# LEARNING ABOUT BIODIVERSITY CONSERVATION THROUGH TRAINING ON HOW TO WRITE SUCCESFULL ECOLOGICAL PROJECTS

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***Abstract:*** *Quality of environment influences on the overall quality of the country. Protection of biotic component of environment is realised through biodiversity conservation (BC) programs and actions. Adoption of basic knowledge on BC preferably should be realised as the training on how to write proposals for real ecological (conservation) project calls. The main phases of the course must include theoretical intro to conservation science, a training for a) defining the right goal(s) of the project, b) making usefull literature review, c) organizing and realising monitoring for collection of necessary data, and an introduction to basic concepts of conservation planning and main principles of conservation-developmental management. Skills adopted in this way enable students to become efficient conservation practitioners.*

***Keywords:*** *environmenal protection, biodiversity conservation, project proposals, conservation praxis*

## 1. INTRODUCTION

Biodiversity conservation is becoming a hot topic in XXI century: the effects of already announced climate changes have been multiplied by aggressive anthropogenic alteration of natural habitats [1]. Educating practitioners to understand ecological processes makes them capable to recognize and prevent inadequate or detrimental anthropogenic interventions or, in cases when those interventions already happened, to mitigate negative impacts on environment. Negative anthropogenic alteration of natural habitats started long before establishment of ecology as a modern biological science, and this had produced huge biodiversity losses: Progress in studying and understanding ecological processes was not necessarily accompanied with ecological „enlightment“ of contemporary human society [2]. Ecological knowledge usually stayed within specific part of academic community and relativelly small efforts were put in ecological education of the entire community. Until recently, ecological projects were usually focused on purely scientific research .

Contemporary human society is separated from the nature by the ways of life in such extent that, in technologically advanced parts of the world, some citizens consider nature conservation unnecessary [3]. However, modern industrial world indeed depends very much on all three hierarchical levels of biological diversity (Figure 1). Human kind would not survive without actively maintained ecological systems (arable lands, orchards, gardens,..), neither without those which are still wild. The most prominent examples of long-term dependence of human society on biological diversity are: agriculture, fishery, forest exploitation, pharmacy, tourism and ecosystem services.

Destruction of natural habitats is recognized as the biggest individual threatening factor to biological diversity [2, 4]. Fast development of industry and technology resulted in enormous increase of extinction rate of pristine habitats. Loss of habitats incude also loss of local populations of present species, as well as loss of local biological communities. Habitat destruction may not necessarily mean extinction of entire local populations of species who have been living there; once their home habitat is destroyed, some individuals will survive if they are capable to move to the nearest suitable habitat and join conspecific local population there. However, in the process of moving from one locality to the next, certain number of individuals most probably will die or be eaten, or, perhaps, will fail to join another population. In any one of these scenarios, gene pool of the population previously settled in a habitat which became either partially or totally destroyed will be lost for future generations. Habitat destruction thus directly could diminish local biological diversity [2].

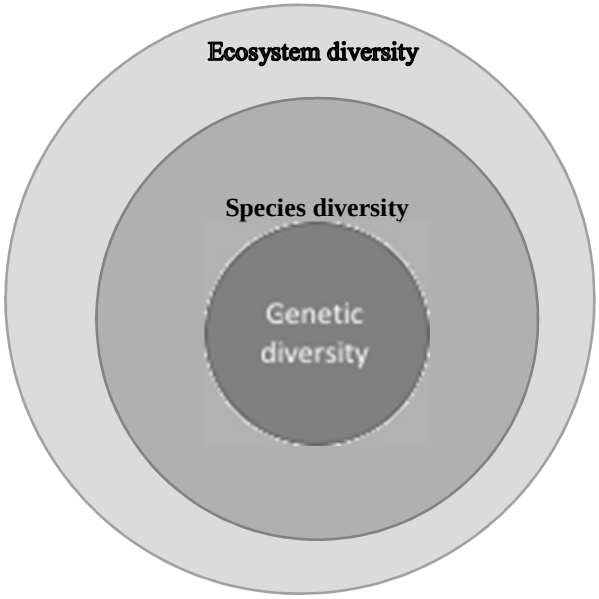


**Figure 1**: Three hierarchical levels of biological diversity: genetic, species and ecosystem diversity.

Overexploitation of wild species often induces directional selection, especially in commercial hunting [2 - 4]. This type of hunting includes irrevocable removal of mostly biggest individuals from population, despite reccommendation of conservation biologists that commercial sampling has to be done at random and excluding extremes (individuals out of defined range of values for certain traits). The world ocean is example of an ecosystem which is under great pressure of overexploitation.

