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Reinforcing Protected Areas Capacity through an Innovative Methodology for Sustainability

– BIO2CARE –

(Reg. No: 1890)

WP5/Deliverable 5.1.5

Policy recommendations regarding protected areas and biodiversity

Contributing Partners

LB - Democritus University of Thrace - Laboratory of Environmental Management and Industrial Ecology
PB6 - Regional Inspectorate of Environment and Waters - Blagoevgrad
PB8 - South-West University "Neofit Rilsky"
PB9 - Pirin Tourism Forum

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Table of Contents

WP5/Deliverable 5.1.5
Policy recommendations regarding protected areas and biodiversity

Chapter 1: Sustainability of the BIO2CARE project and added value to the Cross-Border Cooperation Area: Valorising BIO2CARE deliverables

1.1. Bulgarian partners point of view

Cross-border cooperation is extremely important for achieving the goals of the BIO2CARE project. The BIO2CARE proposal was developed jointly after a comprehensive discussion and exchange of views between partners on both sides to address the key challenges and common needs on biodiversity conservation and sustainability assessment. Public administrations and governing bodies of National Parks (Protected Areas) in the area face many constraints such as lack of funding, institutional constraints and lack of knowledge, time and experience. It is therefore important to facilitate the development and monitoring of action plans by the authorities in support of sustainable investment. The exchange of knowledge between the partners is essential for achieving the goals of the BIO2CARE project. The results and products of the project should "cover", as far as possible, the different specifics, needs and experiences of the partners, so that they are transferable and benefit both the whole partnership and other stakeholders.

The project includes a significant number of sub-activities that require the active participation of all partners. For example, Work Package 3, due to the fact that a unique methodology is applied, may lead to the development of a uniform integrated decision support system (DSS) used by both parks. This is the real added value of developing this integrated decision support system (DSS) under the Program, as it will enable the managing authorities of national parks (protected areas) to work according to the same procedures and exchange information, contributing to the stimulation of scientific knowledge and supporting the policy-making process. Therefore, all activities, results and products will be jointly planned and implemented. Through cross-border cooperation, both the project partners and the target groups will expand their knowledge in the field of biodiversity protection and sustainability assessment, increase their experience and provide the relevant regional

institutions with the opportunity to integrate the developed tools and methods and strengthen their capacity on these issues. Significant attention was paid to creating synergies that go beyond the project partnership through relevant activities and results.

The BIO2CARE project aims to provide a wide range of results. All of them should be owned, financed and operated (if necessary) by the relevant partners, such as:

- Studies (methodology, current situation analysis and SWOT analysis): These studies have never been applied to both Parks (Protected Areas), so they are a distinctive new component in the daily work of National Parks. The methodologies that will be applied ensure that in the near future the same methodologies proving their sustainability will be used in the revision of the studies. The surveys will be uploaded on the partners' websites, ensuring their long-term availability after the end of the project;

- Monitoring networks for fauna, flora and illegal activities;

- E-tools / software programs ("BIO2CARE Calc" & "BIO2CARE Symbiosis") and two (2) smart applications ("BIO4TOURISM"): Monitoring systems are expected to provide substantial coverage and monitoring for a long time, while electronic tools and applications will provide services to staff, scientists and visitors to protected areas. The two managing authorities of the nature parks (National Park of Eastern Macedonia and Thrace, the Hellenic Republic and Rila National Park, Republic of Bulgaria) will be responsible for the operation and maintenance of the equipment and applications. These systems will be built into the organizational structure of nature parks (protected areas) and will be part of the daily work of employees in protected areas. The trainings in the last months of the project duration will ensure their optimal use. The information gained from the use of this equipment should be freely available and will be disseminated by the partners to the stakeholders (other national parks, public administration, etc.) through various channels (events, conferences, demonstrations, established networks from stakeholders, etc.). The corresponding operating costs, which are very low, will be easily absorbed by the annual budget of the nature parks;

- Trails accessible by people in difficulty and / or with disabilities: these trails fall under the jurisdiction of Nestos Municipality and Rila National Park Directorate, respectively, their maintenance

is expected to be low cost so as not to hinder the budgets of the respective partners. for the future. In the foreseeable future, these pathways can be widened, creating much larger networks serving more visitors. Experience in the construction, operation and maintenance of trails can be easily learned from other protected areas and municipalities in the form of a "Lessons Learned Report";

- Development of "BIO2CARE - Eco-labeling scheme". Upon completion of the project, it should be supported by the parks, which will ask other participants to participate. This is a task that is part of the harmonious joint cooperation between protected areas (nature parks) and local communities. The trainings in the last months of the project duration will ensure their optimal use;

- Two (2) training sessions on the use of “BIO2CARE” software and two (2) targeted seminars on “BIO2CARE - Eco-labeling scheme”. The training materials will be available for at least 5 years thereafter. They will be available from the partners' websites. Stakeholders will also be informed;

- Report with policy recommendations (final result of Work Package 5): should be reviewed annually, with new data and findings from protected areas and the activities of the Greek Biotope Center (EKBY).

1.2. Greek partners point of view

BIO2CARE implementation led to the development of a very innovative Decision Support system (DSS) for Protected Areas (PAs) consisting of: a) one set of studies including a methodology, current situation analysis and SWOT analysis studies, b) Monitoring networks for the high-tech monitoring of fauna, flora and illegal activities, c) Two e-tools for estimating the carrying capacity in the areas of interest (BIO2CARE Calc) and for examining, assessing and proposing potential symbiotic activities (BIO2CARE Symbiosis) and smart applications for facilitating and promoting green tourism. The specific DSS is the greatest achievement of BIO2CARE since it changes the way a protected area is managed towards sustainability as well enabling the development of synergies between the Management Bodies (MBs) of PAs in different areas/countries. The development of the two e-tools can increase the managerial capacity of the PA MBs in order to improve the management of the PAs as systems, define and prioritize the necessary improvements. The combination with high-tech monitoring systems (both for fauna/flora and for illegal activities) further contributed to the improvement of PAs environmental status.

