Monitoring of Biodiversity in Protected Areas

Biodiversity monitoring is a continuous, systemized research on biodiversity components that is designed to identify their status, threats and trends. Monitoring of biodiversity is a key component of species and habitats management, which supports to assess the effectiveness of biodiversity management; determine biodiversity-related threats and trends; establish favorable conservation status of species; assess the compliance of national policy on protection and use of biodiversity with international multilateral treaties (conventions and agreements).

Biodiversity monitoring is a mandatory component of many international agreements. Article 7 of the Convention on Biodiversity obliges member states to identify components of biodiversity that are important for its conservation and sustainable use and to carry out monitoring; also, to monitor processes that have adverse impacts on the conservation and sustainable use of biodiversity. Biodiversity monitoring is included in several EU policy documents. It is especially important that the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora as amended by Directive 97/62/EC, 2006/105/EC and Regulation (EC) 1882/2003) and the Birds Directive (Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds) legally oblige member countries to monitor biodiversity. Georgia's declared political course is linked to EU integration. One of the obligations under the Association Agreement with the European Union ("Association Agreement between the European Union and the European Atomic Energy Community and their Member States, of the one part, and Georgia, of the other part" was signed on June 27, 2014) is to harmonize the country's legislation with the above-mentioned directives. Protected areas are the cornerstone of biodiversity conservation and, therefore, for the purposes of conservation and sustainable use, it is important to carry out their monitoring.

GREEN Alternative

Striving for environmental and social justice in Georgia

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The study was carried out in the frame of Green Alternatives case study "Development of Biodiversity Monitoring System for Assessment of Forest Protected Areas". Project is funded by GEF implemented by the Ministry of Nature protection and Agriculture of Georgia and World Resources Institute.

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GLOBAL FOREST WATCH

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By Resolution #27 of 19 February 2005, the Government of Georgia approved the National Biodiversity Strategy and the first Action Plan. One of its goals was to set up a biodiversity monitoring system. On the basis of the Resolution, a unified biodiversity monitoring system was adopted by the Order #262 of 18 December 2012, of the Minister of Environment Protection of Georgia. This system is based on the Pressure/State/Response model developed by the Organization for Economic Co-operation and Development (OECD). Based on the Order of the Minister, 25 indicators have been approved, four out of which are related to the protected areas:

- R1. Changes to the total coverage of protected areas;
- R2. Protected areas managed by qualified personnel, based on management plans;
- R3. Nature protection zones (changes to the coverage of protected areas, mainly allocated for conservation of biodiversity within the total coverage of the protected areas network);
- P8. Protected areas impacted by the infrastructure development.

With respect to the protected areas, in addition to these four indicators, it would be of interest to study the habitat fragmentation. Pressure indicator "landscape fragmentation" is one of the above-mentioned 25 indicators. Its definition, calculation period, description of indicator, methods of calculation of indicator are not provided in the normative act, unlike the most indicators approved by the Order of the Minister. Within the framework of the GIZ project[1], the landscape fragmentation as a result of asphalt and concrete roads across Georgia has been assessed according to this indicator. More precisely, the change of the road density was estimated at the country as well as region level in 2008-2011. Due to the lack of existing data, the landscape fragmentation could not be assessed according to the grid size (measurement unit, which means the average size of uninterrupted plots of the landscape). Moreover, the impact of other infrastructure (railways, channels, industrial zones, settlements, pipelines and other linear infrastructure) has not been assessed.

Our goal was to assess the biodiversity monitoring indicators (indicators related to protected areas) and evaluate some threats related to the protected areas; based on the results, to develop proposals (recommendations) in the following two directions:

1. To improve biodiversity indicators;
2. To improve planning and management of protected areas.

Research Methodology

In order to obtain information about the number, coverage, zoning and management plans of the protected areas, we have worked out and analyzed laws and management plans for each protected area (Source: Legislative Herald of the Ministry of Justice – www.matsne.gov.ge). Results of the research are provided according to the Georgian legislation as of March 23, 2018.

FLUIDS (atlas.mepa.gov.ge) Forest and Land Use Information System portal data were used for analyzing the location and zoning of protected areas, as well as for tourist and other infrastructure. Management plans of protected areas (both active and expired) were used as the source of information on infrastructure. Public registry data, interviews with field experts and on-site visits were also used to verify information. Geoinformation systems were used for data analysis (ArcMap 10.2.2).

[1] Results of unified system of biodiversity monitoring, March, 2013, Project "Sustainable Management of Biodiversity in the South Caucasus" (GIZ)

One of the components of the research project was the involvement of students and young professionals and promotion for their professional growth. Masters' theses prepared by students of the Natural Sciences and Engineering Faculty of Ilia State University have been used in this research: Master's thesis of Mariam Archuadze "Impact of Design of Protected Areas on the Status of Keystone Species", Master's thesis of Irine Kutateladze "Impact of Infrastructure Facilities on Biodiversity of Protected Areas", Master's thesis of Davit Kobakhidze "Impact of tourism on Keystone Species in Lagodekhi Protected Areas". Students have analyzed materials obtained with the support of Green Alternative and Forest and Land Use Information System Portal - FLUIDS (atlas.mepa.gov.ge from different scientific perspectives. Student research was designed to test and calibrate biodiversity indicators in field conditions[2].

Research Results

Assessment of protected areas was conducted according to four indicators approved by the normative act of Minister of Environment Protection of Georgia (Order #262 of 18 December 2012).

Indicator R1. Change to the total coverage of protected areas

In legal terms, there are currently 88 protected areas (14 strict nature reserves, 11 national parks, 19 managed reserves, 40 natural monuments, 2 protected landscapes and 2 multi-purpose use areas), which constitute a total area of 627104.7255 hectares. However, according to the LEPL Agency of Protected Areas (APA)[3], there are 86 protected areas: (14 strict nature reserves, 11 national parks, 19 managed reserves, 40 natural monuments and 2 protected landscapes (http://apa.gov.ge/ge/protected-areas), total area of which is also reported in different data. In fact, there are 92 protected territories in Georgia, 8 out of which are located in Abkhazia (Bichvinta, Lidzava, Miuseri, Ritsa, Pskhu, Gumista, Skurcha Strict Nature Reserves) and Tskhinvali region (Liakhvi Strict Nature Reserve) that are occupied by Russia (see the detailed explanation in the chapter "Review of Results").

