ENHANCING FINANCIAL SUSTAINABILITY

OF THE PROTECTED AREAS SYSTEM IN GEORGIA

Technical support to prioritize biodiversity monitoring indicators (species and habitats) for 10 Georgian PAs to support the development of standardized PA-specific Management Effectiveness Assessment plans *(Biodiversity Monitoring Indicators)*

Deliverable 3:

10-Year Plan for Monitoring of Short List Indicators

[Draft]

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Abbreviations

APA	Agency of Protected Areas
CNF	Caucasus Nature Fund
GEF	Global Environment Facility
GIZ	German Development Agency
MEPA	Ministry of Environmental Protection and Agriculture
NFI	National Forest Inventory
UNDP	United Nations Development Programme

1 Contents

2 Introduction

On one of the purposes of the Technical Assistance Grant Agreement between the Caucasus Nature Fund and the author, signed on 15 May 2020, was to prepare a 10-year plan for monitoring of short list indicators with agreed monitoring methodologies for each prioritized indicator indicator. The plan would cover the following protected areas: Borjomi-Kharagauli national park (BKNP), Javakheti PA, Vashlovani PA, Kazbegi PA, Algeti PA, Pshav-Khevsureti PA, Tusheti PA complex (Tusheti PA and Tusheti Protected Landscape, Mtirala NP, Kintrishi PA and Machakhela PA.

3 Selection and prioritization of biodiversity indicators for target PAs

3.1 Approach and methodology

Prioritised short list of biodiversity indicators for the target PAs was elaborated in the previous stages of the assignment through a rigorous participatory process involving all relevant experts as well as key stakeholders and in close cooperation and joint work with the main beneficiaries – MEPA and APA.

The analysis of the past efforts and lessons learnt in relation to biodiversity monitoring on Georgia's protected areas suggested that it was critically important that each selected species or habitat would be (i) correctly chosen from the biological viewpoint and be suitable for the purpose of helping achieve effective and adaptive management of a given PA, thus implying that the process had to be expert-driven and (ii) practical from the management point of view and adequate to available resources. Therefore, the process involved all the relevant leading experts as well as key stakeholders to elaborate a final agreed and prioritised (short) list of biodiversity indicators in several consecutive steps (see Fig. 1)

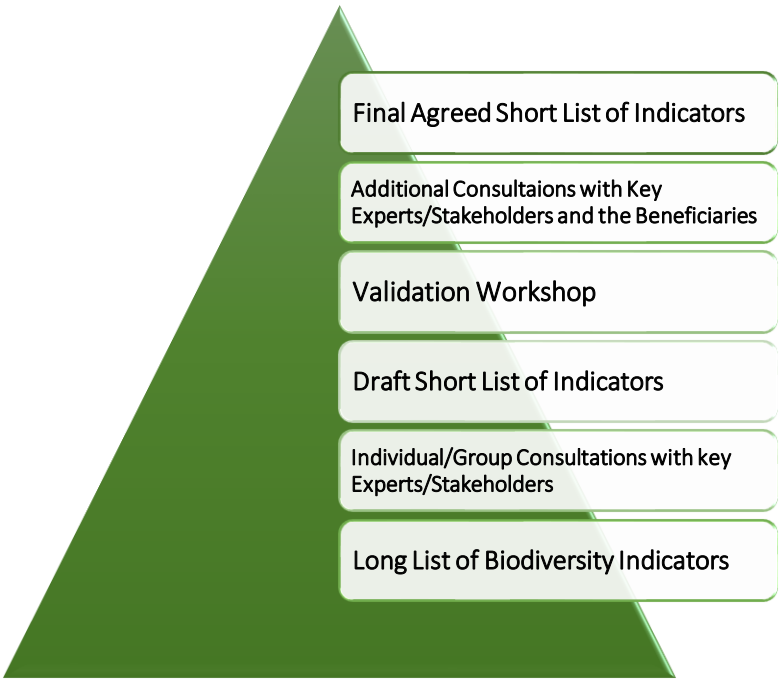

Fig. 1. The process of selecting agreed prioritised list of biodiversity indicators.

A draft set of criteria for the prioritization of the indicators was prepared based on the following: existing PA management plans, practicality, cost-effectiveness, feasibility, national and international significance, link to NBSM etc. The criteria were grouped into two main categories: (1) technical criteria and (2) management criteria.

