritance of land (eight), starting a business (two), starting a family (three), and because of nature and associated resources (three).

The main occupation of the majority of responders (12) is in tourism service. Next big group is formed of seven pensioners. The smaller share left is divided as follows: farmers – 2, merchant – 1, teacher – 1, fireman – 1, security – 1, craftsmen – 2, postman – 1 (Figure 5).

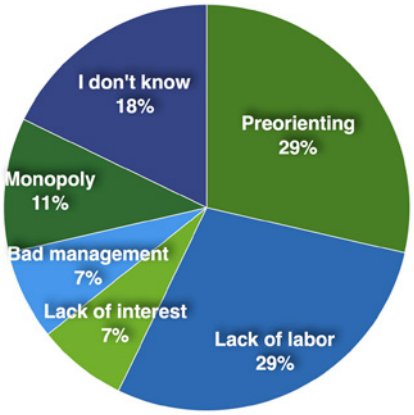


FIGURE 5: OCCUPATION OF THE LOCAL POPULATION IN BULJARICA

On the matter of employment, out of the 21 employed people, 16 run their own business and 5 are employed by the state. The rest are retired. Half of the responders cultivate land; two of them sell their products and the rest produce only for their own consumption.

The majority or responders (23) share the opinion that agricultural production in Buljarica is in a decline in the last 10 years, and most of them think that the reasons behind are a lack of labour offers (8 responders) and orientation toward tourism (8 responders) (Figure 6).

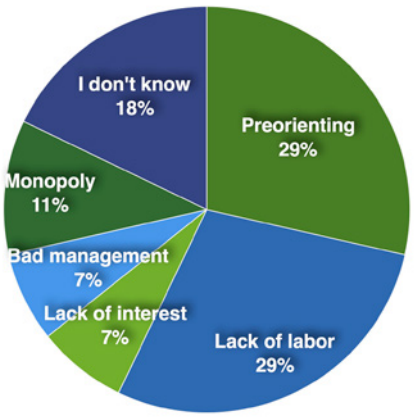


FIGURE 6: REASONS FOR AGRICULTURAL PRODUCTION DECREASE

Concerning poultry and cattle, only six of the responders breed some. The most important natural resources in Buljarica are believed to be the sea (10 responders), followed by landscape (8), and clean water (5) (Figure 7).

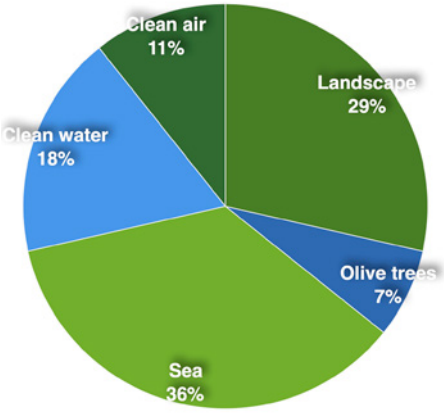


FIGURE 7: MOST IMPORTANT NATURAL RESOURCES IN BULJARICA

Identified as the biggest threats to these resources are unplanned construction, bad management by the state institutions, selling the land, tourism, poverty, construction sites at the beach, pollution, research of oil and gas and foreign investors (Figure 8).

FIGURE 8: BIGGEST THREATS TO BULJARICA'S NATURAL RESOURCES

As the strongest threats to current economic benefits from the fastest-growing industry here, tourism, the responders identified selling of land (11), unplanned construction (8), pollution and politics (4 and 3 respectively), and lack of labour and neglect of nature (1 each) (Figure 9).

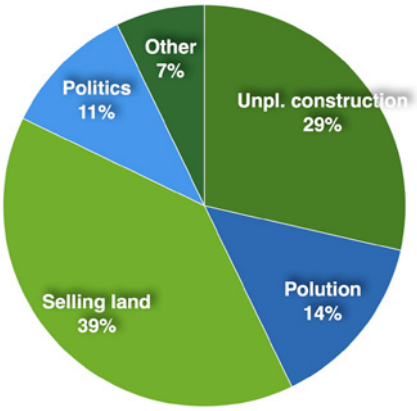


FIGURE 9: BIGGEST THREATS TO CURRENT ECONOMIC BENEFITS (TOURISM)

To the question "What is the biggest potential for economic growth?", the majority answered "tourism". The distribution is as follows: a combination of agriculture, conservation and tourism (11), solely tourism (10), and solely conservation (4) (Figure 10).

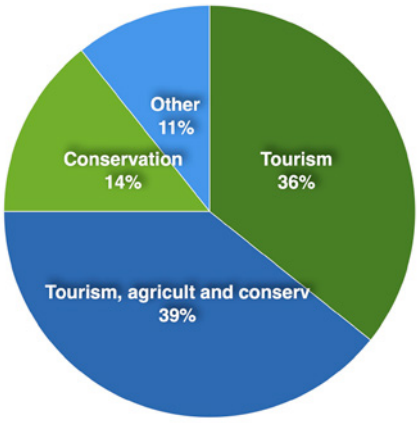


FIGURE 10: BIGGEST POTENTIALS FOR ECONOMIC GROWTH

When asked to compare their income status and living standard in previous times and now, opinions and situations deferred: 10 responders stated to live worse than before, and 9 better. For 9 responders, the situation is unchanged.

To the question about services that people living in Buljarica are missing, answers could be summarized to the following: one-third feels that everything is missing (kindergartens, school, health services, infrastructure, good electricity supply, sewage system, urban facilities); five stated that the most important thing missing is infrastructure and few others were specific that sewage is what's missing; few felt that what is needed are golf courses and/or a marina.

The answers to the question "What are the biggest development problems?" were not obtained, because most responders were returning to the answer about the missing services.

If offered, 50% interviewees stated they would sell their land, out of which only two were actively searching for buyers; the other 50% would not sell. Also, half of the responders thought that selling the government land is not a good project (for details see Figure 11).

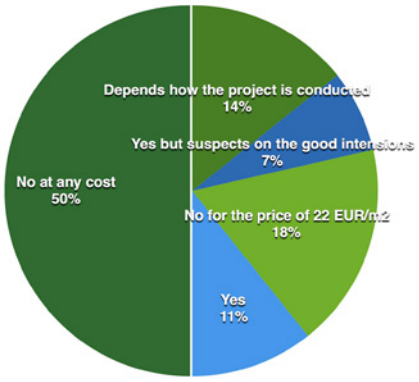


FIGURE 11: OPINIONS REGARDING SELLING OF GOVERNMENT LAND

When it comes to disputes over common resources, five responders answered that there are problems and 23 that they have no problems.

Responders described that 20 years ago Buljarica was a place with cultivated fields, olive plantations, functional irrigation channels and tourism in expansion. Some stated that the expansion of tourism and the development of campsites started 30 years ago. Most agreed that fields were cultivated (up to 70% of land) and that cattle breeding was common. Many responders stated that the landscape was nicer, not neglected, and without many illegal buildings. Some thought that it was cleaner and that people cared more. Also, most of them felt that living prospects were stable, and that optimistic feeling prevailed. Less than one-third said that everything is about the same with a small variation in land use and construction. Some stated that nowadays there is electricity, water and infrastructure developed (and all were missing back then), but there is much less work in the area now.

Key findings

It can be concluded that tourism is the main occupation in Buljarica, also seen as the biggest potential for economic growth, but also the reason behind leaving agriculture in some respect. However, half of the responders still cultivate the land. The majority think that combination of agriculture, tourism and conservation, or solely tourism is the biggest development potential. Selling of land and unplanned construction were identified as biggest threats to tourism.

It is considered that the most important natural resource in Buljarica is the sea, followed by the landscape and clean water, which are all threatened again by unplanned construction, bad management by the state institutions, selling the land, unsustainable tourism, poverty, neglect, and many other factors.

However, the responders had very little knowledge about alternative tourism development possibilities yet thought that mass-tourism with one to two months' peak, prevailing in the nearby Petrovac and Budva, was not appealing. Most were not able to come to any new ideas, referring mostly to the common development of "sun and beach" type of touristic offer present at Montenegrin coast. In this context, sustainable development remains a challenging option, requiring the building of knowledge and capacities of locals along with managing of the selling of land and high construction activities risks.

Photo 30: Remains of barrage fortress / blockhaus Dubovica

Photographer: Milena Krasić

Photo 31: St. Parascheva's Church

Photographer: Milena Krasić

CULTURAL HERITAGE IN BULJARICA (SHORT OVERVIEW)

Cultural heritage, in one of many definitions, may be defined as a legacy of physical artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations.[3]

Buljarica as very old settlement with remains from Prehistric Times, even today has rich, various and representative cultural heritage, both material (immovable and movable) and intangible. For this occasion, in the shortest way, we tried to present some of the most important segments of numerous and diversified cultural heritage in this area. Having in mind that this text is the first data base about cultural heritage in Buljarica, which combines scientific results, literature, our field trips and interviews of locals, we tried to provide as comprehensive as possible overview on this topic.

Immovable cultural heritage

The wider region Paštrovići (where Buljarica is located) has several old and famous medieval Orthodox Christianity monasteries and more than 70 churches, among which one of the most important is Gradište Monastery. In Buljarica also exist several old churches and many archaeological sites, both known and possible, but the most famous are remains of Roman Times villa rustica (rustic villa) in Golubovići with discovered remains of architecture, mosaic floors, pottery, etc., still not researched by archaeologists.

Systematic or protective archaeological researches have never been conducted in Buljarica, except protective archaeological excavations in Gradište Monastery after strong earthquake (1979) where were discovered remains of older church, pottery, glass, and metal. In Buljarica were also undertaken two archaeological prospections – at the beginning of the 1980s and in 2010[4].

In Buljarica exist three examples of Cultural Property – heritage protected by State: 1) medieval Gradište Monastery (put under the State protection in 1949, entered in the National Register of Cultural Property in 1961), 2) Memorial plaque to fallen local patriots in the WWII (entered in the National Register of Cultural Property in 1963), and 3) Memorial cemetery of the local internees in WWI (entered in the National Register of Cultural Property in 1972).[5]

The following Table 8 and Map 11 present six types of registered immovable heritage sites from wider area of Buljarica: 1) Archaeological sites (known ones and possible); 2) Profane traditional architecture; 3) Sacral objects; 4) Memorial places; 5) Fortifications, and 6) Infrastructure, industrial heritage[6], buildings and objects from the 20th century.