The new EU biodiversity strategy for 2030 commits to effectively manage all protected areas, defining clear conservation objectives and measures, and monitoring them appropriately by 2030. BIO2CARE outcomes, and especially the DSS, can highly contribute to

these goals. In the following Table, key criteria and indicators according to the IUCN Green List of Protected and Conserved Areas (GLPCA) are summarized that can greatly help for improving measurement of PAs management effectiveness.

Table 1: Proposed GLPCA criteria and indicators for improving the management effectiveness of Pas and respective BIO2CAREs offerings (Adapted from EEA, 2020)[1].

Component/Criterion	Indicator	BIO2CARE response
Good governance (Vitality and capacity to respond adaptively)	Procedures are in place to ensure that results from monitoring, evaluation and consultation are used to inform management and planning processes, including establishing goals and objectives	BIO2CARE offers a practical and innovative Decision Support System (DSS), co-created with the involvement of PAs MBs, that can highly support efficient management and establishing sustainable goals and objectives.
Good governance (Vitality and capacity to respond adaptively)	Planning and decision-making recognize relevant conditions, issues and goals at national and regional scales that affect the protected area	A holistic approach is applied, that takes into account several issues on regional and even global scale (through the application of holistic indicators). Apart from biodiversity protection on a local level, BIO2CARE offers solutions and recommendations related to the economic development of the area, increasing the knowledge and capacity of local actors, promoting sustainable tourism (also taking into account people with special needs).
Effective management (Long-term management	The site demonstrates that management activities and policies and/or legislation and regulations are being	BIO2CARE ensures that a long-term vision is applied, through the estimation and monitoring of the carrying capacity of the

[1] European Environment Agency, Briefing No 11/2020, Biodiversity-Ecosystems, The Natura 2000 protected areas network: Management effectiveness in the EU's Natura 2000 network of protected areas

strategy)	implemented and are consistent with the management plan (or equivalent)	examined protected area and that all development goals do not cross the respective sustainable boundaries.
Effective management (Long-term management strategy)	The site has adequate numbers of appropriately trained staff provided by the responsible entity and properly supervised to implement all aspects of its management plan or equivalent in the long term	BIO2CARE provided training to the staff of the study areas MBs staff on a multitude of issues, making sure that they are capable of continuing the operation of BIO2CARE innovations.
Effective management (Long-term management strategy)	Financial constraints are not threatening the capacity of management to achieve the site's objectives	All BIO2CARE outcomes are freely available and were developed with a view to simplify as much as possible the necessary procedures, thus financial constraints are not expected to significantly affect the potential implementation (as well the replication by other MBs who do not have extra funds to apply BIO2CARE outcomes).
Effective management (Manage threats)	The site management is implementing a work programme that identifies effective responses to each of the major pressures and threats to target habitat types and species and the ecological coherence of the site, as well as other major site values	BIO2CARE offers solutions that are highly oriented in mitigating key threats of protected areas such as illegal logging, hunting, non-sustainable anthropogenic activities, over-consumption etc.
Effective management (Measure success and impact)	A threshold level has been specified for each set of performance measures relating to natural values that, if achieved, demonstrate	The assessment of the environmental status of protected areas through the implementation of the BIO2CARE methodological

	objectively that the associated major site value is being successfully conserved. Threshold determination can include the assessment of conservation impact based on change in major values over a specified period compared with those anticipated without the protected and conserved area	framework is performed through the estimation of four key holistic environmental indicators: Carrying Capacity (CC), Ecological Footprint (EF), Carbon Footprint (CF) and Water Footprint (WF), that enable setting up threshold levels for the continuous and effective monitoring. Coupled with high-tech monitoring systems this enables measuring success and impact and demonstrate conservation of natural resources in a quantified way.
Conservation outcomes (Demonstrate conservation of natural values)	The site meets or exceeds (agreed) performance thresholds for the conservation of major natural values	

Below key results/deliverables of BIO2CARE project (relevant to the DSS) are summarized that can serve as an excellent basis for Managing Authorities of Protected Areas to improve their managing capacities and monitor in an efficient and sustainable way their areas. All BIO2CARE results are open and freely available on the Project's website:

WP3 – Deliverable 3.1: One (1) study collecting information and producing knowledge regarding anthropogenic activities and status of nature (incl. SWOT analysis) of the area.

During this study, a vast amount of information was collected producing knowledge regarding the anthropogenic activities and status of nature of the protected areas: 1) National Park of Eastern Macedonia and Thrace in Greece (NP-EMATH) (Study Area 1) and 2) Rila National Park of Bulgaria (RNPD) including the catchment area of the river basin of Blagoevgradska Bistrica (Study Area 2). The information presented in this study forms the basis to identify and analyse the special characteristics and basic needs of the examined areas, thus facilitating the development of efficient decision support tools and monitoring systems. Thus, it can serve as an excellent starting point for other protected areas (following a similar approach and developing relevant studies) who wish to develop and implement a more efficient and sustainable management strategy. The areas under focus did not only included the areas of absolute protection but also neighbouring areas where anthropogenic activity is intense. In this way, the results of BIO2CARE benefit not only the protection of natural environment and biodiversity of the areas, but also local communities through the development and adoption of circular economy and green entrepreneurship strategies. Both

of the study areas are characterized by the rich fauna and flora population. Both areas shelter numerous species, hinting the importance they both have on the natural ecosystem of each country. One significant characteristic that both study areas present is the proximity to city centres. In that terms both study areas are easily accessible by tourists and people who want to admire the natural landscape. This proximity with city centres though, means that there should be extra attention in order for the areas to remain unaffected from intense anthropogenic activities.

WP3 – Deliverable 3.2: One (1) methodological framework for assessing the environmental status of the examined area through the estimation of holistic environmental sustainability indicators.

During this study a methodological framework was developed as an effective way to assess the sustainability of an area through the quantification of the pressures that are placed on its ecosystem and are caused by human activities (e.g. through production and consumption of resources and energy, emission generation etc.) occurring within or affecting the area based on known and documented limits of these pressures.