Deliberate or incidental introduction of allochthonous taxa which have capacity to adapt to new environment and which can act as predators, competitors or pathogens inevitably will have negative impact on abundance and survival of native species, leading, in some cases, to local extinctions by overkilling/competitive exclusion [2 - 4].

At the species level, all these three processes - decrease or extinction of their populations induced by overexploitation, fragmentation, degradation and destruction of their habitats, or by introduction of invasive species - would, through biotic interactions, negatively impact on other species in the community [2 - 4]. The final effect is chain of species extinction.

Unfortunatelly, conservation efforts cannot be simultaneously applied to all components of biodiversity which need it. Therefore, conservation priorities, either priority species (highly threatened, endemic or charismatic), priority habitats (essentially important ones for the reproduction, growth or feeding of certain species) or priority areas (hotspots of species diversity within some higher taxa as birds, plants, butterflies…), must be recognized [5]. Also, public education and raising awareness on importance of biodiversity conservation must be continuous process, starting from an early childhood.

## 2. DEFINING PROPER GOAL(S) OF AN ECOLOGICAL PROJECT

Subjects of conservation-ecological projects are mostly threatened species or species groups, habitat types, biological communities or ecosystems. Questions defined in project proposal and answered through the project realisation usually are related to the assessment of the level of threat of specific species, species group, habitat type or ecosystem. These biodiversity components have to be checked against IUCN Red List criteria [6 - 7], what usually requires foundation of long-term monitoring for proper data collection. Besides, the main goals of ecological project also could be: education and raising awareness of general public, mitigation or removal of existing conflict between human society and specific biodiversity component, engagement of local communities in active protection of specific components or overall biodiversity .

Practical work is the best way to learn how to write succesfull ecological project proposals, so starting practise by writing own project proposal and applying for the grant as soon as possible is highly recommended. An overview of final reports of realised projects granted by fund to which applicant is planning to apply can greatly help in this matter. The trap to copy/paste already used topic must be avoided. One of very transparent funds is „Rufford Small Grants“ which enables detailed overview of sponsored projects on its website [8]. There, granted projects are categorised by geographic location, but, also, by main topics like: Assessement of national or regional conservation status of certain species, species community, or habitat; ecological education; evaluation of biological diversity; conflicts; ecological tourism.

Properly chosen goals provide additional points in the process of evaluating project proposal. Sometimes, the leading idea of research project is already predefined by the topic of the master or PhD thesis of a future project leader [3]. It is clear that the main topic of big research project hardly can be transformed into proposal of only one short-term ecological project. Viz, the majority of small grants requires finalization of the project within one callendar year or in 365 days from the day of the project approval [8].

Feasible goals of short-term ecological projects include collection of samples for taxonomic identification, assessment of species distribution within geographic area covered by the project, inventory of fauna or flora of predefined area, or evaluation of threatening factors and conservation status of certain habitat type within that area [3, 5]. Any kind of educational activities which will increase awareness of local inhabitants on importance of conservation of certain species, species group, habitat type or ecosystem, also belong to the feasible goals of short-term ecological projects. On the contrary, assessment of population structure of an elusive species, as well as evaluation of its population dynamics, are considered as more demanding research goals [3, 5]. These goals should never be formally applied to population or conservation biology short-term pioneer research project because they cannot be realised within just one year of field work. When planning project activities, future project leader inevitably should define results which are material, permanent and visible [3, 5].

## 3. LITERATURE SURVEY

Detailed collecting and analysis of existing literature is necessary to do before writing project proposal to check is there - in the geographic area marked for realization of the future project - already some research done and of which kind [3]. Repetition of previously applied research is acceptable if enough time has passed since completion of the previous project, so the new overview is worthy to be done.

Literature survey is among the first „must-do“ steps which leader of the proposed project has to make before starting to develop an idea about future reseach and transforming it into a project proposal [5](Figure 2). Necessary part of the introduction of a project proposal is an review of previous research on the same or similar topic, conducted within the broad geographic area of planned research.

The best way to do literature survey is by one of the official web search engines, such as Google Scholar. It requires definition of key words and carefull examination of all web pages which will appear as a result of a survey. Sometimes, there could be more than 100 web pages,

but it is important to examine them all, download available publications or, if they are not available online, write down entire reference and try to find it in the library or directly from the authors.