Among the protected areas located on the territory under control of Georgia, 81 are managed by APA through 20 territorial administrations. One protected area - Tusheti Protected Landscape - is managed by Akhmeta municipality. Two protected areas – Pshav-Khevsureti Multi-Purpose Use Area (established by the Law of Georgia on Creation and Management of Pshav-Khevsureti Protected Areas, Article 3, Paragraph 3(d), and Javakheti Multi-Purpose Use Area (established by the Law of Georgia on Creation and Management of Javakheti Protected Areas, Article 3, paragraph 3(g)) are not managed by any institution. However, respective laws identify those settlements, which are included in these Multi-Purpose Use Areas. According to the same legislation, the management of the Multi-Purpose Use Area shall be carried out by local self-government bodies. According to the Order #12 of May 10, 2013, of Minister of Environment and Natural Resources Protection of Georgia on Approval of Typical Regulations of Territorial Administrations of the Agency of Protected Areas (Article 2), administrations of the Ptskhu-Gumista, Bichvinta-Miuseri, Ritsa and Liakhvi Strict Nature Reserves have been created in order to manage protected areas located on the territories not controlled by Georgia.

[2] All three students successfully defended master's' theses and completed Master's degree.
[3] As of 5 May 2018

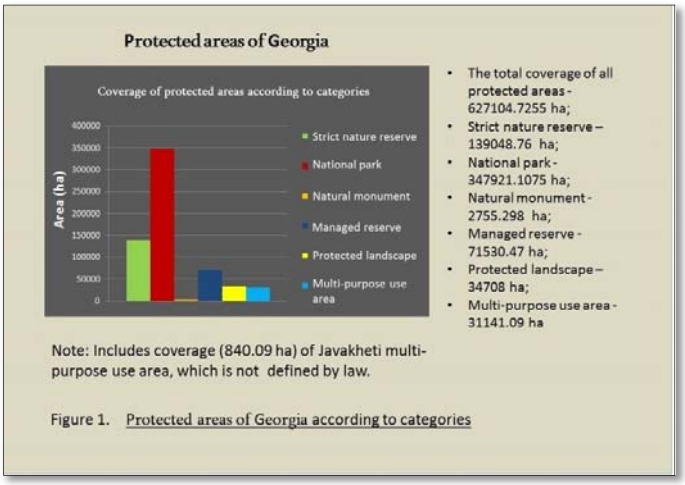

Figure 1. Protected areas of Georgia according to categories

The total coverage of all protected areas is 627104.7255 ha, which is about 9% of the country's territory. Strict nature reserves are located on 139048.76 ha, national parks - 347921.1075 ha, natural monuments - 2755.298 ha, managed reserves - 71530.47 ha, protected landscapes - 34708 ha, multi-purpose use areas - 31141.09 ha (Figure 1). 67141 ha of protected areas are located on the territories occupied by the Russian Federation.

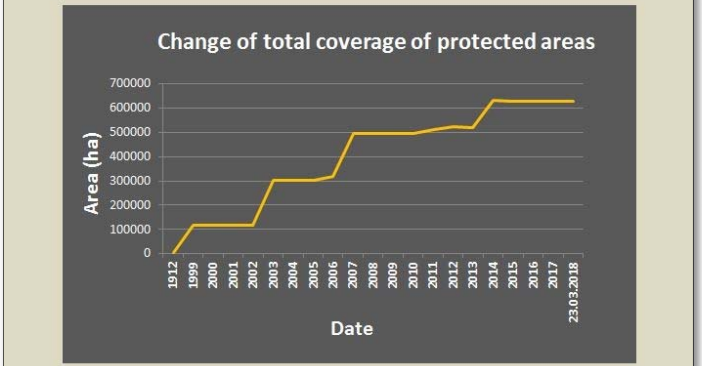

Figure 2. Change of total coverage of protected areas

It is noteworthy that the coverage of certain natural monuments is not defined by the legislation, which means that these data may be changed in the future. As for the multi-purpose use areas, the law defines the area of the Pshav-Khevsureti Multi-Purpose Use Area - it includes the settlements within the perimeter of the park (251 ha) and outside the perimeter of the park (30050 ha). Coverage of Javakheti Multi-Purpose Use Area is not defined by law; however, according to our GIS analysis, the total coverage of settlements listed in the law is 840.09 ha. Figure 2 shows the change of total coverage of protected areas.

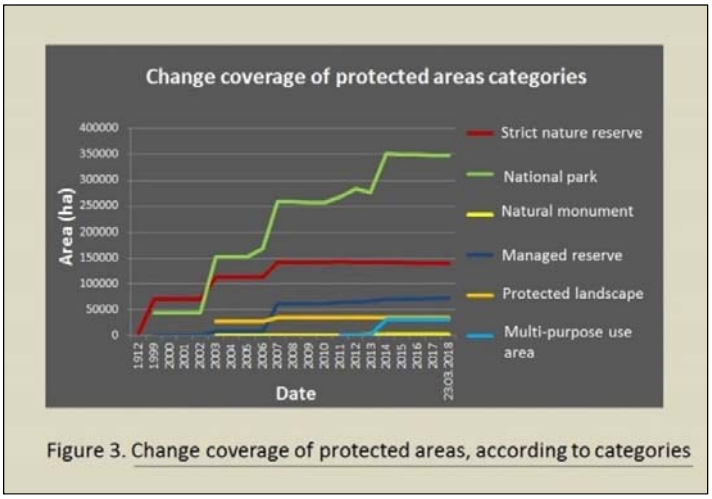

Figure 3. Change coverage of protected areas, according to categories

Changes of the coverage of protected areas (according to categories) are shown in Figure 3. As expected, to a large extent, the total coverage of national parks has been increased.

We have calculated change of coverage of protected areas for each protected area. In addition, we summarized changes of coverage of inner zones of each protected area.

Indicator R2. Protected Areas managed by qualified personnel, based on approved management plans.

Approved management plans are crucial for effective and efficient management of protected areas[4], including for implementation of its main function – conservation and other objectives that support the functioning of protected areas (such as tourism and appropriate infrastructure). Out of 84 protected areas, which are located on the territory controlled by the Georgian authorities, 42 (50%) have the management plans. 56% of coverage of protected areas (314606.348 ha) is managed according to the approved management plans while 44% of coverage of protected areas (244517.2875 ha) are without management plans. Protected areas, which do not have approved management plans at this stage, are managed based on the temporary regulations (except multi-purpose use areas). If we take into consideration the strict nature reserves in Abkhazia and Tskhinvali region, then the ratio will be somewhat worse (see Fig. 4).