Movable cultural heritage

Movable cultural heritage in Buljarica has various artistic, cultural and historical purposes. The richest and the most valuable movable heritage in Buljarica is from Gradište Monastery: iconostasis with icons (18th c.), remains of the iconostasis (1860's), two new iconostases (20–21st c.), old religious books and liturgical objects, icons (17–20th c.), registry books of births, marriages and deaths of locals (18–19th c.), old photographs, documents, and library. Two monks from this Monastery, Sava and Stefan of Paštrovići, in 1597 created and printed in Venice the earliest Primer in this region and the Prayer Book. Similar to other movable heritage and treasures which were stolen and devastated through the centuries, the original prints of these books, unfortunately, do not exist in Gradište Monastery, but some newer copies did. Also, most of the churches nowadays are ruined and without any movable objects, but in the past they could have had certain liturgical artefacts, books, archive, etc.

In several known archaeological sites until today are found some pieces of movable heritage: artefacts (pottery, metal, glass). It is noticed that some families possess certain archaeological material which were accidentally found in Buljarica.

Intangible cultural heritage

Buljarica's local community, as other communities, inherits some of the forms of intangible cultural heritage, such as traditional singing and music, local speech, legends (e. g. about Buljarica and dragon, hidden golden treasure, monastery Gradište and St. Nicolas church from 1116, etc), toponyms, religious practices and rituals connected to the Monastery and churches, wedding rituals, crafts, agriculture etc., and only few of these phenomena were researched.

3 www.unesco.org/new/en/cairo/culture/tangible-cultural-heritage/(last accessed on January 19, 2017).

4 Insight into the unpublished results of the archaeological prospection from 2010 was provided by courtesy of archaeologist Milena Vrzić (Public Institution Museums and Galleries of Budva), one of the authors. Acknowledgements o Stevo Davidović from Buljarica (Secretary of Urbanism and Sustainable Development, Municipality of Budva) for useful information about some sites.

5 Documentation from the Office for Protection of Cultural Property of Montenegro (Ministry of Culture).

6 Industrial heritage is presented in this table because industiral sites "are important milestones in the history of humanity, marking humanity's dual power of destruction and creation that engenders both nuisances and progress. They embody the hope of a better life, and the ever-greater power over matter. The last 30 years have brought increased awareness of the importance of

TABLE 8: IMMOVABLE CULTURAL HERITAGE SITES

Archaeological sites			
No	**NAME/LOCATION**	**TYPE**	**DATED**
1	Đurđevo Hill	Hillfort	Bronze Age, Ancient Times
2	"Near Resovo Hill"	Remains of graves with charred items	Ancinet Times
3	"Western Buljarica"	Remains of human skeletons (?)	Non dated
4	"Near Slatava river"	Remains of lead pipes	Ancinet Times
5	Gradište Monastery	Hillfort (according to toponyme "gradište" – hillfort)	Ancient or Medieval (?)
6	Gradište Monastery	Cemetery (?)	Ancient Times (?)
7	Bratež (Počmin)	Tumulus	Prehistory
8	Počmin	Tumulus	Prehistory (Bronze Age)
9	Armenkova Tumulus (Drenovica)	Tumulus	Prehistory (Bronze Age – Hallstatt)
10	Hill Kalac (Drenovica)	No data	Middle Ages
11	Gradac	Hillfort	Prehistory (Bronze Age – Hallstatt)
12	Gradac	Tumulus	Prehistory (Bronze Age)
13	Golo brdo (Đurovići)	Tumulus	Prehistory (Bronze Age)
14	Golo brdo (Đurovići)	Tumulus	Prehistory (Bronze Age)
15	Golo brdo (Đurovići)	Tumulus	Prehistory (Bronze Age)
16	Golo brdo (Đurović)	Tumulus	Prehistory (Bronze Age)
17	Golubovići	Remains of villa rustica	Ancient Times
18	Golubovići	Remains of mosaics from villa rustica (?)	Ancient Times
19	Stupovi (Golubovići)	Remains of seven graves, metal coins and pottery	Ancient Times
20	Kolač	Remains of architecture, mosaics, lead pipes	Ancient Times (?)
21	Na Grke (Kufin)	Indicative toponymal (Eng. "On the Greeks")	Undated
22	Mijovića krš	Tumulus	Prehistory
23	Mijovića krš	Tumulus	Prehistory
24	Mijovića krš	Tumulus	Prehistory
25	Tumulus	Tumulus	Prehistory

Fortifications		
No	**NAME/LOCATION**	**DATED**
26	Remains of Monastery Gradište's old tower	Middle Ages / New Century
27	Remains of tana Kula (Velje / Resovo hill)	19th century
28	Remains of barrage fortress / blockhaus Stepen (Paštrovska Mt.)	19th century
29	Remains of barrage fortress / blockhaus Novo Selo (Paštrovska Mt.)	19th century
30	Remains of for Presjeka (Paštrovska Mt.)	1848.
31	Remains of barrage fortress / blockhaus Vjetreno gumno (Dubovica)	19th century
32	Remains of barrage fortress / blockhaus Dubovica (Dubovica)	19th century
33	Austro-Hungarian Fortress	19th century

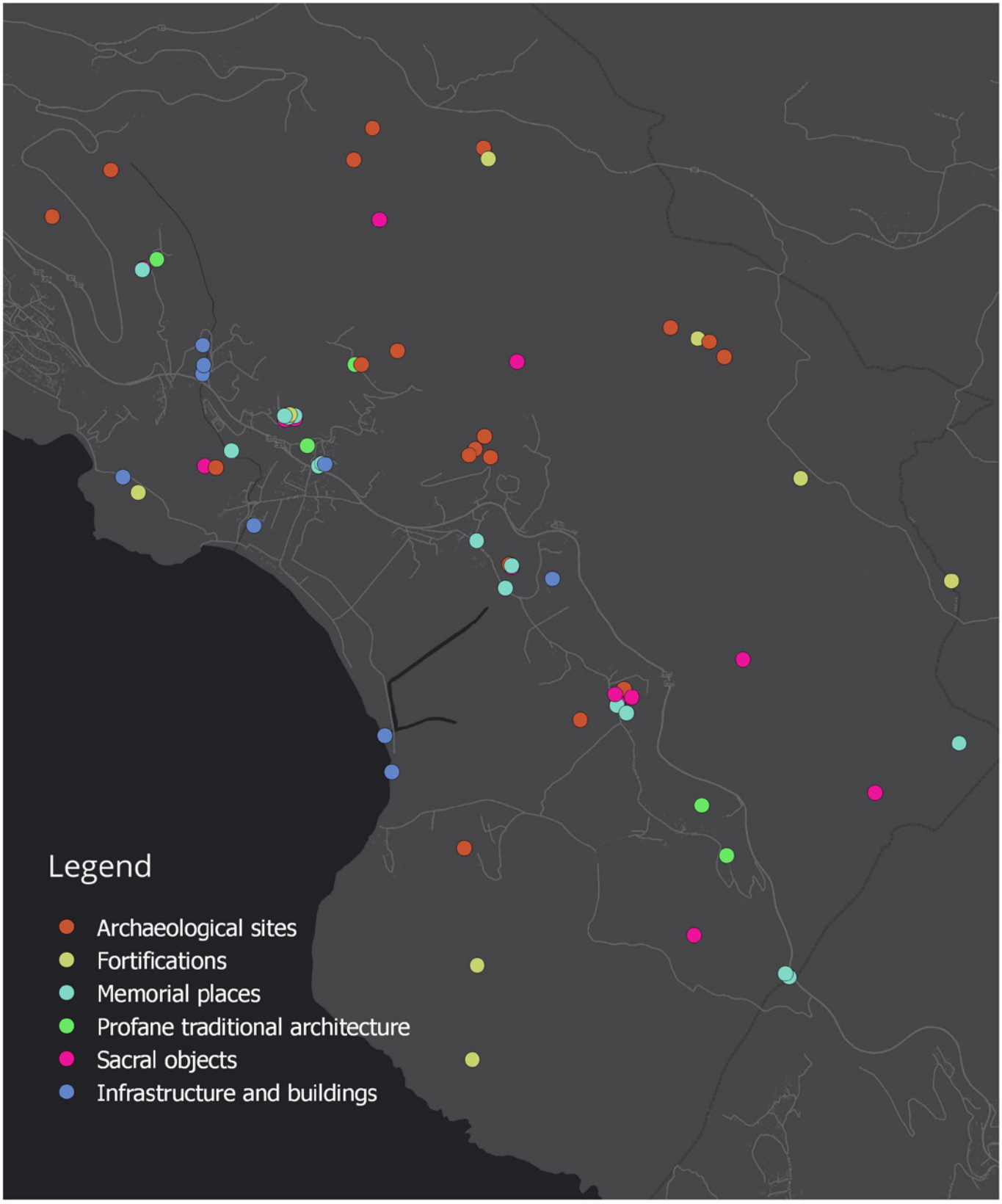
Profane traditional achitecture			
No	**NAME/LOCATION**	**TYPE**	**DATED**
34	Prijevorac village	Group of buildings	From (?) until 20th century
35	Gruda village	Group of buildings	From (?) until 20th century
36	Zanovića Tower (Kaluderac)	Private house	New Century
37	Kaluderac village	Group of buildings	From (?) until 20th century
38	Androvići village	Group of buildings	From (?) until 20th century
39	Remains of houses near Slatava river	Group of buildings	Non dated
40	Čupanjica	Group of buildings	New Century – 20th century
41	Midžorov krš	Remains of Group of buildings / fortification	Middle Ages / New Century
42	Magazini	Group of buildings	New Century – 20th century
43	Midžorove kuće	Group of buildings	New Century – 20th century
44	Kneževo village	Remains of group of buildings	Middle Ages / New Century
45	Drenovica	Group of buildings	New Century – 20th century
46	Popovo village	Remains of group of buildings	Before middle 18th century
47	Glušice	Remains of group of buildings	Middle Ages / New Century
48	Houses of Golubovići family (later of Gregovići family)	Group of buildings	From (?) until 20th century
49	Đurovići village	Group of buildings	New Century – 20th century
50	Boškovića Tower (Bijela smokva)	Remains of private house / tower	Middle Ages / New Century – till 1785
51	Kanjoševa Tower (Kanjoši)	Remains of private house	Late Middle Ages / New Century
52	Kanjoši	Group of buildings	From (?) until 20th century
53	Bačvice village	Group of buildings	From (?) until 20th century
54	Pod Glavicom village	Group of buildings	From (?) until 20th century

Sacral objects		
No	**NAME/LOCATION**	**DATED**
55	Gradište Monastery	14th century (?)
56	St. Nicolas' Church (fresco painting from 17th century)	1116 (?), 14th century (?)
57	St. Sava's Church	1500 (?), 19th century or earlier
58	Church of the Assumption of the Our Lady (fresco painting from 17th century)	17th century or earlier
59	Remains of St. George's Church (Đurđevo brdo)	Middle Ages (?)
60	Remains of Sts. Peter and Paul's Church (Kaluderac)	Middle Ages / 18th century (?)
61	Remains of church/churches (?) (Kaluderac)	Undated
62	Remains of St. John's Church – with old fresco painting (Počmin)	Middle Ages (?)
63	Remains of church (Popovo selo)	Middle Ages / New Century (?)
64	Remains of Sts. Martyrs Minas, Victor and Vincents' Church (Gradac)	Late Middle Ages / New Century / 16th century (?)
65	Remains of St. Demetrius' Church (Ugo)	Middle Ages (?)
66	Remains of Holy Lady's Church (Šaptina)	Late Middle Ages (?)
67	Holy Healeras Cosmas and Damian's Church (Golubovići)	Middle Ages / New Century
68	Remains of church (Porubica, Golubovići)	Middle Ages (?)
69	St. Parascheva's Church – with old fresco painting (Pataljage, Dubovica)	Middle Ages / New Century / 16th century (?)