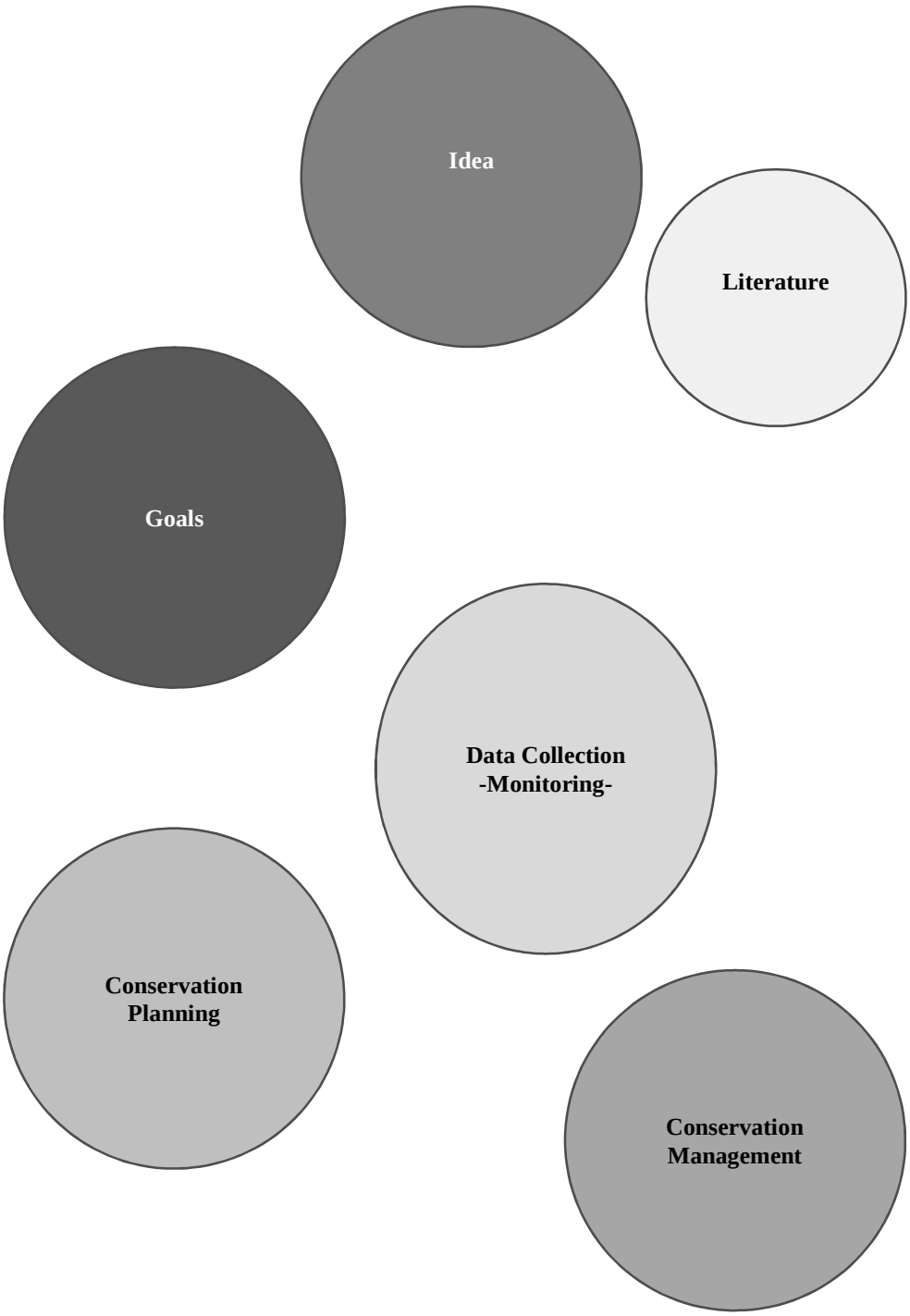


**Figure 2:** Simplifed illustration of progress of an ecological project – from idea through data collection to conservation planning and conservation management.

## 4. COLLECTION OF DATA THROUGH BIODIVERSITY MONITORING

Biodiversity monitoring, or, in other words, supervising of selected components of biological diversity, implies monitoring of changes in their structure and dynamics for the realization of the ultimate goal – prevention of extinction of those components. Monitoring is an necessary routine required by all states which signed CBD in 1992. on global summit in Rio de Janeiro [9]. Those states obliged themselves to protect and sustainably manage biological diversity within their political borders, what implies also obligation of continuous biodiversity monitoring.

The essence of monitoring, apart from timely prevention or significant mitigation of various threatening factors, includes answers on questions such as: a) how the structure and dynamics of population of selected species changes along the years; b) what are the ecological requirements of selected species; c) how populations of the same species react on changes in managament; d) which are the most important areas for the survival of the certain species within specific geographical space (for example, within a state)? These are just some of many existing questions which need answer. At the same time, these are just some of many possible goals of ecological projects, or, more precisely, these are long-term goals which can be realised only through continuous projects [3].