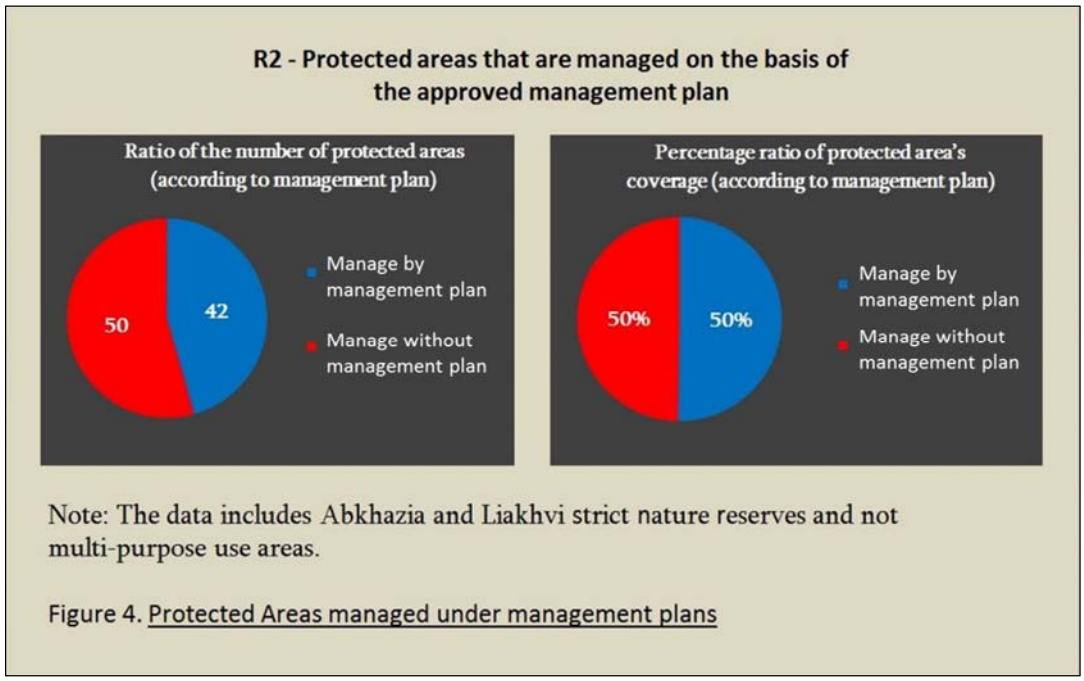

Figure 4. Protected Areas managed under management plans

Indicator R3. Nature protection zones (changes to the coverage of protected areas, mainly allocated for conservation of biodiversity within to the total coverage of the protected area network)

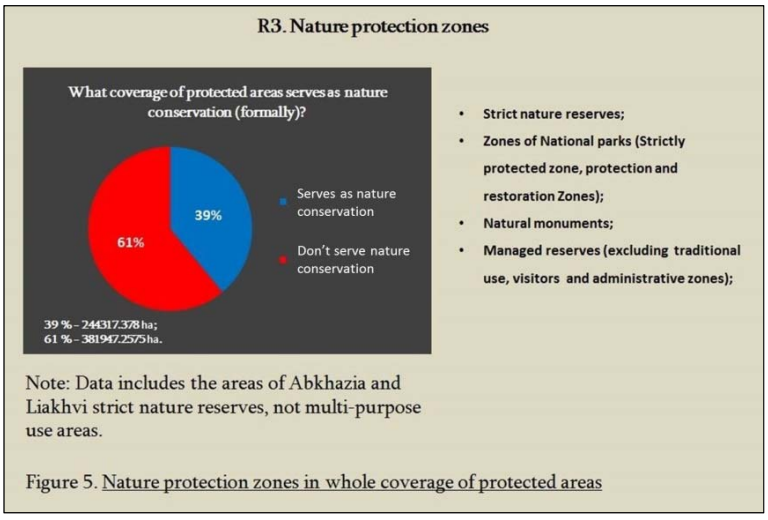

Figure 5. Nature protection zones in whole coverage of protected areas

According to the definition given in the normative act, coverage of I, II and III IUCN category protected areas are considered as Nature Protection Zones with the exception of visitors, administrative and traditional use zones. According to the Order, these zones directly help protect the environment. Use of natural resources is not allowed on this area. The more such share in the total coverage of protected areas, the

[4] Order #262 of the Minister of Environment Protection of Georgia, dated December 18, 2012 on Approval of Indicators of Unified System of Biological Diversity Monitoring, their Description Methodology and Reporting

better prerequisites are in place to preserve the endangered species and their habitats, vulnerable ecosystems, and general biodiversity.

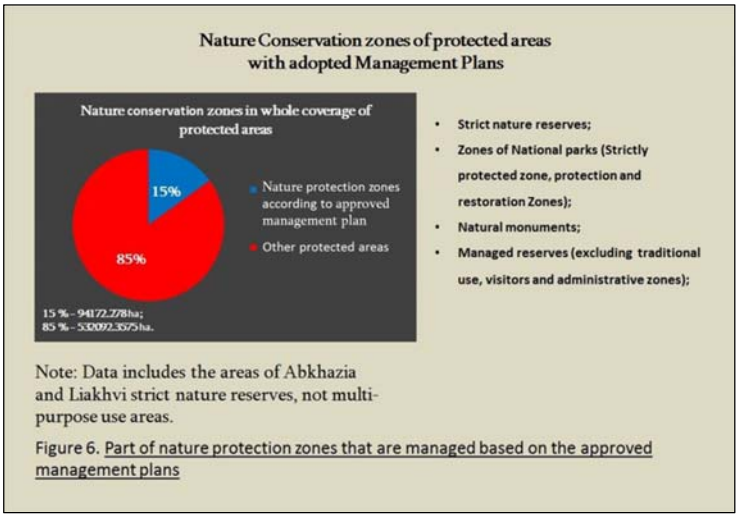

Figure 6. Part of nature protection zones that are managed based on the approved management plans

We have somewhat changed the content of the indicator defined by the Order (see in the Chapter "Review of Results") and added managed reserves to nature protection zones – excluding the traditional use zones and visitor zones[5]. Taking into consideration the areas of Abkhazia and Liakhvi Strict Nature Reserves, nature protection zones constitute 39% of all protected areas (244317.378 ha).

Having in mind that approved management plans are crucial for effective and efficient management of the protected areas, we have identified what part of nature protection zones are managed based on the approved management plans. As it turned out, only their 15% (94172.278 ha) is managed in line with management plans – Figure 6.