Memorial places	
No	**NAME/LOCATION**
70	Memorial plaque about beginning of the National Liberation Struggle against fascists in WWII – 13/7/1941 (Gradište Monastery, 1973)
71	Memorial plaque and fountain to executed local patriots in the National Liberation Struggle against fascists in WWII (near the village supermarket, 1961)
72	Memorial plaque on the former Primary school building (centre of the village, 1954)
73	Memorial plaque about "Primorski" battalion strengthened in 1943 during the National Liberation Struggle against fascists in WWII (Golubovići, middle second half of 20th century)
74	Memorial plaque to fallen local patriots in the WWII (Golubovići, middle second half of 20th century)
75	Memorial plaque to soldier Milo Franičević who was killed in WWI in France (Dobra voda, between two World Wars)
76	Memorial plaque to soldier Milo Franičević who was killed in WWI in France (Porubica, between two World Wars)
77	Memorial plaque about beginning of the National Liberation Struggle against fascists in WWII – 13/7/1941 (Kufin, 1981)
78	Memorial plaque to the executed patriots in the National Liberation Struggle in WWII (Kufin, 1997)
79	Memorial plaque to the executed patriot Špiro Šoljaga in the National Liberation Struggle in WWII (Kufin, 1998)
80	Memorial plaque to mark the arrival of Austro-Hungarian Emperor Franz Josef I in the southernmost part of the Empire in 1875 (Din vrh, 1875?)
81	Old cemetery (Gradište Monastery, until the beginning of the 20th century)
82	Cemetery (Gradište Monastery, 20–21st century)
83	Old cemetery around Sts. Peter and Paul's Church (Kaluderac, Middle Ages / New Century (?))
84	Old cemetery around Sts. Martyrs Minas, Victor and Vincents' Church (Gradac, Middle Ages / New Century (?))
85	Old cemetery around Holy Healers Cosmas and Damian's Church (Golubovići, Middle Ages / New Century (?))
86	Memorial cemetery of the local internees in WWI (Džamanja do, WWI)
87	Remains of graves and grave goods near the church (Porubica, Undated)

Infrastructure, industrial heritage, buildings and objects from 20th century		
No	**NAME/LOCATION**	**DATED**
88	Pyramid shape stone land marks (Resovo / Velje Hill)	New Century (?)
89	Stone bridge on Slatava river	New Century (?)
90	Stone bridge on Slatava river	New Century (?)
91	Remains of Šoljaga mill on Slatava river (Kaluderac)	New Century (?) / First half of 20th century
92	Remains of mill on Nerin river (Gradrac)	New Century (?)
93	Austro-Hungarian road (from Kufin near Buljarica)	End of the 19th century / Beginning of the 20th century
94	Remains of Austro-Hungarian dock and canal (Nadluško field)	End of the 19th century / beginning of the 20th century
95	Fountains in Bačvice, Pod Glavicom, Magazini, Golubovići and Đurovići	1931
96	Remains of Italian army war moat (Na Glavicu, Đurđevo brdo)	WWII
97	Remains of German army war bunker (Đurđevo brdo)	WWII
98	Former Primary school building (center of the village)	1954
99	Former teacher's apartment (center of the village)	1954
100	Jaz canal (Nadluško field)	Middle 20th century
101	Oil wells for exploration (Velja njiva, Buljarica field)	Middle 20th century
102	Gas wells for exploration (Kanjoši)	Middle 20th century
103	Former Montex Factory (western part of Buljarica field)	Middle 20th century
104	Geological wells for exploration (Gradište Monastery)	Beginning of 1980s

MAP 11: CLASSIFICATION AND POSITION OF CULTURAL HERITAGE



0 500 1000 1500 2000 m

Map created by Montenegrin Ecologists Society
Date: May 2017

CRITICAL ECOSYSTEM PARTNERSHIP FUND

CRNOGORSKO DRUŠTVO EKOLOGA

ECOSYSTEM SERVICES

Ecosystem services can be defined as 'the benefits people obtain from ecosystems' (MEA, 2005)[7]*. All natural ecosystems yield economically valuable services. For example, production of food and medicines, regulation of climate and diseases, provision of productive soils and clean water, protection against natural disasters, opportunities for recreation, maintenance of cultural heritage and spiritual benefits, among many others* (Kosmus et al 2012).

The depiction of ecosystem services reflects the potential of a given site for ecosystem-based sustainable development (Ibisch & Hobson, 2014). It is a very important tool to present how people use biodiversity and depend on it, and what the loss of it could mean. Ecosystem services can also connect services that wider population uses and that biodiversity, likely taken for granted, provides.

A comprehensive study of ecosystem services (Emerton 2013) estimated the overall baseline value of the selected biodiversity and ecosystem services for the Montenegrin economy at 982 million EUR. The assessment referred to 2011 when, for example, the gross output for the whole Montenegrin economy was 5.24 billion EUR.

The identification of ecosystem services, also discussed during the MARISCO exercise, pointed out many important assets of Buljarica cove. Their list was produced; however, more research would be needed for detailed quantitative and qualitative description.

Ecosystems of Buljarica cove include provisioning, regulating, cultural and supporting services.

Provisioning services

Provisioning services involve goods produced or provided by ecosystems, such as food, fuelwood, fresh water, fibre, genetic resources and medicine (MEA, 2005).

The following provisional services according to the CICES list (version 4.3) were identified to be in use in the Buljarica cove as the nutrition ones:

- Providing food: cultivated crops, wheat, fruits, vegetables, olives, corn, grapevine; domestic animals and their products: meat, milk (and dairy products), eggs, honey; wild plants (Asparagus acutifolius, Tamus communis, Rubus sp., Crithmum maritimum, Arbutus unedo, Satureja montana, Quercus sp., Myrtus communis); wild animals (sea fish: Sparidae, Mugilidae, Scombridae, etc.; shellfish: crustaceans, molluscs); game animals (wild pigs, ducks and other wild birds; freshwater fish (eels)); and
- Providing water: surface and groundwater for drinking (springs, underground water sources). Because the shortage of water is an issue that can possibly impede further development of the coast tourism and other services, rich supply of Buljarica with drinking water emerges as an important service, not just locally but regionally as well. Also, extensive agriculture and fishing are development sectors affiliated to tourism too, which are expected to expand in the near future, representing an opportunity for sustainable long-term growth.
- Further provisional services, classified under materials are:
- Biomass-related: materials from plants (reed, wood, timber); materials from plants and animals for agriculture (natural animal fertilisers); and
- Water-related: surface water for non-drinking purposes (irrigation, collected precipitation, livestock consumption).
- Under the last provisioning category, energy, fuelwood is in use.
- The variety of provisioning services that are in use shows that local and regional safety (development) and sustainable growth directly depend on nature.

Regulating services

Regulating services are benefits obtained from regulation of ecosystem processes, such as water purification and regulation, erosion control, climate regulation (local through vegetation cover, and global through carbon sequestration), disease control, pest species regulation, pollination, and control and dampening of natural disasters (MEA, 2005).

Regulation and maintenance in Buljarica are represented by remediation of wastes, toxins and other nuisance, through:

- Mediation by biota: bio-remediation using micro-organisms; filtration, sequestration, storage, accumulation; regulation of pests abundance (e.g. mosquito larvae) (reed, amphibians, Posidonia sequestration); and by
- Mediation by ecosystems: mediation of noise (green infrastructure).

Regulation of flows is present through:

- Mass flow regulation: mass stabilisation and control of erosion; erosion protection of coast by sea grasses; vegetation cover protecting; and
- Water flow regulation: buffering and attenuation of mass flows (by streams); liquid flows ("hydrological cycle and water flow maintenance: the capacity of maintaining baseline flows for water supply and discharge; e.g. fostering groundwater; recharge by appropriate land coverage that captures effective rainfall; includes drought and

industrial history in understanding heritage. It is important to note that Industrial Heritage exists in all phases of human development." (whc.unesco.org/archive/ind-study01.pdf, last accessed on January 22, 2017).

7 Millennium Ecosystem Assessment 2005. Ecosystems and Human Well-being: Synthesis. Washington DC.

water scarcity aspects."[8]); flood protection (by a reduction in risk, area protected).

Maintenance of physical, chemical, and biological conditions is provided through:

- Lifecycle maintenance, habitat and gene pool protection: pollination and seed dispersal; marine nursery habitats;
- Pest and disease control (by birds, bats, amphibians and reptiles);
- Soil formation and composition; and
- Water conditions of fresh and salt water; and micro- and regional climate regulation ("Modifying temperature, humidity, wind fields; maintenance of rural and urban climate and air quality and regional precipitation/temperature patterns": Emerton 2013).
- Buljarica ecosystems sustain regulating services important for disaster reduction, mediation of pollution and noise, gene pool protection, pest and diseases control, climate regulation, etc.

Cultural services

Cultural services are nonmaterial benefits obtained from ecosystems, such as recreation and tourism, cultural identity and diversity, cultural landscapes and heritage values, indigenous knowledge systems, spiritual, aesthetic, and inspirational services (MEA, 2005).