The focus on human activities was given due to the fact that sustainability requires anthropogenic systems to act within certain "ecological" limits to ensure the continuous supply of goods and resources to current and future generations. This methodological framework provides the management bodies with a more holistic point of view regarding the current situation analysis and assists them to structure a strategic planning development in their area of responsibility. The assessment of the environmental status of protected areas through the implementation of the BIO2CARE methodological framework is happening through the estimation of four key holistic environmental indicators: Carrying Capacity (CC), Ecological Footprint (EF), Carbon Footprint (CF) and Water Footprint (WF).

CC and EF are calculated in parallel since the extraction of EF is necessary to convert the energy and food consumption needs in land requirements in order to compare them with the Biocapacity of the examined system (actual production from available lands) and thus find the CC of the area. The estimation of CC and EF is conducted with implementation of 14 steps. The BIO2CARE methodological framework for assessing the carrying capacity of protected areas was developed through the implementation of scientific indicators, and the reason behind it is the need not only for a holistic approach but also to ensure the transferability of this holistic approach. By implementing the developed methodological framework to these two, similar yet different, study areas, is a first step towards proof of scalability and replicability.

Within the concept of BIO2CARE, the methodological framework was developed in order to assess the carrying capacity of protected areas with anthropogenic activities within their

boundaries, and provide a helpful tool for the administrative bodies. The use of the methodological framework though, is not limited and it could be potentially used in a variety of different study areas:

- ✓ Cities/municipalities – serving as an administrative tool for municipal bodies in order to determine the carrying capacity within their boundaries and proceed to various actions to reduce carbon emissions, water consumption etc.
- ✓ Administrative regions – once again providing a helpful tool for the regional administrative bodies, including many more activities within the region, such as industrial activity.
- ✓ Protected areas without anthropogenic activities – fine tuning the methodological framework
- ✓ taking into account only the tourist section.

BIO2CARE project presents only a small amount of the capabilities of this methodological framework, which could be constantly growing in the future, expanding the implementation scenarios, specifying more indicators, serving more needs towards sustainable development.

WP3 – Deliverable 3.3: One (1) report including results from the implementation of the methodological framework in two intervention areas

The methodological framework that was developed in Del 3.2 of WP3 of the Project BIO2CARE, includes all necessary steps-actions and guidance to estimate and assess the Carrying Capacity and other holistic environmental indicators-footprints in protected areas. The aforementioned framework provides the management bodies with a more holistic point of view regarding the current situation analysis and assists them to structure a strategic planning development in their area of responsibility. During Deliverable 3.3 the methodological framework that was developed in WP3 Del 3.2 was implemented in the two Study Areas of the Project.

The data needed for the implementation, respective calculations and comprehensive results per indicators are presented in detail. Building upon the results, and international literature specific actions of improvement are proposed that can help improve the Carrying Capacity, Ecological Footprint, Carbon Footprint and Water Footprint of an area. This is very significant info (even without the application of the methodology) for relevant stakeholders. A sensitivity analysis was also performed to evaluate different scenarios and assess the impact of alternative anthropogenic activities to the environmental status of the examined areas.

Table 2: Key results from the implementation of BIO2CARE methodology

Sustainability Indicators	(Study Area 1) GR	(Study Area 2) BG
Ecological Footprint	181,324 Gha	148,183 Gha
Biocapacity	187,528 Gha (97%)	181,659 Gha (84%)
Carbon Footprint	225,365 tons CO_{2eq}	190,356 tons CO_{2eq}
Water Footprint	540,000,000 m^3/year	249,685,329 m^3/year

WP3 – Deliverable 3.4: One (1) case study/model assessing the symbiotic potential of the existing and future activities within the examined areas & One (1) comparative study based on the Life Cycle Approach, presenting the benefits of circular economy for the environment (existing situation vs symbiotic situation)

The focal point of this study was the implementation of Industrial Ecology principles and tools in order to assess the existing situation, propose an alternative scenario for economic, environmental and social development, and assess the potential scenario as well. The examination of the environmental performance of each Study Area was carried out through the spectrum of Life Cycle Assessment, utilizing specific impact categories and methods. The alternative scenario towards a sustainable development of the two study areas revolved around the identification and proposition of potential symbiotic activities, implementing industrial symbiosis principles, while assessing the potential benefits from this proposed symbiotic scenario again through a descriptive LCA study model.

The symbiotic scenario of each Study Area, was developed base on literature, knowledge from best practices, as well as the distinguishing characteristics and potential of the two Study Areas. Regarding Study Area 1, sixteen (16) potential symbiotic activities/exchanges were identified, trying to utilize, boost, and minimize the environmental impacts of existing production activities, while also proposing the development of new activities in order provide benefits for the local economy, community and environment. The environmental benefits of the proposed symbiotic activities include the reduction of more than 4.000 tonnes of CO_2, the reduction of at least 72.000 tons of oil, and more.

Regarding study area 2, 18 potential symbiotic activities were identified, based mostly on economic development, but presenting a significant reduction on environmental impacts as well. An important example of environmental benefits is the use of methane produced energy (through landfills and manure management) which could potentially lead to the reduction of almost 6500 MWh of electrical energy consumption.

During the first LCA study of the existing situation for both study areas, two methods were used to interpret the results. Midpoint evaluation showed that the carbon footprint of the two Study Areas according to the LCA principles and the ReCiPe impact assessment method amounts to 221,000 and 359,000 tons of CO_{2eq}. respectively. The results are in close proximity with the estimations performed using the methodological framework developed in D3.2, further validating its applicability. Endpoint evaluation was carried using the Eco-indicator 99 method. According to this evaluation the annual environmental impact of the two Study Areas resulting from the consumption of electricity and fuel for the specific anthropogenic activities included in the analysis amounts to 16,400,000 Eco Pts or 560 Eco Pts / inhabitant for Study Area 1 and 27,100,000 Eco Pts or 390 Eco Pts / inhabitant for Study Area 2.