Indicator P8. Protected Areas impacted by the infrastructure development

Theoretically, the huge number of tourists/visitors and the associated infrastructure might have a significant negative impact on the biodiversity of protected areas. This indicator is designed to avoid this threat. In accordance with the normative act, it determines the coverage of protected areas where their own infrastructure is located: trails, visitor zones, hotels, camping sites, administrative buildings, etc. "The calculation of the Indicator is envisaged only for IUCN I-IV category protected areas that serve "to protect nature" (strict nature reserves, national parks, natural monuments, managed reserves)." According to the Indicator, the ratio of the total coverage occupied by such infrastructural facilities is measured against the total coverage of the protected area. Depending on the share of the infrastructure coverage, four levels of impact on the protected area are identified: Level I (0-5%), Level II (5-10%), Level III (10-25%), Level IV (> 25%). If the share of the infrastructure does not exceed 10%, the protected area is assessed positively and it is considered that it serves to achieve conservation goals. As a result of the research, it was found that actually in none of the cases of protected areas, tourism-related infrastructure does not occupy so much area as to exceed the Pressure Level I. For instance, in the case of Tbilisi, Borjomi-Kharagauli and Algeti Protected Areas, the share of tourism infrastructure does not exceed 1% of the total coverage. As a rule, this infrastructure design is minimal and complies with environmental conditions[6].

In addition to the indicators approved by the normative act, the trends related to the protected areas have been studied by other methods that can be used to conduct biodiversity monitoring in the future.

[5] There might be a mechanical error in the Order of the Minister, as in the same order, the definition of Indicator P8 states that IUCN I-IV Category Protected Areas - strict nature reserves, national parks, natural monuments and managed reserves serve "Nature Protection".
[6] Master's thesis of Irine Kutateladze "Impact of Infrastructure Facilities on Biodiversity of Protected Areas", 2018

Impact of tourism on biodiversity

We have studied the impact of tourism on biodiversity on the example of Lagodekhi Protected Areas[7]. A deer (*Cervus elaphus*) and a brown bear (*Ursus arctos*) were selected as the keystone species. Camera trap data from 2012-2017 and statistics of visitors in Lagodekhi Protected Areas were analyzed and processed using various statistical methods. During the daytime when the number of visitors was high, deer and bear were rarely spotted by camera-traps. They mostly were spotted during the night-time. The different situation was reported during the period of visitors inactivity: deer and bear were almost equally spotted by camera-traps during day and night time. It can be assumed that a large number of visitors threatens and/or disturbs the deer and bear populations. Because of that, some populations will likely to seek for uncomfortable but safe habitat (see Figures 7 and 8).

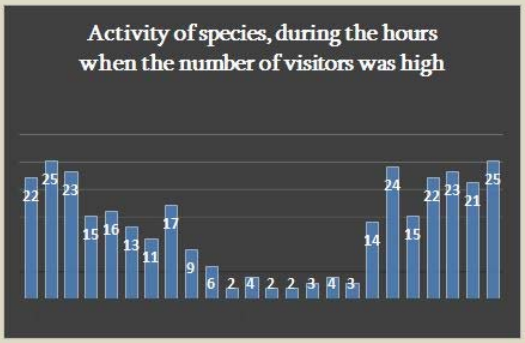

Figure 7. Activity of species, during the daytime when the number of visitors was high

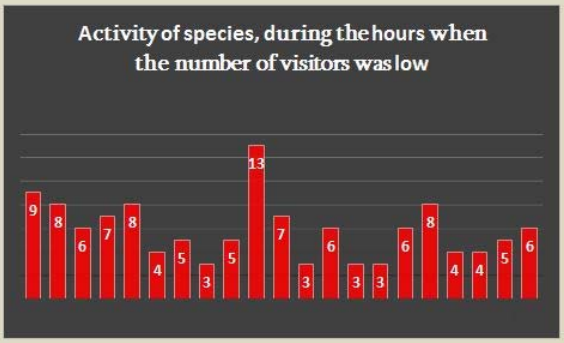

Figure 8. Activity of species, during the daytime when the number of visitors was low.

Impact of infrastructural facilities on biodiversity of protected areas[8]

Indicator P8 – "Protected areas impacted by the infrastructure development" does not assess the impact of the infrastructure that does not belong to the protected areas and is not associated with their functioning; however, it is located within the coverage of protected areas, such as: road infrastructure, power lines, pipelines and etc. In various foreign studies, this type of infrastructure has been regarded as one of the major impeding factors. Their negative impact has been proved based on natural processes and concrete examples.

Assessment of such impact on key/keystone populations (habitat fragmentation) could not be performed because of lack of sufficient information (maps of species density in protected areas, camera-trap data, etc.). With this in mind, a study of the impact of infrastructure located within protected areas, including those which do not belong to the protected areas, on the habitats protected by the Bern Convention (habitats strictly protected under the Resolution 4 of the Bern Convention, adopted by the Standing Committee) and species enlisted in the Appendix I. This information is available on the portal Forest and Land-Use Information System - FLUIDS (atlas.mepa.gov.ge). It was prepared by NACRES - Centre for Biodiversity Conservation and Research.

The research has shown that this infrastructure, especially intercity and rural roads, cause fragmentation of certain habitats that are strongly protected by the Resolution 4 of the Bern Convention, promote different types of pressure on biodiversity, including: illegal logging, poaching, movement of illicit firearms, pollution of the

[7] Master's thesis of Davit Kobakhidze "Impact of tourism on Keystone Species in Lagodekhi Protected Areas", 2018
[8] Master's thesis of Irine Kutateladze "Impact of Infrastructure Facilities on Biodiversity of Protected Areas", 2018

territories. In addition, roads connecting villages adjacent to protected areas create a risk of wildfires. The roads leading to the protected areas together with habitat fragmentation causes the Edge Effect. As a result of active undertakings of population near villages and adjacent roads, we do not find large mammals spread in the protected areas.