Physical and intellectual interactions with biota, ecosystems, and land-/seascapes [environmental settings] are presented through:

- Experiential and physical interaction: use of animals and seascapes (diving), and physical use of seascapes (fishing, angling); and also through
- Intellectual and representative interactions: research, education, etc.

Buljarica provides settings for Spiritual, symbolic and other interactions with biota, ecosystems, and land-/seascapes [environmental settings] by having the following cultural outputs: landscape, enjoyment, preservation for future generations, etc.

Buljarica upholds significant opportunity to be used for in/ex-situ learning and entertainment through education, scientific research and interaction with its cultural, historical and natural values.

The details on ecosystem services' connection with biodiversity are available in the Excel form of the biodiversity research species-related tables.

Supporting services

Supporting services that maintain the conditions for life on Earth: soil development (conservation, formation), primary production and nutrient cycling (MEA, 2005). Supporting services are represented by structural component and ecosystem functions.

- Structural component: vegetation that serves as home for numerous animals;
- Ecosystem functions: cycling nutrients (providing energy and nutrient sources for trophic pathways), primary production (vegetation maintenance of both livestock and wildlife).

HUMAN WELL-BEING

Human well-being is interconnected with ecosystem services that, again, rely on biodiversity. During the preparation of this Study, closely following the MARISCO recommendations, they were assessed in two ways: using the findings of socioeconomic analyses gathered through face-to-face interviews, and using the expert opinion that combined these with ecosystems and biodiversity. The features most important for the wellbeing of the community are listed below:

A clean environment is important for the quality of life: locals assign much rhetorical significance to it, but that is not supported in their behaviour. Also, the presence of tourists during summer months significantly affects the environment.

Traditional agricultural lifestyle is one of the assets that would be very important for sustainable development; however, it is disappearing due to spreading of construction sites, and clearing of land for selling. The certification of traditionally made, even organic products would possibly improve their competitiveness in the market.

Access to clean water is maintained through the usage of Buljarica springs for drinking water. However, water supply is inadequate and an issue present in most of the coastal municipalities.

The basis for economic income (tourism/agriculture) is an opportunity that Buljarica withholds. Eco-tourism is a perspective for the proper valorisation of natural resources that can ensure long-term sustainable livelihood and socio-economic development.

Educational purposes represent an important opportunity that could possibly halt emigration. Research experts believe that on-site educational activities might be beneficial for the wider public, the scientific community, but also for increasing of pride, knowledge, and socio-cultural interactions for local inhabitants.

Safety: erosions, floods, earthquakes, fires, etc. Its capacity to mitigate some natural disasters is a very important property of Buljarica cove, rarely taken into consideration and typically not connected with biodiversity values.

8 Assessment of ecosystem services – assignment to different ecosystems according to CICES (Version 4.3)

KEY ECOLOGICAL ATTRIBUTES

Key ecological attributes are properties and resources needed to maintain viability/function and the ones that provide the resilience to cope with perturbation (e.g., clear, nutrient-poor water, the presence of caves).

The following nine Key Ecological Attributes (KEAs) are considered as important properties of Buljarica cove ecosystems that maintain its function as well as adaptability and resilience to disturbance and change:

Water quality is very important for all species which are strictly related to freshwater habitats because the levels and permanence of surface waters are directly connected with the level and regime of groundwater. Among other species, groundwater is important for Odonata and other invertebrates. Considering seawater, change of its quality would directly affect Posidonia oceanica which is one of the key species for ecosystem services.

Soil stability sustains vascular plant species richness and forest ecosystems and prevents successions. It maintains soil fertility and nutrient storage, and reduces the risk of erosion and landslides.

Freshwater flow regime provides connectivity between different habitats. In that way, it enables life cycle completion for aquatic and semi-aquatic species, especially for amphibians, the supply of nutrients to other ecosystems, and ensures vitality important for other animal groups. The process of self-purification and self-sustainability of ecosystems is provided directly from this ecological attribute.

Species diversity guarantees the provision and maintenance of a high variety of ecosystem services, which in turn significantly contribute to the resilience of the ecosystem and wellbeing of local communities.

Hydrological regime (groundwater and seawater interactions) provides stable conditions for exchange of nutrients and dynamics that ensure richness and diversity of species and improve quantity and quality of ecosystem services.

Continuous forest cover at the edge of the marshland provides key prerequisites for the persistence of numerous species. Some use it as a corridor between their primary habitat and feeding ground or between two water bodies. The forest is thin and partially flooded. Its edges are attractive for e.g. Emys orbicularis – for everyday activities and for egg laying, and also for some snakes which use leaf litter to lay their eggs. It also provides optimal nesting places for many birds, and numerous bats find shelter and food in it. The forest stabilises the soil and provides protection from erosion and landslides. It also regulates climate, improves air quality and protects from noise.

The abundance of food resources guarantees the stability of population sizes and diversity of species and processes.

Connectivity among ecosystems and habitat types ensures the daily survival of species, distribution and diversity of gene pools, and maintaining of ecological processes, thus supporting complexity and adaptability and therefore resilience of ecosystems and their services.

Photo 32: Bio-physical interaction between marine and marsh ecosystem throughout wave force

STRESSES AND THREATS AT BULJARICA COVE

Ecosystem degradation is threatening human development. On the one hand, it is clear that transformation of the environmental resource base has contributed to substantial net gains in human well-being and economic development – at least over the short-term, and for some people. On the other hand, this has incurred substantial economic losses, some of which are far-reaching in their impacts. Damage to natural ecosystems is undermining their ability to provide vital goods and services, with considerable economic and social consequences. Many of the costs associated with ecosystem degradation are only now becoming apparent. (Kosmus et al. 2012).

Stresses describe the symptoms and manifestations of the degradation of key ecological attributes" and "a certain state, reaction or symptoms of a system or any of its components to anthropogenic 'forcing factors' – the so-called threats. If sustained, the impact will lead to shifts or changes in the system. (Ibisch & Hobson, 2014). The status of biodiversity objects of Buljarica is described by nine stresses which have already been observed or are expected to develop in the near future.

Threats are considered to be any human-induced forcing or pressing factor that is likely to directly or indirectly impact on the natural structure and dynamics of an ecosystem. They represent processes of change that negatively affect biodiversity objects by causing stress and increasing their vulnerability, ultimately inducing a state change connected with degradation. (Ibisch & Hobson, 2014).

During MARISCO workshop in Podgorica, expert consultants have identified stresses and threats.

In this chapter, we will give a short description of stresses and explain how they are connected with and induced by threats.

Eutrophication and intensive expansion of reed: these stresses are caused by different pollutants – coming from tourist camps, individual houses and residential areas – discharged in channels and ponds of Buljarica marsh and further to the sea. These lead to an increase in nutrient load, which results in eutrophication that causes algal blooms, oxygen depletion, reduction of overall water quality and an increase of sedimentation of organic matter. These factors strongly affect the basic habitat of aquatic organisms, especially terrapins, frogs, water birds and dragonflies. Also, nutrient runoff from agricultural land, gardens and orchards negatively affects brackish marshland and the coastal area. High levels of nitrate and phosphorus favour the spreading of invasive plant species, such as *Amorpha fruticosa* and *Arundo donax.* Still, this threat is mitigated to a certain level, because the reed *Phragmites australis* makes monodominant stands, which sequester nutrients, heavy metals and carbon, build and stabilise soil, and create a self-maintaining ecosystem that provides good ecological conditions for species that live in.

Successions in previously cultivated areas and low soil quality: these stresses are present in numerous habitats and are induced by abandoning of arable land and agricultural activities. These neglected areas first become overgrown with the bracken fern (*Pteridium aquilinum*), bushes and trees, but are later often burned by the locals. Soil starts to become acid and very poor. Thirty years ago, extensive and traditional agriculture was common: these practices were not damaging the soil. However, today, its quality is poor, the soil is barren and prone to erosion.

Changing of water regime and dysfunction of water channels and drainage system: A dam built along the coast reduced the native coastal vegetation, brought invasive species and strongly affected communication between two ecosystems, sea and marsh. The dam destroyed the natural slope of the shoreline built by waves and disrupted annual water level changes in marsh, channels and ponds. Natural water level fluctuations are necessary for maintaining the key ecological factors of a brackish marshland. For example, this dam led to reduced water salinity, which affected species diversity and the composition of plant community and favoured monodominant stands of reed. This further affects the diversity and dynamics and, consequently, the key values of ecosystems. Furthermore, narrowing down of channels, caused by construction, physical damages, and other threats, but also the cumulative effect of stress, decreased the water flow, resulting in decreased nutrient and chemical runoff: that further contributes to eutrophication.

Reducing the extent of native habitat types and decreasing of population sizes of important species: these stresses were observed in most part of Buljarica cove in a moderate degree. Urban development, burning of reed and forests, physical damage to beach vegetation because of tourist presence and building of a dam strongly affected ecosystems, especially in the lowland area, and disturbed all native habitat types. Accumulation of many small changes over a 30-year period has led to altering of ecosystems which began to be unstable and unsupported by relevant environmental building blocks and keystone species, which caused the decreases in population sizes. Moreover, the already mentioned invasive species also contribute to degradation of ecosystems. Green alga *Caulerpa cylindracea* competes for habitat with the structure builder species Posidonia oceanica. In spite of the fact that Posidonia meadows are one of the Mediterranean habitats most resistant to invasion by *Caulerpa cylindracea,* the ecosystem they build is disturbed; detailed studies are needed to determine to what extent. The Mongoose Herpestes auropunctatus is strongly affecting some species, e.g. snakes and native small mammals such as Mustela nivalis. Research conducted for the purpose of this study showed that fishing and hunting are not well managed and regulated, and are often illegal. They are not followed by appropriate enforcement of regulation and inspection actions. "Fishing" with dynamite and hunting of strongly protected and endangered species are quite common. In Buljarica, a hunting area is established, but it is not regulated in any way: its territory is not precisely determined and it falls under no law.

Regarding degradation of Posidonia meadows, it is also important to emphasise the mechanical damage it suffers, caused by boat anchoring.