For the second LCA study, based on the identified symbiotic activities, a new inventory analysis was carried, using as data the reduction of energy and material consumption resulting from the symbiotic activities. Once more a midpoint and an endpoint evaluation were utilized to interpret the results. Some key conclusions based on the two LCA studies are: The implementation of the proposed symbiotic activities leads to a noticeable reduction of the environmental impact in most categories and especially Ozone, and Terrestrial ecotoxicity, the impact categories freshwater eutrophication, agricultural land occupation, urban land occupation and natural land transformation are not affected by the proposed symbiotic activities.

Regarding the Social LCA studies of the existing and symbiotic potential, a more theoretical approach was adopted. Based on the official guidelines of UNEP, utilizing stakeholder categories identified from those guidelines, an examination of the socioeconomic environment of both study areas showcased that the implementation of symbiotic activities could have a beneficial role for the development of both areas. It is proposed, and deemed necessarily, that a further examination, a wider Social-LCA study, probably utilizing new tools such as the PSICA database, should be in mind, for deeper knowledge and more quantified and not theoretical data and results.

WP4 – Deliverable 4.1.1: High-tech monitoring system in the areas of interest (fauna/flora & illegal activities)

Under this Deliverable, BIO2CARE project installed and is currently operating a series of novel equipment and systems focusing on monitoring fauna/flora and detecting illegal activities on study areas. These systems, collect data from sensors like cameras and Ultrasound detectors, from sound detectors and from drones and include among others: trail cameras and an ultrasound recording unit have been selected for monitoring of mammals, sound level meters, loggers, solar panels connected to rechargeable batteries, UAV models (fixed wing, ebeeX) utilizing satellites' data. The systems are described in details

in the project's website and can serve as good-practices for the MBs of other protected areas who wish to enhance the efficiency of their monitoring activities.

WP4 – Deliverable 4.1.3: Two (2) e-tools/software for estimating the carrying capacity in the areas of interest (BIO2CARE Calc) and for examining, assessing and proposing potential symbiotic activities in the areas of interest (BIO2CARE Symbiosis)

In order to simplify the implementation of the methodologies developed in WP3 (thus enhancing potential replicability by other PAs), relevant e-tools/software were developed and are freely available that can automate relevant calculations. Specifically, the "BIO2CARE Calc", is an online application that provides the opportunity to the user to calculate the Carrying Capacity, the Ecological Footprint, the Biocapacity and the Carbon Footprint of a protected area. The application has a simple and friendly work interface and integrates all the complicated calculations of the methodology included in the Deliverable 3.2. The development of the application contributes to the reduction of the complexity and the expertise needed for the implementation of the aforementioned methodology. The second tool, the "BIO2CARE Symbiosis" is an online cartographic/mapping application that allows users to search for potential symbiotic activities, using as data the inputs and outputs of their own production activity, but also the production activities of other users. The application has a simple and friendly work interface and it was based upon the case study developed in the Deliverable 3.4.

All relevant deliverables (as well many other interesting outcomes of BIO2CARE Project) are available on the project's website: www.bio2care.eu

Chapter 2: Conclusions and recommendations to the policies related to the use of the resources of protected areas by the local population in an environmentally friendly way with an emphasis on tourism, marketing, production of food, herbs, etc.

BIO2CARE produced an impressive repository of innovative tools and methodologies that can highly support the effective management of protected areas. BIO2CARE innovations form a very innovative Decision Support system (DSS) for Protected Areas (PAs) that can be applied following a step-by-step approach:

- **Step 1 – Analysis of current situation**: The specific step refers to the collection of information and production of new knowledge regarding anthropogenic activities and status of nature (incl. SWOT analysis) of the area under examination. It is recommended to PAs MBs to develop a similar to D3.1 study before setting a long-term strategy. Having baseline values on several parameters is also essential to monitor progress and impact.

- **Step 2 – Assessment of current situation**: As a next step, it is recommended that PAs MBs should estimate the four key holistic environmental indicators: Carrying Capacity (CC), Ecological Footprint (EF), Carbon Footprint (CF) and Water Footprint (WF) proposed by BIO2CARE (D3.2) for a baseline year. This will help them better understand current problems and set specific targets. BIO2CARE Calc can help them make the necessary estimations in an efficient way. Step 1 and 2 can help policy makers to set a more sustainable and efficient long-term strategy.

- **Step 3 – Installation of high-tech monitoring systems**: If deemed necessary, PAs should acquire and install monitoring systems that will facilitate monitoring procedures according to the key threats and goals identified, taking into account the results from Steps 1 and 2.

- **Step 4 – Continuous monitoring and mitigation**: Carrying Capacity (CC), Ecological Footprint (EF), Carbon Footprint (CF) and Water Footprint (WF) should be re-examined continuously (recommended every one year). This will enable checking progress and mitigate potential threats quickly.

The following lessons learned, as extracted during the implementation of BIO2CARE's DSS and activities in general, are suggested to be taken into account to inform the preparation of a new strategic and policy framework.

An effective way to assess the sustainability of an area is through the quantification of the pressures that are placed on its ecosystem and are caused by human activities (e.g. through production and consumption of resources and energy, emission generation etc.) occurring within or affecting the area based on known and documented limits of these pressures. To assess these pressures, it is necessary to evaluate the current situation and define sustainability indicators relevant to the activities in question. Sustainability requires anthropogenic systems to act within certain "ecological" limits to ensure the continuous supply of goods and resources to current and future generations[2]. In other words, the sustainability of an area (protected or not) depends on whether the impact of human activities is within the "ecological" limits including those activities that take place outside the area of examination but their impact affects this area[3].

From 1990, the sustainable development of protected areas has been directly linked to the Carrying Capacity (CC) concept for two main reasons[4]: a) the concept of sustainability entails a "limit", as in the case of Carrying Capacity, b) both concepts share the same challenges in formulating the objectives and the procedures for their evaluation. CC is a concept defined on a case-by-case basis and depends on the nature of the problem and the objectives set by the researcher. For this reason, as in the case of sustainability, various definitions are available in literature depending on the objectives of the study. A generic definition of the Carrying Capacity of ecosystems was given by Rees[5] according to which "CC is the maximum population of specific species that can be hosted by an environment without causing permanent damage to the productivity of the system under examination".