The basic rule of monitoring is maintenance of required level of precision and comparability of the data. Monitoring is applied in predefined geographic space where researchers define certain areas for data collection, for example such as abundance data on one or several species. Regarding possibility that individuals of one species can have different activity patterns in different parts of the day and/or in different seasons within the year, it could happen that members of the same sex or age group are not always equally visible. Detailed informing on biology and ecology of the taxon which is the subject of monitoring prior to the start of monitoring is the good way to avoid sampling error [10]. It is recommendable to apply monitoring once per every main season of the year or once per every main phase of species annual activity, if they do not overlap with seasons. Also, sampling error will be present if there is a big difference in the level of experience among researchers. To avoid sampling imprecision, it is recommended that the same type of data is measured by the same researcher. However, in a long-term monitoring it is impossible to engage always the same researcher for the same task. Carefull inspection of long-term data base can help to reveal which variables are often imprecisely measured and which ones rarely or never had erroneous measurement values. The second ones then should be chosen for the long term monitoring analyses. If research team has no previous experience in monitoring, they should spend several years prior to the start of project to analyse relations among variation of specific environmental and phenological parameters. Also, sampling spots within the same locality should be chosen at random [5, 10].

## 5. BASIC CONCEPTS OF CONSERVATION TRAINING

Despite formally proclaimed conservation status of certain species, habitat or area, it could happen that there is no information on their current conservation status, or the management plan is not applied as defined due to lack of personell, financial support or support from the local community [3]. It frequently happens when protected species traditionally have been exploited without control or assigned as „negative“ or „dangerous“ [12-13]. Such situation provides opportunity for realization of projects which main goals can be to recognize gaps in previous management of chosen biodiversity component and to define short-term, mid-term or long-term management plan for its protection from extinction.

In the phase of establishing management of biodiversity components in an area, the management plan should contain *a priori* analysis of several variants of conservation idea. Basic rule for creating management plan dedicated to conservation of biodiversity components is to make it feasible. Planning helps to review all options possible to realize with available funds (finances, existing equipment, existing personell). During planning process, „economic“ and „luxury“ project options have to be simultaneously developed. „Economic“ project option is the one which is feasible with existing equipment, finances and personell, while „luxury“ one is feasible if additional financial support is provided.

Completed realization of existing project should not mean its end [5]. Nowadays, permanent management of biodiversity components is obligatory due to currently existing threats, and reaching the conditions when it would not be needed anymore is almost impossible, due to the size of global human population, the lifestyle and behavioural characteristics and issues which stop or slow down development of „green“ technologies. During the last twenty years, increase of intensity of anthropogenic alteration of Biosphere became so high that makes ability of human kind to become appropriatelly ecologically educated quite questionable [1]. Therefore, planning conservation of biodiversity components should be understood as a continuous process where reaching success in one moment of time does not mean the end of further planning and realization of conservation activities [11].

Contemporary approach to designing conservation management projects means definition of several consecutive levels, which include: Mission, current status, goals, strategy, acting, monitoring and project analysis [3, 5].

## 6. MAIN PRINCIPLES OF CONSERVATION-DEVELOPMENTAL MANAGEMENT

Traditional approach to biodiversity conservation implied selection of areas which, by their features, deserve title of local centers of biological diversity and, consequently, complete elimination of human settlements from protected zones. Contemporary conservation projects are designed to contribute to both biodiversity conservation and improvement of economical status of local inhabitants, namely – to support cooperation between conservation biologists and locals. Thereby, it has to be clear that improvement of life standard will not inevitably diminish uncontrolled exploitation of natural resources, but subsidies for maintaining conservation actions and application of concept of sustainable development certainly will. In regard to increase of false „sustainable“ solutions from 2000. to nowadays which collected large financial incentives (an example is construction of run-of-river small hydropower plants throughout the Balkan Peninsula [14-17]), new conservation projects must include training of citizens in recognition and formulation of true sustainable ideas and technologies.