The draft criteria were then discussed with the beneficiary (APA, MEPA), key stakeholders and leading experts from all relevant fields of botany and zoology, having the experience of working with PAs and/or in the field of biodiversity monitoring. We had individual or group virtual meetings (via Skype or Zoom) as wall as physical meetings. The flora and habitat experts noted that while the draft proposed technical criteria were focussed on specific species and were probably suitable for fauna indicator species, they were less relevant for flora species since specific flora species or specific habitat types were unlikely to serve as good indicators for biodiversity monitoring on protected areas. Thus, an entirely different approach was proposed to identify flora biodiversity indicators, namely instead of focussing on individual species to use the following wider classes or groupings: grasslands, forests and invasive plants. Thus the subsequent process of identifying flora indicators for biodiversity monitoring on the target PAs was based on this approach. The management criteria remained the same.

The final agreed technical and management criteria for fauna indicators were as follows:

I. Scientific and conservation criteria:

- Indicators (i.e. fauna species) identified in the management plans of the target PAs.
- Indicators of threats and pressures on PAs such as poaching, excessive grazing, pathogens, forest use/timber extraction, tourism, climate change, etc.

- National significance − species listed in the national Red List or having an outstanding economical or social significance, etc.
- International and regional significance − species listed in resolution No.6 of the Standing Committee of the Bern Convention (so called Emerald species).
- Indicators of the National Biodiversity Monitoring System

II. Management criteria:

- Practicality – *How effectively can monitoring results be translated into the management of the given PA?*
- Cost-effectiveness – *What are the available methods (those that can yield credible results) and how accessible and cost-effective are they*?
- Feasibility – *Do/will we have sufficient human and financial resources necessary to implement the indicator?*

3.2 Fauna species

The first step was to create a primary (long) list of biodiversity indicators that would be later discussed with key experts and stakeholders. We analysed all existing information and documents such as the management plans (or similar documents) of the target protected areas and other legal or policy documents in which PA goals and objectives were set out and the main values as well as current threats and priorities were described. We then composed a long working list of biodiversity indicators for each of the target PAs to serve as the baseline information for further prioritization. This list was organized in a table and included the descriptions of actual or estimated status of the indicator (species/habitat) if available as well as potential or actual pressures that affect them. The understanding of the current and potential threats to each of the indicator would help us analyse the causal link between the state of indicator and the threats/pressures as well as elaborate on the potential of improved management effectiveness i.e. possible management responses that could be proposed in order to reduce the pressures/threats and eventually improve the status of the indicator.

Together with the draft selection criteria, the above-mentioned short list of indicators was discussed with the beneficiary (APA, MEPA), key stakeholders and leading botanists and zoologists with the experience of working with PAs and/or in the field of biodiversity monitoring.

The comments and suggestions received from the key experts were analysed and incorporated into the primary list of indicators to produce the draft version of prioritised short list of indicators. Later the draft short list was presented at the final validation workshop on fauna indicators, attended by the majority of key experts and stakeholders. Additional comments received during the workshop helped finilise the short list of fauna indicators.

While working on the updating of the draft short list, it was noted that (i) the new short list of priority indicators still contained a rather high number of indicators, (ii) several indicators in fact overlapped in the threats/pressures or condition they were selected to respond to or indicate (e.g. woodpeckers, forest bats and squirrel were each proposed to monitor forest condition) and (iii) some indicators would require specialised approach i.e. very specific monitoring activities and careful planning as well as trained skilful observers, and could not be monitored via routine patrolling or other forms of activities already happening on PAs; other indicators, on the other hand, would not require such specialised approach and would be best monitored via other common activities − field data for such indicators could be collected as a "by-product" of such activities as patrolling by rangers, nature viewing by victors, etc.

Based on the above analysis, we further categorised and prioritised the short listed indicators into:

(1) High priority indicators for specific monitoring

(2) Medium priority indicators for specific monitoring

(3) Priority indicators for non-specific monitoring.

Subsequently, additional meetings were held with the beneficiaries − APA and MEPA − to finalise the short list of fauna indicators (see Annex 1).

3.3 Flora, Habitats and forest pathogens

The comments and suggestions received from the botanists were analysed and incorporated into the primary list of indicators to produce the draft version of prioritised short list of indicators for flora, habitats and forest pathogens. All leading botanists suggested that forest monitoring was a high priority for all PAs with significant forest cover, and that the monitoring should rely on permanent sample plots, it was also proposed that the process should be carried in compliance and full synergy with the national forest inventory (NFI) – the process that was recently launched and is expected to be completed later 2020. NFI covers the whole country including PAs and employees a grid-based sampling technique involving the recording of up to 70 variable in each permanent sample plot. We had additional meetings with the beneficiaries (APA and MEPA) as well as experts and project leaders of NFI. There was a consensus that the forest monitoring activities on the protected areas should be harmonised with NFI, while intensifying the sampling effort by narrowing down the sampling grid from 3.6 km to 1.8 km thus increasing the number of sample plots. A series of additional meetings were organised with the experts and the beneficiaries and the short list of indicators of flora, habitats and forest pathogens was finilised (see Annex 2).