Representation of Protected Territories[9]

One of the components of the research was the representation of habitats strictly protected by the Bern Convention within the boundaries of protected areas[10]. It has been studied what habitats and to what extent (protection mode) are protected in protected areas. The study has also revealed some shortcomings related to the inconsistency of the categories to be protected, form, absence of links between protected areas and fragmentation of protected areas. For example, it turned out that following five habitats enlisted in the Resolution #4 of the Bern Convention have been observed in the Machakhela National Park:

1. "G1.6 Fagus woodland";
2. "E 3.5 Humid oligotrophic grassland";
3. "G1.A7 Mixed deciduous woodland";
4. "E 3.4. Moist or wet eutropic and mesotrophic grassland";
5. "F 7.3. Eastern Mediterranean phrygana"

Out of these, only the habitat "G1.6 Fagus woodland" is located in the strictly protected zone, while the remaining four habitats are found only as small fragments in the traditional use zone, in the vicinity of the settlements that use timber and non-timber resources of these habitats. The fragmentation of these habitats occurs with different infrastructure (roads, power lines, settlements). Since the Machakhela and Skurdidi rivers are not included in the National Park, habitats enlisted in the Resolution #4 of the Bern Convention have been found outside the protected area. These places are important for Caucasian Salamander (*Mertenisiela caucasica*). The large share of its favorable habitats remains beyond the boundaries of the protected areas.

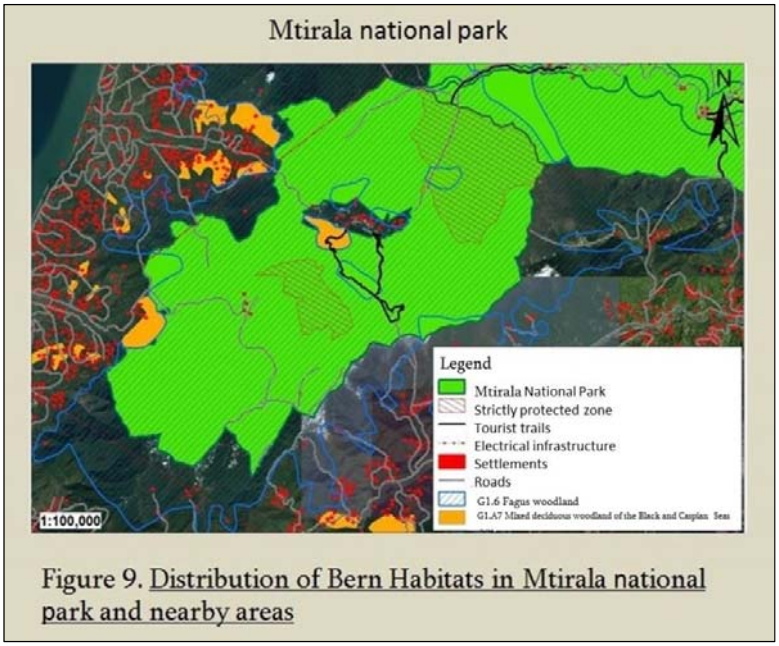

Figure 9. Distribution of Bern Habitats in Mtirala national park and nearby areas

"G1.6 Fagus woodland" and "G1.A7 Mixed deciduous woodland of the Black and Caspian Seas" are presented in the Mtirala National Park. Out of them, the former holds a dominant position, while other habitat is presented as only two fragments. One of the fragments is placed in the visitors' zone and the other one - in the traditional use zone (*see Figure 9*).

The infrastructure that causes habitat fragmentation is less common in the Mtirala National Park than in Machakhela. The main reason for causing fragmentation is

[9] Master's thesis of Mariam Archuadze "Impact of Design of Protected Areas on the Status of Keystone Species", 2018
[10] Master's thesis of Mariam Archuadze "Impact of Design of Protected Areas on the Status of Keystone Species", 2018

the power line, roads and tourist trails located in the park area, but the latter have the less impact on biodiversity than other factors.

Review of results

As we have already mentioned, the number and coverage of protected areas existing in Georgia by law, differs from the data provided by the Agency of Protected Areas and other official sources. This difference is caused by following reasons: the Agency for Protected Areas does not take into account two multi-purpose use areas - Javakheti and Pshav-Khevsureti Protected Areas - that have been established by respective laws nor their coverage - 31141.09 ha. The number of protected areas depends on how we reckon the number of protected areas in the view of strict nature reserves located in Abkhazia. The website of the Agency of Protected Areas (www.apa.gov.ge) and other official documents indicate that there are 14 strict nature reserves in Georgia, including three in Abkhazia: Bichvinta-Miusera, Ritsa and Pskhu-Gumista. However, the same link under the subchapter "Protected areas of the Autonomouse Republic of Abkhazia (Abkhazia) mentions that there are 5 strict nature reserves in Abkhazia with a total coverage of 60753 ha: Gumista Strict Nature Reserve (13,400 ha), Pskhu Strict Nature Reserve (27,334 ha), Skurcha Strict Nature Reserve (85 ha), Ritsa Strict Nature Reserve (13,893 ha), Bichvinta-Miusera Strict Nature Reserve which, in its turn, consists of three - Bichvinta (165 ha), Miusera (218 ha) and Lidzava (1296 ha) stretches. According to Articles 8, 9 and 10 of the Law of Georgia on the Status of Protected Areas, strict nature reserves of Pskhu-Gumista (40819) Ha), Bichvinta-Miusera (3645 ha) and Ritsa (16289 ha) are established. Thus, given the fact that the Phskhu-Gumista Reserve is actually not one but three strict nature reserves then there are 90 protected areas, including 16 strict nature reserves, in Georgia. If we consider that the three-stretches of Bichvinta–Miusera are independent strict nature reserves, then there will be 92 protected areas, including 18 strict nature reserves.

The information provided in the Law of Georgia on the Status of Protected Areas and on the APA website on the protected areas existing in Abkhazia and their coverage differs from each other and requires verification (in terms of both number and coverage). As for the multi-purpose use areas, it is absolutely incorrect that today in Georgia there are no protected areas of this category as it is referred to in the information available on the APA website as well as mentioned in various official documents and surveys of public officials and experts.

It should also be noted that the information posted on the APA website is not easily comprehensive and informative to the stakeholders. There are no unified data on the website concerning the coverage and number of protected areas and their management administrations. In some cases, without detailed review of the legislation, it is not clear which protected area is administered by a specific administration. For example, according to the Law of Georgia on the Creation and Management of Imereti Caves Protected Areas, the Okatse Canyon Natural Monument and the Okatse Waterfall Nature Monument are included within the Imereti Caves Protected Areas; however, they are managed by the Administration of Martvili and Okatse Nature Monuments. The Mukhura waterfall is managed by Imereti Caves Protected Areas Administration, though it is created not by the Law of Georgia on the Creation and Management of Imereti Caves Protected Areas, but the Law of Georgia on Creation and Management of Natural Monuments.

It should also be noted that there are many actual mistakes and inconsistencies in the normative acts related to the protected areas (laws on the establishment of protected areas and management plans of the same protected areas) that complicates both the research of the management of protected areas and their management process.