Studies regarding the CC of a national park/protected area[6,7,8,9] focus mainly in the field of tourism and are usually limited to finding the optimal level of recreational use that the area

[2] Daily, G.C. (Ed.) (1997). Nature's services: societal dependence on natural ecosystems. Island Press, Washington, D.C.

[3] Graymore M., Neil G. Sipe, Roy E. Rickson. (2010). Sustaining Human Carrying Capacity: A tool for regional sustainability assessment, Ecological Economics, vol. 69, pp. 459–468.

[4] Saarinen, J. (2006). Traditions of sustainability in tourism studies. Annals of Tourism Research, 33(4), pp. 1121-1140.

[5] Rees W E, (1997). Urban ecosystems: the human dimension. Urban Ecosystems, 1: 63–75.

[6] Prato. T., (2001). Modeling carrying capacity for national parks, Ecological Economics, 39, pp 321–331.

under consideration can accommodate without harming its biodiversity and visitors' pleasure[10].

However, national parks and protected areas, sometimes include zones where apart from tourism, other anthropogenic activities take place such as agricultural, industrial, residential etc. These activities exert additional pressure on the area and not taking them into account while assessing the sustainability of this area leads to an underestimation of the environmental impacts and/or incomplete conclusions. Thus, the estimation of the CC of a protected area should take into account the impact of all activities taking place within the boundaries of this area and/or affect it.

In areas where anthropogenic activities take place, regional strategies usually aim at **increasing the number of businesses, products locally produced, population and tourists visiting this area**. By default, this leads to increased energy and water consumption, highest utilization of raw materials and increased environmental impacts. As a result, we face the great challenge of improving the environmental sustainability of an area alongside with the economic growth of the region. To do so, it is necessary to move from traditional environmental protection and management approaches to modern ones that take into account the characteristics of sustainable development.

The BIO2CARE project adopts and promotes the modern approach of environmental protection through the development of holistic decision support systems and by taking into account the objectives of sustainable development. Protected areas are quite complex ecosystems combining high biodiversity and ecological value with anthropogenic activity which sets major challenges for the sustainable development. This **increased complexity** may lead to **unforeseen needs in terms of effort and requirements** to accomplish over-ambitious or highly innovative goals (e.g. construction activities within these areas may take much more than business-as-usual.

Access to data is critical in order to support efficient decision making. In that aspect PA MBs should put very high emphasis in establishing procedures (and/or installing relevant

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[7] Lawson S, Manning R, Valliere W, Wang B, (2003). Proactive monitoring and adaptive management of social carrying capacity in Arches National Park: an application of computer simulation modeling. Journal of Environmental Management, 68, pp 305–313.

[8] Prato T, (2009). Fuzzy adaptive management of social and ecological carrying capacities for protected areas, Journal of Environmental Management, 90, pp 2551–2557.

[9] Needham M, Szuster B, Bell C. (2011). Encounter norms, social carrying capacity indicators, and standards of quality at a marine protected area. Ocean & Coastal Management, 54, pp 633-641.

[10] PAC/RAC (2003). Guide to good practice in tourism carrying capacity assessment. Split: PAC/RAC.

metering equipment) for **gathering all necessary data** (e.g. info on energy consumption, biodiversity, transportation activity etc.) and **develop synergies with data providers** (e.g. municipalities, DSOs, ESCOs etc.). GDPR rules should be respected though.

On-line **training sessions** and workshops proved to be very efficient especially in terms of the number of participants and exhibited high acceptance. A shift to on-line training for specific cases is highly suggested (also considering that significant resources can be saved in that way).

Below some key **Opportunities** (characteristics of the external environment that can be exploited to benefit the examined system and its objective) and **Threats** (characteristics of the external environment that can undermine the examined system and its objective), as identified by the BIO2CARE consortium are summarized, that can further support policy makers and PAs MBs into developing and adopting more efficient strategies for biodiversity protection.

Opportunities *(where future policies should focus)***:**

- A constant increase of international touristic interest is observed, especially regarding alternative types of tourism such as ecotourism, agrotourism, bird watching, rural tourism and adventure tourism. Compatibility with COVID-19 requirements (usually these types of tourism are characterized by low crowds, rural activities) may further increase the competitive share.

- Increased dynamics of the aquaculture industry in the international market (for PAs applicable). Combined with product processing, can act as an axis of development.

- Production of eco-products. Demand on high quality, environmental friendlier products is on the rise worldwide.

- Conserving natural ecosystems and making effort to decrease negative impacts. The efficiency of procedures (e.g. monitoring of illegal activities) for the conservation and protection of the ecosystems can be increased.

- Increasing funding schemes and programs for protecting the biodiversity and promoting sustainable development and circular economy.

- Existence of the legislative framework which allows the conservation of the protected areas. Future legislation and strategic goals in EU and National level are paying more

and more, high attention to biodiversity protection. Additionally, the area of responsibility of the management bodies are expected to be significantly increased (e.g. by including NATURA sites) in the near future.

- International cooperation and development of networks with relevant agents – management bodies of other protected areas.

- Extensive potential for advertising – promoting the areas.

- Shift from mere agricultural production to SMEs which add value to this production (e.g. not sell grapes but wine; not fruits but jam or juice).

- Certification of services, products and others, especially under international standards. Establishment of local geographic brands too.

Threats *(what future policies should mitigate)***:**

- The main problem faced by most of the National Parks management organizations worldwide is the increased annual volume of visitors (and their corresponding impact on the natural environment). A high increase in tourists (unregulated tourist flows) can lead to increased direct and indirect environmental impacts. Illegal tree cutting and hunting are also major threats for protected areas.

- Lack of interest by the local communities, tourist suppliers and respective agents to participate in initiatives for protecting the natural habitat of the area and take action and/or change habits.

- Presence of energy consuming building stock (in protected areas with major anthropogenic activity) and energy intensive public buildings with increased saving needs.

- Overproduction and overconsumption (due to increased population, tourists, business and industrial activity) can lead to the degradation of the local sources and ecosystems and high ecological footprint (disruption of carrying capacity).