3.4 Emerald species

Each of the target PA has a number of Emerald species – species, listed in Resolution No.6 of the Standing Committee of the Bern Convention. Some PAs are particularly with as many as more than 20 rich in non-avian Emerald species alone. While the country is obliged by the Bern convention to monitor all species included in Res. No. 6, according to the experts, many of them can not be used as indicators for PA

management effectiveness or adaptive management due to their ecology or current population status – some of these species are so rare that their use for routine monitoring is not possible. On the other hand, some emerald species such as brown bear, lynx, bezoar goat and several woodpeckers were selected as high or medium priority indicators for the target PAs.

4 Elaboration of a 10 year monitoring plan

The final review and synthesis of the agreed short list of fauna and that of plants, habitats and forest pathogens revealed the need of further and final prioritisation of indicators. While an ideal option, it was evident that it would impractical as well as not cost-effective to implement all the agreed priority indicators. The evaluation of certain short-listed indicators from the fauna list *vis-à-vis* plant and habitat indicators showed some overlaps and potential duplication. For example, woodpeckers were selected as a good indicator of the health of forest ecosystem. However, the proposed methodology of forest monitoring would already address this issue while in addition providing information on a huge number of forest variable. Thus a s first step we identified such duplications which in addition to the mentioned "paired indicators" included "monitoring of hare for grasslands and meadows and grassland monitoring using permanent plots". We then looked at the costs and overall efforts required for each of the indicator in question as well as the information that would be obtained through their using as biodiversity indicator. The matrix below demonstrates this process using the example of **woodpeckers *vs*. forest monitoring**.

	Woodpeckers	**Forest monitoring on permanent plots**
Objective	Monitoring forest ecosystem health	Monitoring forest ecosystem health
Cost per assessment	Relatively low	Relatively high
Human resources	Trained observers; Expert data analysis.	Trained foresters; Expert data analysis
Frequency	Once in 3 years	Once in 10 years
Obtained information	Amount of deadwood and possibly also on changes in forest composition; Data on woodpecker spp. Some of which are emerald species. Etc.	Detailed information on the composition and ecological condition of forest; (The protocol includes up to 70 forest valuables) Distribution of concrete forest habitat types many of which are Emerald habitats. Etc.

As a result of the above analysis it became evident that in the case of **woodpeckers *vs*. forest monitoring,** the cost of implementing woodpeckers monitoring activities was lower per monitoring effort than that of forest monitoring but because of the high frequency the overall combined cost for the period of 10 years would not be much different. In addition forest monitoring would yield a huge amount of detailed data on the forest, outweighing the value of woodpeckers as a indicator.

Finally, as a result of detailed consultations with the Project and the main beneficiaries – APA and MEPA, it was decided that for the purpose of the 10-yaer monitoring plan, forest monitoring was preferred over woodpeckers, hence to implement forest monitoring in as many parks as possible, especially where detailed forest monitoring was a pressing need, while still carry out woodpecker monitoring in the remaining parks. Similarly, it was decided to include in the 10-year plan grasslands monitoring as opposed to hare or ground bird monitoring.

5 Monitoring plan 2020-229

INDICATOR	PARK	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Brown bear (*Ursus arctos*)	ALGETI NP				x					x	
	MTIRALA NP			x					x		
	MACHAKHELA NP			x					x		
	KINTRISHI PA			x					x		
	VASHLOVANI PA				x					x	
	PSHAV-KHEVSURETI PA				x					x	
	LAGODEKHI PA				x					x	
	KAZBEGI PA				x					x	
	BORJOMI-KHARAGAULI			x					x		
Bezoar goat (*Capra aegagrus*)	TPA & TPL	X	x			x			x		
	PSHAV-KHEVSURETI PA	X	x			x			x		
East C. tur (*Capra cylindricornis*)	TPA & TPL		x				x			x	
	PSHAV-KHEVSURETI PA		x				x			x	
	LAGODEKHI PA			x				x			x
	KAZBEGI PA			x				x			x
Red deer (*Cervus elaphus*)	TPA & TPL	X			x			x			x
	LAGODEKHI PA		x			x			x		
	BORJOMI-KHARAGAULI		x			x			x		
Eurasian lynx (*Lynx lynx*)	VASHLOVANI PA			x			x			x	
Goitered gazelle (*Gazella subguturosa*)	VASHLOVANI PA										
Ungulates: chamois and roe deer	MACHAKHELA NP	X	x				x				x
	MTIRALA NP	X	x				x				x
	KINTRISHI PA	X	x				x				x
Bearded vulture (*Gypaetus barbatus*)	KAZBEGI PA		x		x		x		x		x
Eurasian griffon (*Gyps fulvus*)	KAZBEGI PA		x		x		x		x		x
Vultures:Egyptian vulture, Griffon	VASHLOVANI PA (Eagle canyon)		x	x	x	x	x	x	x	x	x