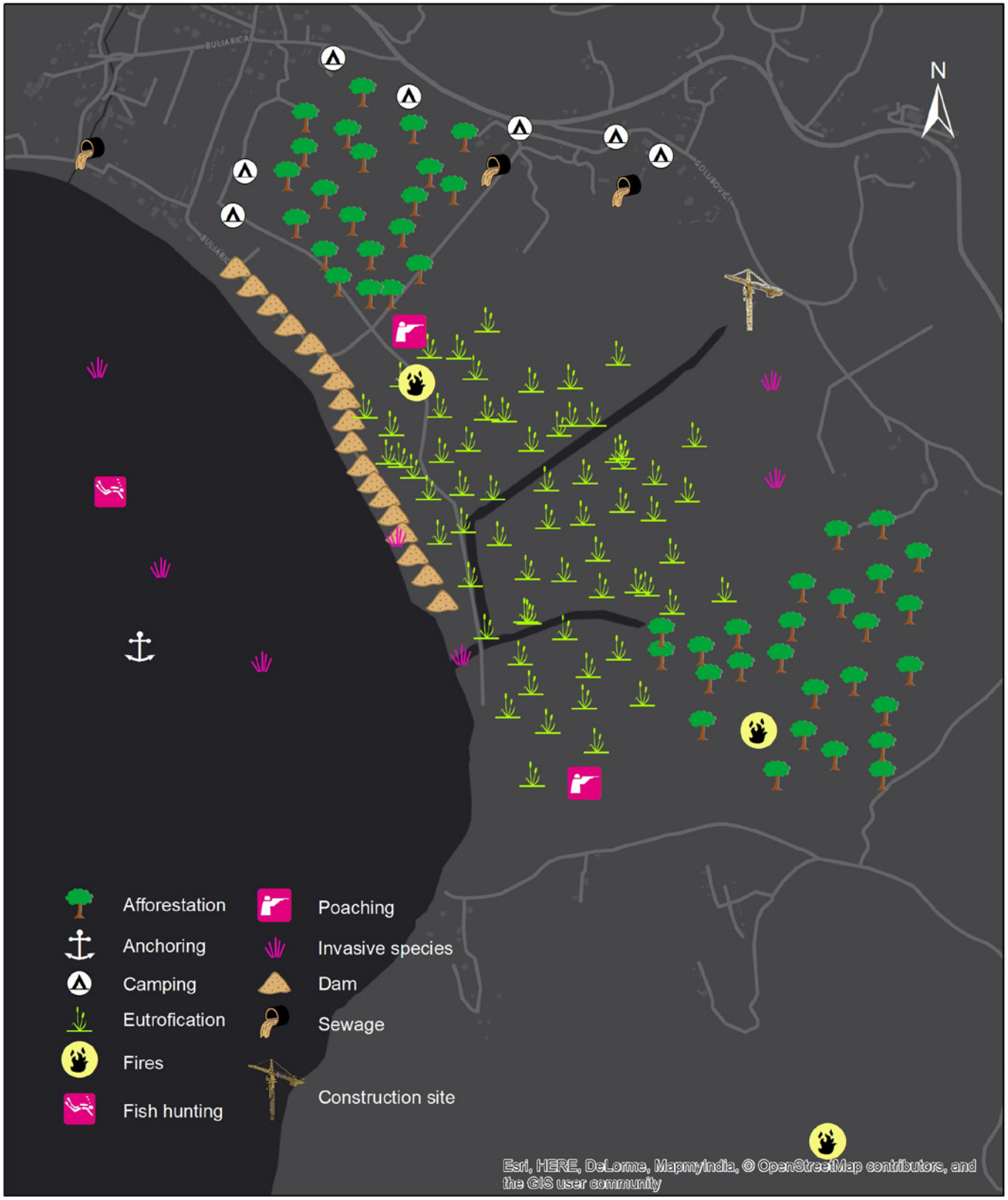
Possible threats that can occur in future due to climate changes, natural and man-induced disasters or as a result of planned development are also discussed: sea level rise, floods, earthquakes, development of oil platforms and contributing infrastructure, building of a golf course. All these threats could have a drastic impact on the entire area and induce more stresses, some of which could have irreversible consequences.

Threats are presented on Map 12 which shows their geographical distribution and physical relation to certain ecosystems.

Photo 33: The dam built along the coast strongly affects communication between two ecosystems

Photo 34: Unplanned and inappropriate urban development; camping site along the coast

MAP 12: CLASSIFICATION AND SPATIAL DISTRIBUTION OF MAJOR THREATS



0 0,25 0,5 1 Kilometers

Map created by Montenegrin Ecologists Society
Date: September 2016

CRITICAL ECOSYSTEM PARTNERSHIP FUND

CRNOGORSKO DRUŠTVO EKOLOGA

CONTRIBUTING FACTORS

A contributing factor is best described as a human action or activity that directly or indirectly results in the emergence of a threat, which then goes on to induce a stress or stresses in one or a number of components in an ecosystem. Often, contributing factors act synergistically but they may also produce antagonistic effects. Many of these factors represent risks because they can unforeseeably appear or change in the future and can contribute to impacts on biodiversity objects. (Ibisch & Hobson, 2014).

The large set of contributing factors was analysed within the MARISCO conceptual model (see the table below), representing the causes of threats and consequently stresses that are damaging the functionality and values of the Buljarica ecosystem. Contributing factors related to the Institutional framework are embedded in the root cause factor **Immature institutional framework subjected to influence of different interest groups**. Here the especially pronounced and concrete problem is a long-term concession of state land for the building of a luxurious tourist complex, which would be realised against the fact that Montenegro is constitutionally outlined as an ecological state, and against sustainable development, diversification of tourism offers and conservation policies and plans.

Valorisation of state property is of prime concern and a priority that steers the development directions on national and local levels and generates proactive efforts. All major development projects in Montenegro were recently realised through external investments. However, important regulation and planning to govern this process is missing: there is no law for determining the public interest, there is no strategy of valorisation, the methodology for determining the value of state property is missing, and privatisation and investment plans are developed on a yearly basis. In this situation, external capital influx plays a very important role in steering the development and use of resources in Montenegro, and all this is prone to high-level corruption and crime.

The aforementioned contributing factor is assessed as directly related to the next one, **Political decisions made regardless of technical/scientific knowledge**. Stakeholders from all sectors (government, private, non-governmental, business, scientific, media, etc.) claim to have weak capacities (technical, human and financial). The problem is aggravated by the fact that over 90% of the national budget is assigned for fixed expenditures (salaries, pension contributions, health and social benefits), having further allocations for development of human resources, planning and implementation of policies disbursed from a very small share. Correspondingly, scientific institutions and associated actors do not play important role in decision-making processes. Strategies and SEA do not rely on evidence-based solid analyses, nor invite for the meaningful participative process, allowing opportunistic planning to prevail over multidisciplinary research, analyses and knowledge-based decision-making. For example, although some research regarding the Buljarica marine area was conducted under the recent CAMP project, integration of the findings and establishment of identified MPAs did not come to a realisation. These two introduce the problem of **Low priority level of ecology** in both local and state institutions. The environment is still considered to represent a barrier to development and an administrative burden. Natural capital is used without assessing its limits, added values and opportunities for long-term sustainable development. The budget for the environment is very small, the state administration has very limited capacities, and there is evidence of environmental degradation, even in protected areas. Despite the protection status of Buljarica beach, no measures are planned or enforced in this respect.

As the consequence of the aforementioned, another problem appears, **Low enforcement of environmental laws and regulations**. According to the 2015 Montenegro Report of the European Commission, major reforms are still needed to strengthen the country's physical infrastructure and human capital and to ensure a predictable and supportive regulatory environment. Regardless of the point that EU accession is the most important driver of the reform processes in Montenegro, key findings of the 2016 Report on Montenegro underlined that strengthening of the administrative capacity for ensuring the application of the acquis remains a substantial challenge for Montenegro. The latter report also specifies that good progress in further aligning of policies and legislation in the area of environment and climate changes (chapter 27) was achieved, but significant efforts are needed for their implementation and enforcement, in particular in water, nature protection and waste management sectors. Illegal activities in fishing, forestry, hunting, building, pollution, etc., are common. The situation in Buljarica is reflecting all mentioned.

The previous problem is connected to the next two: **No solid or water waste management, and Illegal or badly planned constructions**. In Buljarica, as in many other places, the infrastructure for wastewater and solid waste management is not ensured, consequently having illegal dumpsites and discharge of wastewaters into land, rivers or sea as a common practice. Also, illegal construction is not subject to punitive measures, moreover, as there is no detailed urban plan the legalisation of such buildings is expected. Planned infrastructure is not supported with solid baseline data on hydrology and seismic risks, it is neither connected with the rational planning of greenery and other supportive infrastructures nor based on integral planning, being subjected to high risks and possibly negative interface with natural and socio-economic processes.

Contributing factors related to Institutional framework induce most of the threats to the ecosystem and are assessed to be of significant strategic relevance to the Buljarica cove biodiversity objectives. However, their manageability would require significant long-term efforts much beyond the scope of this project.

The root cause of many problems could be sought

within one of the main contributing factors: **Lack of long-term vision** for more sustainable tourism development, which is connected to **Low integral planning** connected to institutional factors. The situation in the area of sustainable use of resources in Montenegro is characterised by the following weaknesses: centralised planning, insufficient commitment and efforts of the authorities towards the implementation of the subsidiarity principle (control and responsibility are given to the institutions/stakeholders that are closest to the resource in question, as research shows that the best long-term decisions are made by those who live closest to the resource); sectoral planning and acting, incorrect application of SEA and EIA to improve sustainable tourism development and integral planning, performing these only to fulfil the law obligation; low level of participatory planning followed also by small number and low capacity of NGOs, and weak contribution of media to building a well-informed, aware and responsible society. In this situation, where Buljarica currently does not represent the character of the local and regional economy, has no coordinated strategy for sustainable development or large and coherent society groups which would act as a strong voice, it operates within the framework of discrete activities. As such, it is very susceptible to centralised and sectoral development plans.

Contributing factors related to good governance are as follow: **Low participation of local community in decision making; Conflicting sectoral planning; Insufficient access to knowledge; Low interest of people in joint planning; Unidentified development alternatives.** Unfavourable economic conditions of the local community and lack of knowledge for alternative sustainable development make the quality of environment an issue that is of secondary importance or largely neglected. Short-term income gain is the most common socio-economic driver. This situation is connected with the previously mentioned institutional and governance problems but also induced by **Expansion in real estate markets** by providing the environment for both national and foreign capital influx. Furthermore, this situation is aggravated by the prevailing mass tourism and construction business, and not a single example of sustainable development destination exists in Montenegro which could showcase alternative solutions. Moreover, this is supported with the problem of Uncompetitive products on the free market, where agriculture and traditional lifestyle are also not economically attractive.