- Risks due to Climate change and ecological disasters (such as coastal erosion, floods, heat waves etc.).

- Leakage of experienced staff to “city centre”.

- The area of responsibility of the management bodies is expected to be significantly increased (e.g. by including NATURA sites) in the near future, thus leading to lack of resources (both funding and personnel).

- Unfavourable environment for entrepreneurship in some countries (inc. Greece and Bulgaria) (due to legislation, bureaucracy, taxation, access to funding schemes).

- Exposure to competition with other areas (both within Greece, Bulgaria and near countries) characterized by increased productivity or cheaper costs.

➢ Conclusion No.1:

Life Cycle Assessment (LCA) is the appropriate methodology for studying the life cycle and impact of industrial processes and the way they are redesigned and should be pursued as an objective for optimal use of the environment in the Cross-Border Region. It provides a framework for assessing the impact of products or processes on the environment from their creation to the end of their use, ie from the extraction and processing of raw materials through production, distribution, retail, consumption and disposal of products. Therefore, life cycle analysis allows the management of complex information; the information can be processed sequentially for the purpose of the general optimization of the systems. On the other hand, the results of the life cycle analysis can be a starting point for subsequent applications, different in purpose and purpose. According to the European Commission, the best way to demonstrate the effectiveness of the life cycle analysis approach is to apply it in a variety of practical applications, which can help develop national pilot projects and thus help progress towards the ultimate goal of sustainability.

➢ Conclusion No.2:

The EU Circular Economy Action Plan emphasizes the need to move to a life-cycle circular economy, reuse resources (as far as possible) and reduce residual waste to almost zero. At present, the city of Blagoevgrad (through which the river Blagoevgradska Bistritsa passes), which stands out as a regional center, is in a transitional period from a classic industrial center of local and regional importance to a modern economic center of innovative and educational initiatives. At this stage, a number of classic

industrial branches in the city are in decline with a significantly reduced number of employees or have completely ceased operations. Therefore, the territory of the catchment area of the river Blagoevgrska Bistritsa is suitable for the creation of new enterprises, grouped in an eco-industrial park with strong symbiotic relations between them. These symbiotic activities, which are based on a life-cycle approach, must take into account the social and natural resources available in the area in order to maintain the balance between anthropogenic activity and the protection of natural ecosystems.

- **Conclusion No.3:**

On the one hand, the local communities in Blagoevgrad, as a regional center, are provided with a sufficient amount of social services, which in combination with the ecological and economic features of the district are the basic prerequisites for establishing a good standard of living. On the other hand, the well-being of the local community is threatened by the relatively low level of income and the level of wages, which is lower than the national average.

- **Conclusion No.4:**

It can be argued that Southwestern Bulgaria, part of which falls within the scope of the project (South Rila and the catchment area of Blagoevgradska Bistritsa, falling within the Municipality of Blagoevgrad), offers excellent opportunities for sustainable practices, due to the environmental situation as a whole, as well as a number of other factors of agricultural activity, life, culture, education and qualifications of the population, the socio-economic living conditions.

- **Conclusion No.5:**

A large number of eco-certificates and eco-labels are found in the European Union and internationally. For example, the European Ecolabel is a mark placed on a wide range of product groups, from the main areas of production to tourist accommodation services. Individual Member States also develop and implement national environmental labels. The EU Ecolabel and national Ecolabels can be combined. The EU Ecolabel Regulation requires Member States and the European

Commission to ensure coordination between the EU Ecolabel and other national schemes, in particular in the selection of product groups and the development and revision of criteria. In the event that a product / service has received a national and EU eco-label, the two labels should be placed side by side on it. Internationally, there is a great need for international efforts to harmonize standardization, certification and labeling procedures so as to facilitate trade and protect the environment. At the same time, there is a lack of clarity and good information about the basic concepts it deals with, as well as the flexibility of individual countries and market participants.

- **Conclusion No.6:**

There is no current national labeling scheme in Bulgaria. Information is found on individual networks, such as the RELACS network (in which Greece also participates), which was established (under a project) as a European network of tourist accommodation, united by the idea of working to reduce the impact of tourism on the environment. Unfortunately, after the expiration of the three-year term of the project (2013) and the connection of a small number of hotels, the network is currently not operational. Another Bulgarian experience is related to the creation of a regional brand "Strandzha", again under a project (this time three). In connection with it, certification of various sites is envisaged and implemented, including entrepreneurs in rural and ecological tourism, farmers, beekeepers, herb collectors, etc., and for this purpose a special sign has been created. In 2012, a certificate for official registration of the certificate mark was received from the Patent Office of Bulgaria, and with the completion of the project a Catalog of certified sites and tourist attractions with the regional mark was prepared. However, when consulting the online platforms, after 2016 no publications related to the current state of the brand and its certified sites, activities and attractions are found.

- **Conclusion No.7:**

Regarding the Protected Names and the Protected Geographical Indication of products from Bulgaria, there is also much to be desired. At the time of preparation of the report under Activity 4.5 on “Development and implementation of a sustainable certification scheme involving different levels of certification”, only eight protected names have been identified, including five traditional foods and three products with a protected geographical indication.

➢ **Conclusion No.8:**

Assuming that the study under Activity 4.5 has a limited character with regard to the situation in the Hellenic Republic, it has been established that there is a local certification scheme under the name Green Choice (Fig. 16). Unfortunately, at the time of the survey, no more information about the scheme, its procedures and certified sites was found, except for a Facebook page dedicated to it. A reference to the Ecolabel Index website shows that there are a total of 23 valid certifications in Greece related to sustainable development, consumption and tourism. Of these, only one (BIO Hellas) is relevant for Bulgaria.

➢ **Conclusion No.9:**

After a thorough analysis of labeling / certification schemes used in different sectors and consideration of examples and practices, it is concluded that the benefits of implementing the considered schemes are significant, especially in terms of overcoming the lack of sufficient market information or failed market interventions, but above all for the application of the principles of sustainability and environmental protection. But there is also a concern that labels, standards in general, are restrictive, especially as market barriers for third countries.