INDICATOR	PARK	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Black stork (*Ciconia nigra*)	VASHLOVANI PA (Eagle canyon)		x	x	x	x	x	x	x	x	x
Pheasant (*Phasianus colchicus*)	VASHLOVANI PA		x		x		x		x		x
Caspian Snowcock (*Tetraogallus caspius*)	BORJOMI-KHARAGAULI		x			x			x		
Caucasian grouse (*Lyrurus mlokosiewiczi*)	BORJOMI-KHARAGAULI		x			x			x		
Velvet scoter (*Melanitta fusca)*	BORJOMI-KHARAGAULI (Tabatskuri)		x		x		x		x		x
Great rosefinch (*Carpodacus rubicilla*)	KAZBEGI PA		x		x		x		x		x
Guldenstadt's Redstart (*Phoenicurus erythrogastrus*)	KAZBEGI PA		x		x		x		x		x
Migratory water birds	JAVAKHETI PA			x		x		x		x	
Nesting colonial water birds	JAVAKHTI PA			x		x		x		x	
Rubby shelduck (*Tadorna ferruginea*)	JAVAKEHTI PA			x		x		x		x	
Common crane (*Grus grus*)	JAVAKHETI PA			x		x		x		x	
Woodpeckers	PSHAV-KHEVSURETI PA		x			x			x		
	BORJOMI-KHARAGAULI		x			x			x		
Caucasian salamander (*Mertensiella caucasica*)	MACHAKHELA NP					x					x
	MTIRALA NP					x					x
	KINTRISHI PA					x					x
	BORJOMI-KHARAGAULI					x					x
Trout (*Salmo spp.)*	MTIRALA NP		x		x		x		x		x
	KINTRISHI PA		x		x		x		x		x
	TPA & TPL			x		x		x		x	
	PSHAV-KHEVSURETI PA			x		x		x		x	
	BORJOMI-KHARAGAULI		x		x		x		x		x
Benthic macroinvertebrates and fish composition	JAVAKHETI PA			x			x			x	
	BORJOMI-KHARAGAULI (Tabatskuri)			x			x			x	
Forest (permanent plots)	ALGETI NP		x								
	MTIRALA NP		x								

INDICATOR	PARK	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
	KINTRISHI PA		x								
	MACHAKHELA NP								x		
	TPA & TPL			x							
	LAGODEKHI PA		x								
Grasslands (pastures)	VASHLOVANI PA		x					x			
	ALGETI NP			x					x		
	JAVAKHETI PA				x					x	
	TPA & TPL			x					x		
	PSHAV-KHEVSURETI PA			x					x		
	LAGODEKHI PA		x					x			
	KAZBEGI PA		x					x			
	BORJOMI-KHARAGAUII (Ktsia Tabatskuri)		x					x			
	BORJOMI-KHARAGAULI					x					x
Invasive plants	MTIRALA NP	x				x				x	
	KINTRISHI PA	x				x				x	
	LAGODEKHI PA			x		x		x		x	