Unsurprisingly, **Replication of prevailing unsustainable tourism development** as in Budva and Petrovac appears as the only way forward to realise the potential of Buljarica cove and to escape poverty. This is connected with the problem of the one type of tourism offer – **Dominant sun and beach seasonal type of tourism** – making Montenegro tourism industry on the coast seasonally dependent and vulnerable to shifts in tourism trends. Nevertheless, Montenegro development directions 2015–2018 are confirming the focus on: increased number of tourists with higher purchasing power, increased number of accommodations in four and five star hotels, realisation of the existing and attracting new investments in the tourism sector, enhancement of the promotion of Montenegro in strategic source markets, and the related. In this situation, the sustainable, long-term development with diverse offer and all-year-round tourism, noted as the strategic direction in many documents (namely Master plan for tourism until 2020 and the associated SEA), which requires synchronised, possibly endeavouring `efforts and slow growth, is not as appealing as the exclusive tourism and short-term revenue.

Uncontrolled expansion of touristic activities at Montenegrin coasts in general and **Immigration and emigration** of people are mostly consequences of the previously mentioned. Locals are often selling land and moving to urban centres, while buyers are rapidly building tourism facilities.

Fuel energy demands are one more contributing factor, identified under the Economic transition higher group as the future one. Producing energy is set as a priority and one of the most important development drivers in Montenegro. Montenegro offshore hydrocarbons exploration and production program and the associated SEAs are prepared. However, without adopting these and without the development of monitoring / environmental management plan and the associated structures, first contracts have already been signed, providing foreign investors with the opportunity to both explore and produce oil and gas from several sea blocks. The conflicts with other sectors (tourism, fisheries, etc.) and socio-economic situation are numerous, but poorly analysed and acted through.

Socio-cultural related factors are assessed to be: **Weak culture of communication** (high in strategic relevance), connected with good governance problems, too; **Loss of traditional values** connected to the abandonment of agricultural fields / hay meadows threat; and **Low ecological/environmental awareness** connected to unsustainable hunting and fishing, burning of meadows and forests, pollution, and other threats.

Climate change contributing factor induces the problem of Temperature increase, very important for the Buljarica cove ecosystem as it generates the following threats: sea level rise, invasive species distribution in the sea, and increase in fires – burning of meadows and forest. When it comes to climate changes, administrative capacity on both national and local levels remains quite weak and poorly equipped to deal with the emerging challenges.

TABLE 9: CONTRIBUTING FACTORS AND RELATED THREATS

CONTRIBUTING FACTORS		RELATED THREATS
CATEGORY	SUBCATEGORY	
Immature institutional framework	Immature institutional framework subjected to influence of different interest groups	NA (root cause factor)
	Political decisions made regardless of technical/ scientific knowledge	NA (root cause factor)
	Low priority level of ecology in both local and state institutions	development of oil platforms and the following infrastructure (future threat), pollution (untreated communal and illegal solid waste disposal)
	No solid waste or wastewater management	pollution
	Low enforcement of environmental laws and regulations	marine traffic and anchoring in Posidonia meadows
	Illegal or badly planned constructions	intensive urban development and associated pollution, landslides and erosion
Missing good governance processes	Lack of long-term vision for more sustainable tourism development	NA (root cause factor)
	Insufficient access to knowledge	NA (root cause factor)
	Low interest of people in joint planning	NA (root cause factor)
	Low participation of local community in decision making	intensive urban development and associated pollution
	Low integral planning and visioning	NA (root cause factor)
	Conflicting sectoral planning	possible future threats: construction of a marina, development of oil platforms and the following infrastructure
	Unidentified development alternatives	construction of a marina, oil platform development and drainage of a marsh
	Dominant sun-and-beach seasonal type of tourism	NA (root cause factor)
Economic transition and short-term income	Poverty / Need for income	NA (root cause factor)
	Uncompetitive products on free market	abandonment of agricultural fields / hay meadows
	Replication of prevailing unsustainable tourism development as in Budva and Petrovac	intensive urban development and associated pollution, future threats (construction of a marina, and drainage of a marsh), marine traffic and anchoring in Posidonia meadows
	Expansion in real estate market by enabling environment for both national and foreign capital influx	drainage of marsh and abandonment of agricultural fields / hay meadows
	Fuel energy demands	development of oil platforms and the contributing infrastructure
	Immigration and emigration of people	abandonment of agricultural fields / hay meadows
	Uncontrolled expansion of touristic activities at Montenegrin coasts in general	physical damage to beach vegetation by tourists' presence, marine traffic and anchoring in Posidonia meadows, planned / possibly future ones: construction of marina and drainage of a marsh
Socio-cultural changes	Weak culture of communication	NA (root cause factor)
	Loss of traditional values	abandonment of agricultural fields / hay meadows
	Low ecological/environmental awareness	unsustainable hunting and fishing, burning of meadows and forests, pollution
Man-induced natural factors	Climate change	NA (root cause factor)
	Temperature increase	sea level rise, invasive species distribution in the sea, and increase in fires – burning of meadows and forest

RANKING THE CONTRIBUTING FACTORS AND STRATEGIC PRIORITISATION

All contributing factors have been rated according to the MARISCO guidance (Ibisch & Hobson 2014) in order to assess their current criticality (by analysing the scope, severity and irreversibility of each of the factors), then past and future criticality, and trend of change. Systemic activity was also analysed looking into connections that contributing factors have (reflected by how many other factors/threats they influence or are influenced by). All of this rating scored to the Strategic relevance of the factor, which tells how much importance does a certain factor bear in the whole system. In order to assess manageability and knowledge level of the certain factor, these were analysed too.

According to the ranking[9] of the contributing factors (Table 10), among the most significant for the strategic relevance, the following stand out: Weak culture of communication; Expansion in real estate markets by enabling an environment for both national and foreign capital influx; and Uncontrolled expansion of touristic activities at Montenegrin coasts in general.

The issue is that most of the factors are highly strategically relevant, however very hard to be managed, requiring additional resources for both improving the knowledge and intervention.

TABLE 10: RANKING OF CONTRIBUTING FACTORS

CONTRIBUTING FACTORS	Scope	Severity	Irreversibility	Past criticality	Current criticality	Trend of change	Future criticality	Systemic activity (level of activity)	Systemic activity (n. of influenced elements)	Systemic activity	Strategic relevance (value)	Strategic relevance (final range)	Manageability	Knowledge
Weak culture of communication	3	3	3	1	3	3	3	3	2	3	12	3	3	2
Expansion in real-estates markets by enabling environment for both national and foreign capital influx	3	3	3	2	3	3	3	3	2	3	12	3	3	3
Uncontrolled expansion of touristic activities at Montenegrin coasts in general	3	3	3	2	3	3	2	4	4	4	12	3	3	3
Low integral planning, proactive and visioning	3	3	3	2	3	3	2	3	3	3	11	3	3	3
Fuel energy demands	3	3	3	2	3	3	3	1	1	1	10	2	3	3
Unidentified development alternatives	3	3	3	2	3	3	2	2	2	2	10	2	3	2
Political decisions made regardless of technical/scientific knowledge	3	3	3	3	3	3	2	3	3	3	11	3	3	3
Low ecological/environmental awareness	3	3	3	1	3	3	2	3	3	3	11	3	3	2
Low priority level of ecology in both local and state institutions	3	3	3	2	3	3	2	2	2	2	10	2	3	3
Low enforcement of environmental laws and regulations	3	3	3	2	3	3	2	3	2	3	11	3	3	2
Conflicting sectoral planning	3	3	3	2	3	3	2	2	2	2	10	2	3	3
Illegal or bad planned constructions	3	3	3	2	3	3	2	3	2	3	11	3	3	3
Loss of traditional values	3	3	3	2	3	3	3	1	1	1	10	2	3	2
No solid or water waste management	3	3	3	2	3	3	2	2	1	2	10	2	3	2
Immature institutional framework subjected to influence of different interest groups	3	3	3	3	3	3	2	3	1	2	10	2	2	3
Poverty / Need for income	3	3	3	2	3	3	2	2	1	2	10	2	3	3
Low interest of people in joint planning	3	3	3	1	3	3	2	2	1	2	10	2	3	3
Climate change	1	1	1	2	1	3	3	3	1	2	9	2	3	1
Low participation of local community in decision making	3	3	3	2	3	3	2	1	1	1	9	2	3	2
Insufficient access to knowledge	3	3	3	1	3	2	2	2	2	2	9	2	3	2

9 Interpretation of the values: 1 = low / very manageable / well known, 2 = medium / somewhat manageable / somewhat known, 3 = high / poorly manageable / not known, but theoretically knowable, 4 = very high / not manageable / not knowable

CONSERVATION AND STRATEGIC DESIGN

Conservation design and the concrete management strategies set here for Buljarica cove are based on the results that came from the systemic situation analysis done under the scope of this project. Furthermore, the national and international strategic development directions and frameworks were consulted and analysed, such as specific requirements of the Protocol on Integral Coastal Zone Management, National Strategy for ICZM for Montenegro, National Sustainable Development Strategy for Montenegro, and the Barcelona Convention for the Protection of the Mediterranean.

VISION

After thorough analyses of Buljarica ecosystems within the MARISCO conceptual model, the following visions have been formulated in order to encompass the value and importance of the site and to give the directions for future actions.

- Buljarica is an area of accomplished and growing eco-tourism.
- Potentials are realised through up-to-date conservation measures, where the empowered local community enjoys and appreciates human well-being assets within a sustainable development agenda.
- Water areas, agricultural land and forests are key resources that are valued through ecological and traditional production and they represent an important offer of high-quality tourism.
- Ecologically valuable habitats, endangered species, ecosystems and cultural assets are valuated, well managed and efficiently monitored, ensuring adjusted and suitable conservation and sustainable development growth.
- Buljarica is serving as an educational on the spot site, recognised and valuated as one of the few remaining typical coves of the Adriatic coast.
- Buljarica is a successful case example replicated nationally and internationally for its conservation and sustainable development model.
- Buljarica has a value for the present and future generations, which will have a contribution in the adoption and application of important socio-economic decisions.

CONSERVATION OBJECTS

The objective of this study was to present the value of Buljarica cove from the ecological, socio-economic and cultural aspects. These aspects are perceived through the concept of the ecosystem approach.