➢ **Conclusion No.10:**

Eco-certification schemes can be considered as the introduction of innovations (eco-innovations), both in the production and marketing of products, and on the other hand as a process innovation, as long as following certain procedures according to the requirements for certification of the product or service.

➢ **Conclusion No.11:**

Significantly more detailed stakeholder research is needed, as the introduction of a certification scheme for products and / or services from protected areas will have an impact (positive or negative) on the environment as well as on local communities or the market itself. In order to reach an

understanding on the certification scheme, it is necessary to involve relevant stakeholders. The following can be identified as such:

- Experts, scientists and researchers in the field;
- Park administrations, regional environmental inspections and other institutions in the field of environmental protection;
- Consumer organizations;
- NGOs;
- Branch organizations, producer organizations, retailers, etc.
- Local communities living near protected areas.

The greater the number of participants and stakeholders, as well as their involvement during all stages of the development and implementation of the scheme, the more significant public support will be provided.

Chapter 3: Recommendations for policies related to biodiversity and management of protected areas

- **Recommendation No.1:**

Blagoevgrad (through which the river Blagoevgradska Bistritsa passes) is in a transitional period from a classic industrial center of local and regional importance to a modern economic center of innovative and educational initiatives. At this stage, a number of classic industrial branches in the city are in decline with a significantly reduced number of employees or have completely ceased operations. Therefore, the territory of the catchment area of the river Blagoevgrska Bistritsa is suitable for the creation of new enterprises, grouped in an eco-industrial park with strong symbiotic relations between them. These symbiotic activities, which are based on a life-cycle approach, must take into account the social and natural resources available in the area in order to maintain the balance between anthropogenic activity and the protection of natural ecosystems. Research centers established and funded on the initiative of the Southwestern University "Neofit Rilski" and the American University in Bulgaria, which operate in Blagoevgrad, can play the role of "scientific accelerator" to achieve sustainable development of the region. As a result of these processes, Blagoevgrad can quickly become a center of science, i.e. research and development activities that are combined with the strategic geographical location and proximity of Rila Nature Park will continue to have a strong impact on the structure and sustainability of the local economy.

- **Recommendation №2:**

As recommendations in the report prepared under Activity 4.5 on "Development and implementation of a sustainable certification scheme involving different levels of certification" it is stated that additional policy and economic measures need to be adopted to increase the commitment to sustainable development from side of the local community, given that the ever-increasing demands of environmental standards and the modern realities of the economic scene will further exacerbate the crisis in the traditional industrial sectors in the region. Due to the complexity of inputs and outputs in the project intervention area, the life cycle inventory of this area is a complex and challenging task, which due to lack of reliable information is limited to the used fuel, electricity, heat and landfilled waste.

➢ **Recommendation No.3:**

It is clear from the studied specialized literature and publications that each certification and labeling scheme should be managed by a responsible organization - a state agency (or other establishing body) or a private structure. It also requires a clear understanding of the qualitative, sustainable and environmental, but not limited, parameters on which the scheme is or will be focused.

➢ **Recommendation No.4:**

Due to the specifics of the project activities and the fact that they fall into protected areas where there is an absolute ban on doing business, the product groups in the certification scheme can be divided into two directions:

- First group - tourist services, food and beverages (mainly tea) and fodder, the origin of which falls within the scope of the permit regime for carrying out economic activity;
- Second group - management of the forest fund (logging and wood processing industry.

➢ **Recommendation No.5:**

Due to the fact that the number of mandatory labeling requirements has increased over the years and the introduction of an increasing number of own-label eco-labels at national level, labels regularly face challenges in terms of limited packaging space, as far as always strive to provide end-users with the most reliable and convincing information regarding the impact of the product on the environment throughout its life cycle.

- Solutions to these cases could be provided by innovative IT solutions to provide additional information to end users through the use of barcodes, scanners, smartphones, etc.
- In case the environmental label is not clear enough, the manufacturer and / or the supplier may include other tools (eg internet / website; campaigns, brochures, on-site demonstrations, etc.).
- Due to the fact that users have limited time to take into account all possible data and options, the information provided must be concise and clear. In addition, labeling in itself is

insufficient information and can thus lead to negative changes in the behavior of end-users and even in the market itself.

- **Recommendation No.6:**

One of the main challenges to eco-innovation (as can be seen in eco-certification schemes) is the lack of investment, resource efficiency and the still limited use of energy from renewable sources. In order to stimulate eco-innovation, it is necessary to develop and provide access to innovative financial instruments and funding for eco-innovation.

- **Recommendation No.7:**

Consumers are facing an increasing number of labels, which leads to confusion in the flow of information and this can create uncertainty about the labels they can trust. Despite the already mentioned advantages of eco-certification schemes, there are many challenges that need to be overcome in order to ensure the successful implementation of a certification scheme that provides reliable information on the environmental impact of labeled products and / or services to end users.

Chapter 4: Identifying complementarities with policies in EU, national, regional and local level.

The BIO2CARE project is important and is planned to contribute to the goals and objectives of the programming and strategic documents, both at the national level of the participating countries (Republic of Greece and the Republic of Bulgaria) and at the level of the European Union:

- Regarding the Republic of Greece:

- Contribution to OP "Environment 2014-2020": refers to specific objective (SC) 21: Improving the framework for maintenance, management and restoration of the natural environment and biological diversity (Investment priority 6d);
- Contribution towards the Regional Operational Program (ROP) of Eastern Macedonia and Thrace 2014-2020: related to specific objective 12: Promotion of natural and cultural heritage (Investment Priority 6c), specific objective 13: Protection of ecological reserves (Investment Priority 6d) and specific objective 23: Prevention and mitigation of social exclusion of disabled and vulnerable groups (Investment Priority 9i);
- Contribution to the Operational Plan of the Municipality of Nestos 2015-2019: related to objective "1.1.1 Protection, valorization and promotion of urban, peripheral and rural environment";
- Contribution to the National Biodiversity Strategy and Action Plan of the Republic of Greece.