The presented information can be used by the Ministry of Environment Protection and Agriculture not only for the indicators defined in the Order of the Minister but also for the reporting on the Biodiversity Convention and the Bern Convention (indicator on protected areas - D1). It might be possible to analyze the

trends in the changes of the coverage of protected areas: according to the changes of the coverage of each protected area, as well as of the coverage of internal zones of each protected area (see Recommendations).

According to the obtained results, the situation is unfavorable in terms of the protected areas that are managed on the basis of the approved management plan. The Agency for Protected Areas shall use this information in order to produce management plans for budgetary financing and advocating to receive donor support. We single out the issue of IUCN VI category protected areas, which have no legal basis and institution for their sustainable management. Their proper functioning is very important in Javakheti and Pshav-Khevsureti both for other protected areas located there and social-economic development of the local population. According to the IUCN[11], this category is called as the "Protected area with sustainable use of natural resources". This type of protected area protects the ecosystems and habitats of the species and their associated cultural values and traditional systems of use of natural resources (management); a large part of nature is in a natural condition, use of natural resources in certain areas is based on the methodology and scope that are harmonized with nature protection.

According to the definition of the Indicator "R3. Nature Protection Zones", such areas are considered as the coverage of protected areas of IUCN I, II and III category - excluding visitors, administrative and traditional use zones. According to the Law on the System of Protected Areas, the National Park visitor zone is the same in its substance as the category of protected area "Nature Monument" (IUCN III Category). The objectives and permitted activities of the Protection and Restoration Zones managed by the National park (which belong to the nature protection zones according to this indicator) complies with the objectives and permitted activities of the "Managed Reserves" (IUCN Category IV), however, according to this indicator, the latter does not include "Nature Protection Zones." At the same time, as it was mentioned above, according to other - P8 Indicator, the protected areas of IUCN I-IV category serve to "protect nature". Having this in mind, we suggest that the following should be considered as "Nature Protection Zones" for the R3 indicator: strict nature reserves, national parks (excluding administrative and traditional use zones), natural monuments and managed reserves (excluding administrative and traditional use zones).

It is noteworthy that the traditional use zones of national parks, as well as the protected areas - "protected landscape" and "multi-purpose use areas", play an important role in the conservation: if the category and form of management is properly selected, the protected area of this category will possibly be invaluable. However, to get this effect, it is necessary that, out of four main models of management of protected territories recognized by the Union for Conservation of Nature (IUCN) (1. Management by Government (state or local), 2. Co-management, 3. Private Management, 4. Management by Indigenous Population and Local Communities), Georgia applies not only a model that implies management solely by the government.

As we mentioned above, the indicator "P8. Protected territories under impact of infrastructure development" assesses only the impact on biodiversity of the infrastructure owned by the protected areas. In essence, this is the quantitative and not the qualitative assessment related to the impacts of tourism. Assessment of Georgia's protected areas only by this method shows that tourism has no impact on biodiversity. However, in order to assess the real impact of tourism on biodiversity of protected areas and, if necessary, make appropriate actions, qualitative research and other types of monitoring are required. Such research involves determining the dynamics of the selected types of keystone species and correlation of tourism activities. This is of utmost importance, considering the current trends. For example, "in 2017, 55,519 visitors were registered in Lagodekhi protected areas. Compared to data of 2016, the total number of visitors was increased by 12% in 2017 and, compared to data of 2010, by 267%, i.e. was nearly tripled"[12]. It is noteworthy that a study of the impact of

[11] www.iucn.org

[12] Master's thesis of Davit Kobakhidze "Impact of tourism on Keystone Species in Lagodekhi Protected Areas", 2018

ecotourism of such content was conducted in Georgia for the first time. It was based on data of the camera-traps that were placed for other purposes (monitoring the population, control of poaching) and not for assessment of impact of ecotourism. In the future, research and monitoring will be more effective if the camera-traps are placed on specially selected locations, near tourist attraction sites, and will be functional continuously, throughout the year. In order to observe the movement of key species, apart from camera-traps, it is necessary to use more precise method - GPS collars data and then modeling in GIS. With the help of telemetry, it is possible to obtain the necessary data for the monitoring purposes.

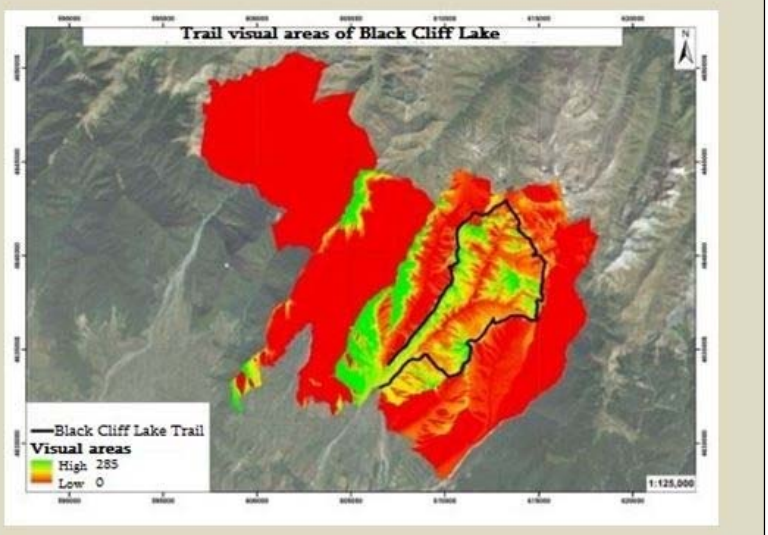

Figure 10. Trail visual areas of Black Cliff Lake

It is desirable to make such survey and monitoring a compulsory part of the management plan for protected areas, because their results can be used not only for regulating tourist activities (limiting the number of tourists and routes with a view of vital habitats for populations or breeding, water access, hibernating and other important locations, but also, giving proper consideration to tourist interests and for better planning of routes. Based on visitor's interests, as a result of the modeling, it is possible to identify the locations where it will be possible to observe animals without approaching and disturbing them, through binoculars and telescopes (As an example, see map of visual areas of Black Cliff Lake Trail (Figure 10. Black Cliff Lake Trail visual areas[13])