Research showed that Buljarica presents a specific and valuable natural and cultural entity on the Adriatic coast. Its ecosystems are comparatively well conserved and inhabited by numerous important species of wildlife. From an environmental point of view, the greatest importance and uniqueness of the Buljarica cove is reflected in its wetland habitats. Interactions between the wetland and its surroundings are the cause of pronounced biological diversity in a small space. Importantly, wetland ecosystems, such as that which makes the most part of Buljarica, are rapidly disappearing on the Montenegrin coast, mostly due to expanding urbanisation. This fact further highlights the value and significance of this area.

The presence of permanent and temporary water bodies, springs, streams and forests provides optimal conditions for feeding, breeding and wintering of insects, amphibians, reptiles, birds and mammals. Many of the animal and plant species present in Buljarica are protected at national and international levels (Table 11). Many of the recorded species are on the List of protected plants and animals of Montenegro (Official Gazette 76/06): 7 insects, 8 amphibians, 19 reptiles, 175 birds and 7 mammals. This fact alone confirms the biological values of Buljarica.

Regarding the marine ecosystem, highest conservation importance is represented by the meadows of Posidonia oceanica, which cover large portions of the sea floor and house numerous other forms of life; also, the water quality directly depends on them, which makes P. oceanica one of the key species for human well-being and ecosystem services.

Not only natural goods form the value of Buljarica: the long presence of humans also left its mark in this area. In Buljarica there are three most important cultural and historical heritage monuments, Gradište Monastery, Memorial plaque to fallen patriots of the region and the Memorial cemetery of the First World War internees. Besides these three, numerous other cultural properties were documented: 25 archaeological sites, 21 groups of buildings (profane traditional architecture), 16 sacral places and 17 memorial places.

TABLE 11: THE MAIN GROUPS OF WILDLIFE RECORDED IN BULJARICA

Animal taxa	No of SPEC	EU Directive	Bern Conv.	Barc. Conv.	Nation legisl.
Insects	175	10	4	0	7
Marine Fish	63	0	5	5	0
Amphibians	11	6	11	0	8
Reptiles	22	19	22	1	19
Birds	178	39	40	12	175
Mammals	23	9	15	1	7
TOTAL	**472**	**83**	**97**	**19**	**216**

CONSERVATION GOALS AND OBJECTIVES

Development of Buljarica has to be aligned with the need to protect its resources. The protection of Buljarica cove in the near future should lead to the expansion of livelihood opportunities, with the long-term sustainable development established around this area. Its economic development supports the social, cultural and ecological sustainability.

In the forthcoming five-year period it is necessary to establish the protected natural area with precisely defined boundaries of the core, buffer and transition zones.

According to the Law on Protection of Nature (Off. Gazette 52/2016), Buljarica could be designated as a Nature Park, Monument of Nature or a Landscape of Outstanding Feaures, because it meets the criteria of these categories prescribed by the law. Which protection category it will gain will be decided by the Study of protection. Undoubtedly, Buljarica has natural, ambient and cultural values according to which it should be declared as a protected natural good of which the categorization is defined by the articles 20–26 of the Law on Protection of Nature.

According the IUCN criteria, Buljarica could be assigned to Category IV of protected/management areas. This category relates to small areas, to protection of threatened habitats and target species (notably those which were assessed as threatened on the IUCN Red List – NT, VU, EN, CR), and also covers isolated populations and sparsely inhabited areas.

Buljarica fulfils two of the nine criteria according to which it could be declared as a Ramsar site. Those are criteria 2 and three, on the basis of certain insect and amphibian species.

Concerning the existing data, according to which Buljarica provides habitat to several species from the Annex II and encompasses several priority habitat types of Annex I of the Habitats Directive, as well as several species from Annex I of the Birds Directive (and roughly knowing their distribution in the Montenegrin shoreline), Buljarica is also a potential Natura 2000 habitat.

Designation of the marine part of Buljarica cove as a Marine Protected Area is already notified to be an important and urgent measure to safeguard Posidonia beds in the near future.

Buljarica urgently needs management and conservation measures that should revitalise it, to mitigate stresses that have affected it in the past 30 years. Development of the participative management planning would contribute to realising a wide set of opportunities that comes from ecosystem services, which will, in turn, significantly contribute to the well-being of the local communities and the wider population.

An important role in the process of establishment of protected natural area, its revitalization and management belongs to the local people, CSOs and local government, who are to be empowered to lead the integral sustainable planning and management of Buljarica.

Strategic portfolio for safeguarding and developing the ecosystems of Buljarica

Both the analysis of biodiversity of Buljarica and the social survey results confirm that it is fully justified to invest in its conservation and restoration, as well as in prevention of unsustainable development. The resources available for the first assessment did not allow for an intensive and participatory process of strategy formulation, but the systemic conceptual model depicting the current and future challenges as well as the socioeconomic information provide a concrete starting point for the development of the first ideas.

The developed strategic portfolio is in its major part a contribution of the backstopping consultant. It is suggested to strive for a comprehensive and holistic approach to sustainable development of the area. A corresponding ideal strategic portfolio would comprise four strategic complexes elaborated below:

- The overarching participatory research, monitoring and communication of the current situation of Buljarica ecosystems,
- Short to mid-term abatement of critical contributing factors that drive the threats to biodiversity through developing and implementing a conservation management regime,
- The treatment of ecosystem stresses and mitigation of direct threats to biodiversity by enhancing or restoring the functionality of harmed ecosystems and their components,
- Exploration of and investment in alternative development models.

The overarching participatory research, monitoring and communication of the current situation of Buljarica ecosystems

The results of the first assessment carried out by our team justify the elaboration of the corresponding information materials for local and national target groups, including decision makers, as well as the international audience (including potential donors). The corresponding strategic action lines would be:

- Local and regional information and 'branding' campaign about the specialties and values of Buljarica cove, its ecosystems, culture and people, embracing press releases and the elaboration of

effective media to be distributed (e.g., posters, flyers for distribution to tourists, schools), and feedback workshops with local inhabitants and authorities presenting the results of the study.
- International awareness raising with the website on biodiversity values and scenic beauty of Buljarica cove (potentially including webcams, blog on ecological observations, also socioeconomic and sociocultural results), as well as information on current threats and future risks.
- Complementary studies for closing some investigation gaps, covering biodiversity, but also cultural values (local history, cultural monuments, traditional buildings, cultural heritage, traces of traditional land use).
- Establishment of an interactive campaign of citizen science involving local people in the observation of selected species or ongoing basic ecological monitoring (e.g., water quality, climate data; with data to be documented and publically communicated).
- Participatory development of future scenarios with local inhabitants and decision makers (workshops based on guiding questions such as: "How do we want to live? What are future opportunities and risks? Which alternative scenarios exist, what are their implications?") as an input for management planning and implementation; scenarios to be visualized with animations, models, etc.

Short- to mid-term abatement of critical contributing factors that drive the threats to biodiversity, through developing and implementing a conservation management regime.

In terms of a temporal priority, this strategic complex is of utmost importance. It is critically relevant to establish a preliminary management regime together with local authorities in order to stop unregulated and illegal activities; this would be accompanied by the development of participatory management plan with relevant stakeholders and authorities defining a common vision and strategic goals for the area. Correspondingly, the strategic action lines would be:

- Development of a detailed urban plan that will be based on protection of coastal ecosystems, conservation of coastal line, preservation of cultural heritage, sustainable use of coastal areas, responsible consumption of resources, prevention and reduction of damage from hazards.
- Participatory zoning and management planning in line with the existing regulations regarding conservation and land use, including the exploration of proposals for the change of status of the site (on a communal and higher level).
- Establishment of a minimum preliminary management regime comprising control and surveillance activities – this could be achieved in combination with further research and monitoring activities.

The treatment of ecosystem stresses and mitigation of direct threats to biodiversity by enhancing or restoring the functionality of harmed ecosystems and their components

The stresses and threats give an idea of important restoration and conservation measures to be implemented. (Potentially) manageable stresses refer to changes of hydrological regimes, traditional land use, management of fire risks and the situation of the beach. Of special importance would be:

- The maintenance and restoration of drainage channels.
- The reconstruction of close-to-nature beach ecosystem. This would especially include the reversal of the illegal construction of a dam along the coast.
- Establishing of a system of early warnings of drought and fires which will protect many ecosystems, landscape values and beach areas from erosion. Applying rehabilitation measures of burned areas.
- Mitigating the negative impacts of illegally constructed buildings. Building of a sewage system and a plant for wastewater treatment. Further urbanisation is acceptable if an urban zone already exists and in the area that has the lowest level of sensitivity and vulnerability.
- Restriction of access to parts of the area – especially to parts of the shoreline and beach which are to be restored – for vehicles, boats and visitors in general.

Exploration of and investment in alternative development models

The area clearly shows the potential for an alternative development avoiding the foreseeable pathway towards total destruction of close-to-nature ecosystems, urbanisation and 'industrialised' tourism. Concretely, the following strategic options should be explored in the framework of participatory feasibility studies:

- Capacity building for local tour guides offering nature-based experiences for tourists visiting the region (hiking tours, visiting program to the hidden hinterland of coastal areas, adventure tourism, introduction to natural history; development of simple materials and guides for guides and tourists).
- Development of Buljarica as the destination of medicine/health tourism (thalassotherapy, medically programmed active vacation, wellness tourism). Buljarica as a protected natural good could be a special tourism niche that will encourage the development of health tourism. Health tourism offer can be combined with other types of sustainable tourism.
- Development of a touristic eco-village as showcase and laboratories to traditional and modern land

use ('tourist farms' with options for active participation and learning experience in 'landscaping', mowing, animal-keeping, organic gardening, permaculture, fishing, bee-keeping, viticulture, olive growing, establishment of orchards etc., as well as some simple restoration measures, including maintenance of drainage channels, beach recovery). Such an eco-village could be started with a few activities and limited infrastructure; initially, it can be operated together with volunteer travellers and student interns from abroad. Once a property has been purchased and developed, additional model activities can be showcased inspiring local people and establishing an attraction for tourists.

It is possible to build an eco-village in accordance with the principles of sustainable development. This can be done by using alternative construction methods that do not cause damage to the habitat. This can "showcase the highest standard of green building, energy saving and energy production from renewable sources and includes rammed-earth construction and the latest solar technology"[10].

It is also possible to construct buildings of available local materials. This way of building represents excellent insulation, which allows the retention of heat in the rooms during the winter but also prevents excessive warming during the summer.