Praxis has shown, in many cases, that integration of biodiversity conservation and sustainable development produces better results than approach which promotes establishment and maintaining of „intact“ national parks forbiden to visitors. However, for some natural areas it is indeed necessary to isolate them from apparent anthropogenic impacts [3]. In such cases it is required to make legal acts which precisely define limits of exploitation of natural resources by local communities. Besides, it is necessary to legaly define whether and in which extent individuals and external stakeholders can realize developmental projects. The purpose of limited access and limited exploitation of biodiversity components has a goal to protect interests of local community settled in or in the close vicinity of protected area and which is traditionally i.e. sustainably exploited local natural resources. Financial value of natural resources is equal to the price of mitigation of negative effects resulting from destruction of those resources. Regarding this, it is interesting to follow and record the extent of the financial damage caused by transformation of wetlands along the big rivers into the construction area or by cutting the forests along the watercourse [11].

The poorest members of the local community are those who traditionally gain the least relative benefit of legal intensive exploitation of natural resources and from that reason they often join illegal ways of exploitation [3]. One of possible goals of conservation-developmental projects indeed is to include these people into the legal ways of gaining a profit by applying principl of sustainability. Even the organization which is the project leader is the strong one, for the sake of project success it must inlude partners as governmental institutions, law experts, and experts capable to recognize causes of previous degradation of resources due to unsustainable exploitation and to recommend efficient restoration measures combined with step-by-step sustainable development [5]. It is not easy task to design project which will be both conservation and developmental one, because sustainable development also implies some degradation of existing biological diversity. However, these integrative projects could be sussessfully applied especially if they are not a big ones.

Looking from the conservation biologist’s point of view, the main goal of this type of project must be focused on biodiversity conservation. Developmental aspect is needed to attract attention

of the local community to support continuous conservation of natural values in the area. Considering that these are very sensitive topics, such projects must be supported by political structures, ministries in charge and state funds, because application of concept of sustainable development cannot immediatelly produce planned results[5].

## 7. A SNAPSHOT FROM SERBIA

An impact of training how to write successful ecological projects on success in getting conservation grant from international funding agencies can be illustrated by brief analysis of project proposals of early carrier researchers from Faculty of Science and Mathematics at University of Niš, accepted for funding by "Rufford Small Grants" (Figure 3). So far, overall number of funded projects from Serbia was 82, where 22% (18 projects) in total were from University of Niš. Before year 2015, only 2% of overall number of conservation projects from Serbia funded by "Rufford Small Grants" were from young researchers educated at University of Niš. From year 2015 to now, when elective course "Principles of Conservation Planning" was offered at PhD studies of Biology, established in the same year at University of Niš, this number increased to 19.5%. This interactive course has been organized as a two-way process between lecturer and students, where the final goal is to produce project proposal which will be offered by the international funding agency, and the final exam is evaluated by the acceptance of the project for funding or its refusal, plus the quality of preparation of the project proposal.

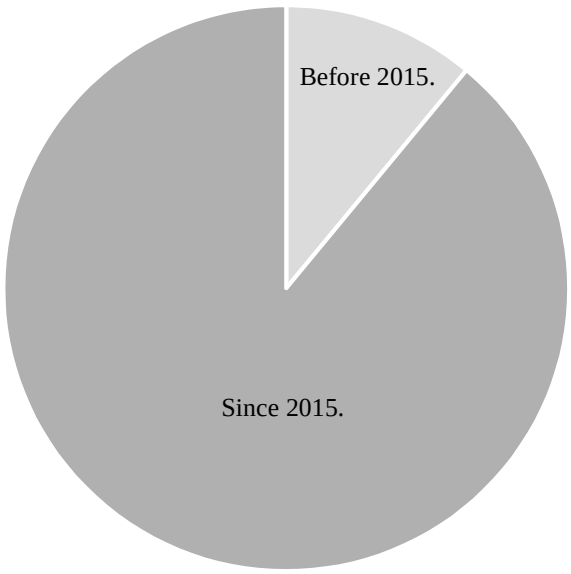


**Figure 3:** Percent of overall conservation projects of early career researchers from University of Niš funded by Rufford Small Grants", before and after year 2015. In 2015. the elective course "Principles of Conservation Planning" was established at PhD Studies in Biology at Department of Biology and Ecology of University of Niš.

## 7. CONCLUSIONS

In comparison to molecular biology which was since the beginning recognized as highly applied biological science, ecology and evolutionary biology, except when directly applied in agriculture, forestry, pharmacy or medicine, were mainly synonimised with „natural history", the term sometimes incorrectly used to describe certain kind of hobby of the wealthy people. The consequences of contemporary species mass extinction and biodiversity crisis are slovely unfolding, showing unpleasant outputs of non-sustainable management of natural resources and

conservation of all biodiversity components thus becomes an ultimate goal. Successful ecological projects realized by young researchers from Serbia confirmed the need for continuous monitoring of species, habitats and ecosystems.

## 8. ACKNOWLEDGEMENTS

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