For the purpose of assessing status, trends and threats of biodiversity, it is important to assess the infrastructure that does not belong to the administration of the protected areas (roads, pipelines, transmission lines and other infrastructural facilities). There are circumstances/limitations that are important to be considered through a quantitative indicator to assess such impacts (to develop a quantitative indicator). Part of infrastructure within the perimeter of the protected areas has been removed from their coverage (an outer part of the protected area can be removed; in such case it is difficult to measure the coverage of the "cut-off" coverage; a stretch in the central part of the protected area can also be removed – in such case, it is rather easy to calculate its coverage. Considering the above-mentioned circumstances, it is impossible to define the percentage ratio of the protected area and the infrastructure, as it was done during calculating the change of coverage of infrastructure belonged to the protected area (indicator "P8. Protected Areas under impact of infrastructure development"). Such simple rule calculation will not lead to the desired results, also considering the fact that in certain cases some of the infrastructure (mainly roads) is not removed from the protected areas. Therefore, it is important to conduct the quantitative and not the qualitative monitoring to assess the infrastructure impacts and trends. In particular, the impact of this type of infrastructure on species and habitats should be studied: whether it causes the habitat degradation and/or fragmentation, visual pollution, whether it creates physical barriers to animals, or whether their lifestyle and the structure of population changes, or whether the risk of poaching and pollution increases. For this purpose, it is necessary to define the specific key/keystone species of animals and study animals

[13] Master's thesis of Davit Kobakhidze "Impact of tourism on Keystone Species in Lagodekhi Protected Areas", 2018

thoroughly, collect and analyze data. At this stage, we have not been able to make such assessment due to lack of sufficient information (species distribution maps in protected areas, camera-trap data, etc.) and time allocated for research. In the future, it will be necessary to ensure obtaining camera-trap data in a more systematized manner and to process and analyze photo- and audio data. For the monitoring purposes, location for placing camera-traps should be selected. Along with this method, other methods of animal registration should become permanent and systematized (tracking, collecting animal wastes, genetic analysis, etc.) and, based on them, animal distribution maps should be developed. This should be specified in a normative act which will define the rights and obligations of various stakeholders (e.g., scientific-research and educational institutions, non-governmental organizations).

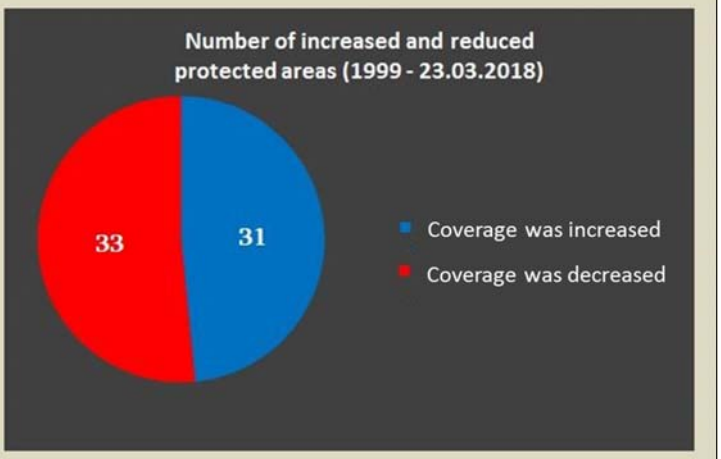

Figure 11. Changes to the coverage of protected areas

Assessment of infrastructure impact on habitats under the Bern Convention (habitats strictly protected under the Resolution 4 of the Bern Convention, adopted by the Standing Committee) and species enlisted in the Appendix turned out to be convenient for the monitoring purposes.

As for quantitative data, based on the existing data, it is possible to conduct an assessment of the tendency of removing coverage from the protected areas. However, in this case, attention should be paid to the fact that the coverage of protected areas will decrease not due to removing the coverage for the needs of infrastructural/development projects, but correcting the boundaries of the protected area in the demarcation process. (Figure 11. Changes to the coverage of protected areas)

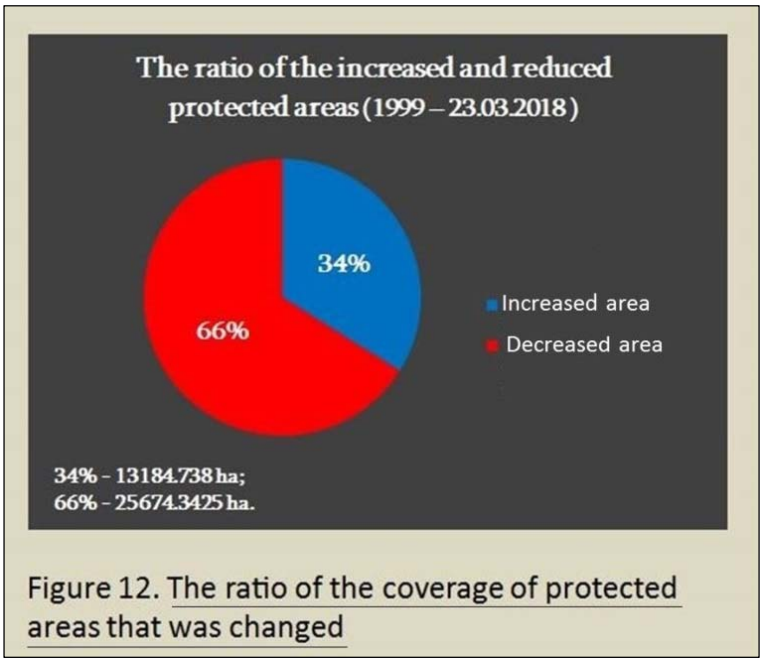

Figure 12. The ratio of the coverage of protected areas that was changed

Within 1999-2018 (as of 23.03), the coverage of 64 protected areas has been changed. Out of them, 31 were increased and 33 - decreased. In the coverage that was changed, the ratio of the decrease is higher (66%, 25674,3425 ha) then the increase (34%, 13184, 738) (Figure 12. The ratio of the coverage of protected areas that was changed).

The representation of the protected habitats can be assessed through the same habitat maps[14]. Similar studies/monitoring is important because it makes possible to evaluate the relevance of conservation

[14] Master's thesis of Mariam Archuadze "Impact of Design of Protected Areas on the Status of Keystone Species", 2018

measures and, if necessary, to change boundaries of inner zones of protected areas, the category (granting stricter protection regime to vulnerable habitat) or coverage (increase) and to initiate new protected areas.

Several classifications of ecosystems and biomes are offered by different authors. In most cases, publications/monographs repeat others that were published previously; the same ecosystem/habitat has different names in different sources. In order to avoid misunderstanding, it is recommended to apply the habitats defined by the Appendices of the Bern Convention for the purposes of the indicator on assessment of protected representation.