Buildings can harness the sun's energy using solar panels or skylight. Large windows and skylights draw heat into the building (passive solar heating). Most of the materials needed for the construction of these facilities can be biodegradable and could be reused or recycled. Those materials represent a small threat for the ecosystem. Thanks to this way of construction, negative impact on biodiversity and habitats is minimised.

The structural part of the eco-village could be traditional and organic gardens, which are part of the tourist offer, and also can serve in the experimental and educational purposes. It would be a productive and wildlife-friendly garden. The energy required for the operation of the village can be provided from alternative sources of energy. The eco-tourist village can have walking, riding and biking trails and routes designed so the visitors can observe the unique biodiversity of Buljarica cove. Part of the offer can be cultural heritage, Information and Education centre, voluntary work on traditional and ecological farms, fishing trips and introducing with the traditional way of life of the people in this area.

A holistic approach would include sustainable land use, renewable energy and water management (e.g., alternative sanitation technology). If there were land, infrastructure and long-term funding it would be possible to develop a self-sustaining settlement that uses renewable energy.

Photo 35: Naked lady (*Colchicum autumnale) is blooming after the blaze*

Photographer: Mihailo Jovićević

10 Official website of the Centre for Alternative Technology: http://visit.cat.org.uk/index.php/test-signing.

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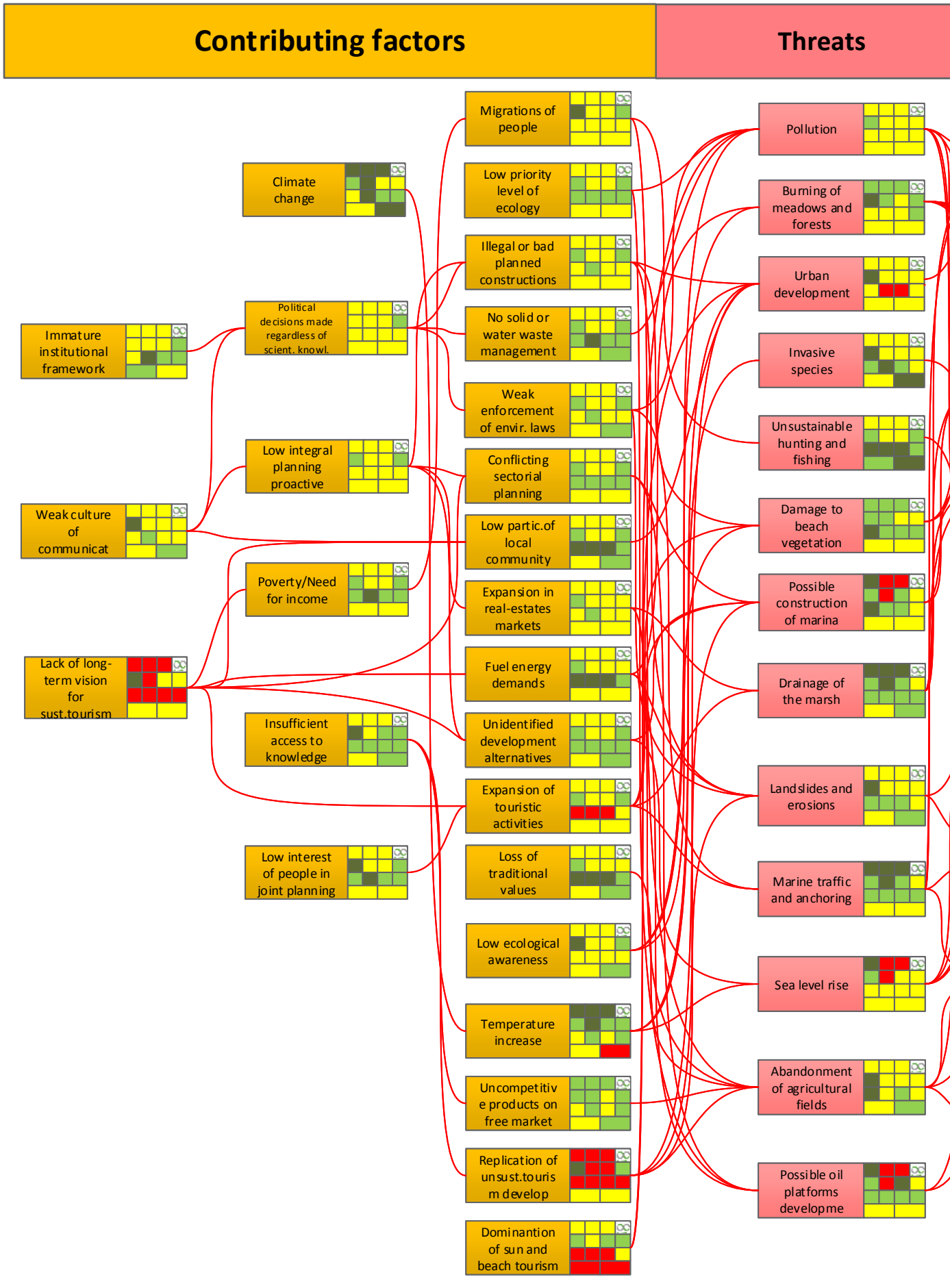
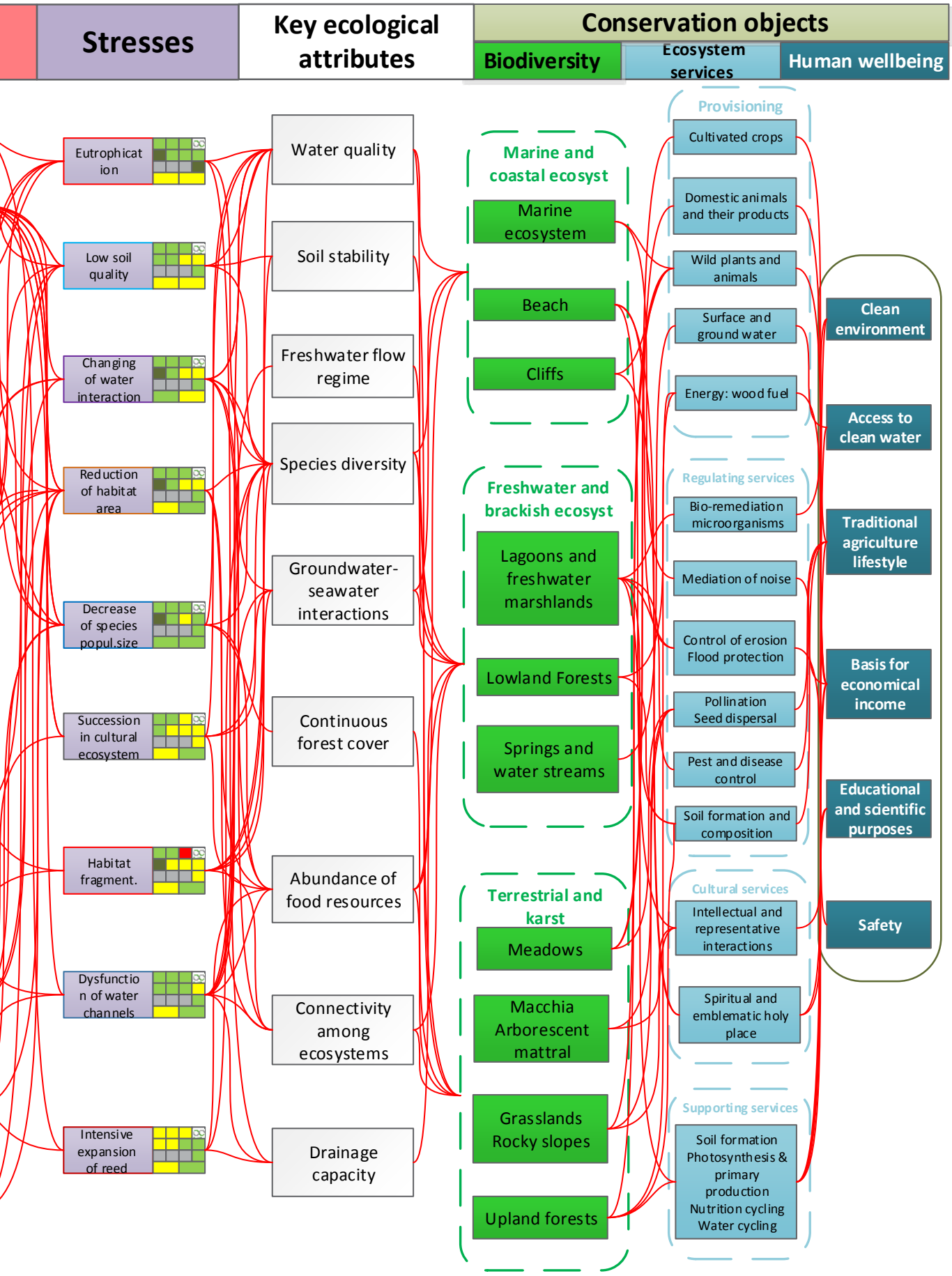
ANNEX I: DIGITIZED MARISCO MATRIX




Stresses
Key ecological attributes
Conservation objects
Biodiversity
Ecosystem services
Human wellbeing
Eutrophication
Low soil quality
Changing of water interaction
Reduction of habitat area
Decrease of species popul.size
Succession in cultural ecosystem
Habitat fragment.
Dysfunction of water channels
Intensive expansion of reed
Water quality
Soil stability
Freshwater flow regime
Species diversity
Groundwater-seawater interactions
Continuous forest cover
Abundance of food resources
Connectivity among ecosystems
Drainage capacity
Marine and coastal ecosyst
Marine ecosystem
Beach
Cliffs
Freshwater and brackish ecosyst
Lagoons and freshwater marshlands
Lowland Forests
Springs and water streams
Terrestrial and karst
Meadows
Macchia Arborescent mattral
Grasslands Rocky slopes
Upland forests
Provisioning
Cultivated crops
Domestic animals and their products
Wild plants and animals
Surface and ground water
Energy: wood fuel
Regulating services
Bio-remediation microorganisms
Mediation of noise
Control of erosion Flood protection
Pollination Seed dispersal
Pest and disease control
Soil formation and composition
Cultural services
Intellectual and representative interactions
Spiritual and emblematic holy place
Supporting services
Soil formation Photosynthesis & primary production Nutrition cycling Water cycling
Clean environment
Access to clean water
Traditional agriculture lifestyle
Basis for economical income
Educational and scientific purposes
Safety