- Regarding the Republic of Bulgaria

- Towards Operational Programme "Environment 2014-2020: relevant for Priority Axis 3 "Natura 2000 and Biodiversity";
- Towards OP "Growing Regions"2014–2020: relevant for priority axis 3 (Sustainable development of tourism) and for priority axis 4 (Local development and cooperation - improving the quality of the environment and risk prevention);

- Development Plan of the Municipality of Blagoevgrad 2014-2020: related to Chapter 7 - State of Nature (measures 7.1, 7.2, 7.3, 7.4 and 7.7);
- The Environmental Protection Act in Bulgaria and the Protected Areas Act.

➢ Regarding EU policies:

- European Biodiversity Strategy covering the period up to 2020
- "Closing the cycle - EU action plan for the circular economy", COM (2015) 614.

European policies regarding Circular Economy and Industrial Symbiosis

Since 2015, the European commission has launched an action plan targeting towards a more circular and sustainable economy. This action plan included 54 actions, as a main core of the plan, that could lead the way towards achieving circular economy. These actions, and their categorization, are described in the following table (European Commission, 2019).

Table 1. Proposed actions in the EU circular economy action plan

Category	**Action**
Production	Emphasis on circular economy aspects in future product requirements and design.
	Develop standards on material efficiency, for setting new design requirement.
	Implementing regulation on electronic displays, to achieve material efficiency and recyclability.
	Examine further options for a more coherent policy framework for EU product policy.
	Create guidelines with best available reference documents for several industrial sectors.
	Create specific guidelines for waste mining management plans.
	Improve the EU Eco-management and Audit Scheme

	Develop an improved knowledge base to support small and medium sized businesses, for the substitution of hazardous substances and materials.
Consumption	Better guaranteed on tangible products accompanied by proof of improvement.
	Actions against false green claims, and greenwashing.
	Horizontal requirements on repair information.
	Enhance the effectiveness of ecolabels.
	Develop of an independent testing programme on premature obsolescence.
	Explore the possible uses of the Product Environmental Footprint to measure and communicate environmental information
	Enhanced integration of circular economy requirements.
Waste management	Revised legislation.
	Improved cooperation with member states for better implementation of EU waste legislation.
	Enforcement of revised waste shipment regulation.
	Promotion of industrial facilities for key waste/recyclate streams.
	More initiatives on waste to energy technologies.
	Promotion of good practices in waste collection systems.
Market for secondary raw materials	Development of quality standards.
	Revised fertilizers regulations.
	Setting minimum requirements for reused water for irrigation and groundwater charge.
	Promotion of safe and cost-effective water reuse.
	Addressing the interface between chemicals, products, and waste legislation.
	Facilitate waste shipment across EU.
	Further development of the EU raw materials information system.
Plastics	Circular Economy strategy on plastics. 4 pillars: - Improving the economics and quality of plastics recycling. - Curbing plastic waste and littering. - Driving investments and innovation. - Harnessing global actions related to international trade.

	Specific actions to reduce marine litter implementing the 2030 Sustainable Development Goals.
Food waste	Development of a common methodology to measure food waste.
	Stakeholders platform to examine how to achieve goals on food waste.
	Clarify relevant EU legislation.
	Explore options for more effective use and understanding of date marking on food.
Critical raw materials	Report on critical raw materials and circular economy.
	Improve exchange of information between manufacturers and recyclers.
	European standards for material-efficient recycling of electronic waste.
	Sharing best practice for the recovery of critical raw materials.
Construction and demolition	Pre-demolition assessment guidelines for the construction sector.
	Voluntary industry-wide recycling protocol.
	Core indicators for the assessment of the lifecycle environmental performance of a building.
Biomass and bio-based materials	Guidelines and dissemination of best practice on the use of biomass.
	Ensuring coherence and synergies with the circular economy when examining the sustainability of bioenergy.
	Assessment of the 2012 Bio-economy strategy to the circular economy.
Innovation and investments	Initiative “Industry 2020 and the circular economy” under Horizon 2020.
	Pilot project for innovation deals to address regulatory obstacles.
	Targeted outreach to encourage applications for funding.
	Targeted outreach and communication to assist member States.
	Support to member States and regions to strengthen innovation for the circular economy.
	Possible launching of a platform to support financing of circular economy projects.
	Engagement with stakeholders.
	Support to a range of stakeholders through actions on public-private partnerships.
Monitoring	Development of a monitoring framework of indicators for circular economy, facilitating the progress towards a circular economy at EU and national level.

According the recent publications of European Union, the action plan, for years after its adoption, is considered fully completed, with the aforementioned actions either fully delivered, or in the process of being implemented.

Specifically regarding Industrial Symbiosis, there are several EU strategies that focus on its importance. In 2011, the Roadmap to a Resource Efficient Europe was presented, outlining the importance for the European economy to transform into a sustainable one by the year of 2050. In the Roadmap the EU commission identifies industrial symbiosis as a support mechanism for sustainable production and consumption, stating the members of the EU should work together to achieve best use of waste and by-products (European Commission, 2011).

In 2012 again, Industrial Symbiosis, was mentioned in the European Resource Efficiency Platform (EREP). Aim of EREP is to provide guidance to EU Member States and private actors, on the transition to a more resource-efficient economy. EREP states that EU and Member States should foster industrial symbiosis by promoting a pan-European network of industrial symbiosis initiatives, under which facilitators could be connected to allow match-making, including across borders and beyond the EU.

There are several other directives regarding waste management, ecolabels, eco-design, product strategies etc., that could potentially achieve their targets by the implementation of industrial symbiosis principles. Such directives include:

- Extended Producers Responsibility (ERP) (OECD, 2001).
- Waste Framework Directive (European Commission, 2008)
- Integrated Product Policy - Building on Environmental Life-Cycle Thinking (European Commission, 2003)

In general, policies both in international and national level, should foster the implementation of industrial symbiosis, by encouraging more waste and resources exchanges between companies. The motives could be both financially and regulatory. National and regional governments could contribute to the development of industrial symbiosis by setting clear objectives and guidelines, penalizing anachronistic waste management options where other solutions are available, and provide incentives to identify financially viable waste management options.

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