Among the inconsistencies that were identified concerning the categories of protected areas, their objectives, ecological conditions and management, we will highlight some of the issues related to the managed reserves. For example, the status of Asa Managed Reserve is completely mismatched with the existing natural conditions and ecological conditions. The Asa Gorge, the northern part of Khevsureti - Arkhoti is an untouchable ecosystem, practically having retained its primitive form. A category of managed reserve is established when an ecosystem/species is in danger and human intervention and active management (e.g., forest regeneration measures, forestry pests and diseases management, fight against epizootics, epidemics and/or invasive species, etc.) to save it or improve the situation is required. There is no such need in the Asa Managed Reserve. The only reason why this status was granted is the opening of a hunting farm in the future. Today, when the local population actively opposes the growing poaching, the state must take adequate counter-measures, tighten control on poaching in this gorge (including from the part of border guards), and to merge the Asa Managed Reserve with the Pshav-Khevsureti National Park. Moreover, the status of Korughi, Iori and Gardabani Managed Reserves is completely mismatched with the activities carried out there. These protected areas are subject to the long-term licensing of hunting farms. It appears that ongoing activities are associated with hunting. Activities that are contrary to the conservation, such as mass destruction of predators, take place. The Agency of Protected Areas does not exercise any control over the areas under its jurisdiction. Consequently, the lawfulness of hunting farm licensing and the fulfillment of the license conditions should be checked and, in case of violations, should be abolished. Or, the status of formally existing managed reserves should be abolished and removed from the list of protected areas.

It is necessary to thoroughly explore the issue of Ilto Managed Reserve to find out whether there is a need to restore ecosystems and species through active management. At the same time, the merger of two adjacent areas - the Ilto Managed Reserve and the Batsara Strict Nature Reserve and establishment of the national park should be discussed.

Recommendations and conclusions

Based on review results, the following recommendations have been elaborated:

1. To make the following information available on the websites of the Agency of Protected Areas, the Ministry of Environment Protection and Agriculture of Georgia and the Environmental Information and Education Center, in the easily accessible/visible areas: “In Georgia, there are currently 88 protected areas (14 strict nature reserves, 11 national parks, 19 managed reserves, 40 natural monuments, 2 protected landscapes and 2 multi-purpose use areas), with a total coverage of 627104.7255 hectares. Out of these areas, 81 protected areas are managed by the Agency of Protected Areas, through 20 territorial administrations. One protected area – Tusheti Protected Landscape – is managed by Akhmeta municipality; Pskhu-Gumista, Bichvinta-

Miusera, Ritsa and Liakhvi Strict Nature Reserves Administrations are established to manage protected areas existing in the territories that are not controlled by the Georgian authorities.

2. To specify the information on the protected areas existing in Abkhazia and their coverage (both in terms of number and coverage) and, if necessary, to introduce changes to the relevant normative acts;

3. To define the coverage of Javakheti Multi-Purpose Use Area by law;

4. To carry out demarcation of areas of Javakheti and Pshav-Khevsureti Multi-Purpose Use Areas and reflect the results in respective normative acts;

5. In line with the National Biodiversity Strategy and Action Plan of Georgia 2014-2020[15], considering the IUCN categories of protected areas and management guidelines, to improve the management of V and VI categories of protected areas, develop proper legal framework and implement pilot projects through ensuring involvement of stakeholder groups having interest in management issues and, first of all, local population.

6. To revise the normative acts related to the protected areas (laws on establishment of protected areas and management plans of these protected areas) and remove existing gaps.

7. To make changes to the normative act and, for the purposes of R3 Indicator, to consider strict nature reserves, national parks (excluding administrative and traditional use zones), natural monuments and managed reserves (excluding administrative and traditional use zones) as "Nature Protection Zones".

8. To remove the function of defining qualification of staff of protected areas from R3 indicator, as it requires qualitatively different research and establish as a separate indicator. In order to assess effectiveness of management of protected areas, to identify a separate indicator to check qualifications of the employed staff.

9. To always necessarily analyze Indicator R3. "Nature Protection Zones (changes to the coverage of protected areas, mainly allocated for conservation of biodiversity within the total coverage of the protected area network) together with the Indicator "R1. Changes to the total coverage of protected areas".

10. To formulate the title of Indicator "P8. Protected Areas under Impact of Infrastructure Development" as follows: "Changes to the coverage of the infrastructure belonged to the protected areas", which more precisely reflects the essence of this quantitative indicator. It can also be used in the future because obtaining the necessary data does not require too much time and funds.

11. Introduction of qualitative indicators is necessary for monitoring of tourism impact on biodiversity and undertaking responsive measures. The intensive use of this indicator should be determined by the protected area management plan.

12. To define "Impact of Infrastructural Projects on Protected Areas" as a separate indicator in order to assess the infrastructure that does not belong to the protected areas.

13. For the purposes of analyzing the impact of tourism as well as infrastructural development projects and its associated threats (habitat fragmentation), it is necessary to use the following methods such as: telemetry, camera-traps (to be placed thematically in selected areas), GIS analysis/modeling.

14. To review the status of Asa, Ilto, Gardabani, Iori and Korughi.

[15] Approved by the Resolution #343 of the Government of Georgia as of May 13, on Adoption of National Biodiversity Strategy and Action Plan of Georgia 2014-2020

15. To explore the managed reserves where hunting farms are functioning. In the end, it is necessary to abolish or restrict the status of the protected area with respect to these areas, or abolish existing farms, for which legal ways should be applied (checking the license conditions, compliance with the status of the managed reserves, adequate reaction to possible breaches, including revocation of licenses).

16. To use habitats enlisted in the Appendices of the Bern Convention (habitats strictly protected under the Resolution 4 of the Bern Convention, adopted by the Standing Committee) to assess the tendency of ecological representations of protected areas. In order to ensure adequate protection regime of such habitats, revision of inner zoning of existing protected areas and planning of new protected areas is required.

Thus, biodiversity monitoring is impeded by the lack of data as well as the non-standardization of existing data. The lack of data is a significant barrier, but even in the view of the existing data, their systematization and interpretation makes it possible to discuss the condition of biodiversity of protected areas, its associated tendencies and effectiveness of conservation measures.

As a result of monitoring, the status of biodiversity is determined and the changes are assessed in time and space. However, it is especially important not to conduct "monitoring for monitoring" to formally fulfill commitments under the national legislation or international obligations. Monitoring should be a guide for decision makers to better manage biodiversity in terms of both protection and use of resources.