6 Potential implementing partners, cost estimates and potential funding sources

		Estimated cost in USD											
INDICATOR	**PARK**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**Potential impl. Partners & Participants**	**Potential funding source**
Brown bear (*Ursus arctos*)	ANP				6 000					6 000		NACRES, volunteers, APA & Forestry rangers	CNF/GEF/UNDP, Fund for Bear and Nature Conservation
	MtNP			12 000					12 000				
	MaNP			10 000					10 000				
	KinPA			12 000					12 000				
	VPA				6 000					6 000			
	PKhPA				15 000					15 000			
	LPA				9 000					9 000			
	KazPA				9 000					9 000			
	BKhNP			25 000					25 000				
Bezoar goat (*Capra aegagrus*)	TPA & TPL	X	7 500			15 000			15 000			NACRES, volunteers, APA rangers	CNF/GEF/UNDP
	PKhPA	X	10 000			10 000			10 000				
East C. tur (*Capra cylindricornis*)	TPA & TPL		15 000				15 000			15 000		NACRES, volunteers, APA rangers	CNF/GEF/UNDP
	PKhPA		15 000				15 000			15 000			
	LPA			8 000				8 000			8 000		
	KaPA			9 000				9 000			9 000		
Red deer (*Cervus elaphus*)	TPA & TPL	X			6 000			6 000			6 000	NACRES, volunteers, APA & Forestry rangers	CNF/GEF/UNDP
	LPA		10 000			10 000			10 000				
	BKhNP		30 000			30 000			30 000				
Eurasian lynx (*Lynx lynx*)	VPA			8 000			8 000			8 000		NACRES, volunteers, APA rangers	CNF/GEF/UNDP
Goitered gazelle (*Gazella subguturosa*)	VPA											WWF, APA rangers	WWF
Ungulates: chamois and roe deer	MaNP	X	3 000				10 000				10 000		CNF/GEF/UNDP
	MtNP	X	3 000				10 000				10 000		

		Estimated cost in USD											
INDICATOR	PARK	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Potential impl. Partners & Participants	Potential funding source
	KinPA	X	3 000				10 000				10 000	NACRES, volunteers, APA rangers	
Bearded vulture (*Gypaetus barbatus*)	KaPA		3 000		3 000		3 000		3 000		3 000	NACRES, volunteers, APA rangers	CNF/GEF/UNDP
Eurasian griffon (*Gyps fulvus*)	KaPA		3 000		3 000		3 000		3 000		3 000	NACRES, volunteers, APA rangers	CNF/GEF/UNDP
Vultures:Egyptian vulture, Griffon	VPA (Eagle canyon)		500	500	500	500	500	500	500	500	500	NACRES, volunteers, APA rangers	CNF/GEF/UNDP
Black stork (*Ciconia nigra*)	VPA (Eagle canyon)		500	500	500	500	500	500	500	500	500	NACRES, volunteers, APA rangers	CNF/GEF/UNDP
Pheasant (*Phasianus colchicus*)	VPA		5 000		5 000		5 000		5 000		5 000	ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP
Caspian Snowcock (*Tetraogallus caspius*)	BKhNP		5 000			5 000			5 000			ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP, BirdLife Int.
Caucasian grouse (*Lyrurus mlokosiewiczi*)	BKhNP		5 000			5 000			5 000			ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP, BirdLife Int.
Velvet scoter (*Melanitta fusca)*	BKhNP (Tabatskuri)		5 000		5 000		5 000		5 000		5 000	ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP, BirdLife Int.
Great rosefinch (*Carpodacus rubicilla*)	KaPA		3 000		3 000		3 000		3 000		3 000	ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP, BirdLife Int.
Guldenstadt's Redstart (*Phoenicurus erythrogastrus*)	KaPA		3 000		3 000		3 000		3 000		3 000	ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP, BirdLife Int.
Migratory water birds	JPA			12 000		12 000		12 000		12 000		ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP, BirdLife Int.

		Estimated cost in USD											
INDICATOR	**PARK**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**Potential impl. Partners & Participants**	**Potential funding source**
Nesting colonial water birds	JPA			8 000		8 000		8 000		8 000		ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP, BirdLife Int.
Rubby shelduck (*Tadorna ferruginea*)	JPA			3 000		3 000		3 000		3 000		ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP, BirdLife Int.
Common crane (*Grus grus*)	JPA			3 000		3 000		3 000		3 000		ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP, BirdLife Int.
Woodpeckers	PKhPA		5 000			5 000			5 000			ISU, SABUKO, volunteers, APA rangers	CNF/GEF/UNDP, BirdLife Int.
	BKhNP		10 000			10 000			10 000				
Caucasian salamander (*Mertensiella caucasica*)	MaNP					3 000					3 000	ISU, volunteers, APA rangers	CNF/GEF/UNDP
	MtNP					3 000					3 000		
	KinPA					3 000					3 000		
	BKhNP					3 000					3 000		
Trout (*Salmo spp.)*	MtNP		4 000		4 000		4 000		4 000		4 000	ISU, volunteers, APA rangers	CNF/GEF/UNDP
	KinPA		4 000		4 000		4 000		4 000		4 000		
	TPA & TPL			8 000		8 000		8 000		8 000			
	PKhPA			7 000		7 000		7 000		7 000			
	BKhNP		8 000		8 000		8 000		8 000		8 000		
Benthic macroinvertebrates and fish composition	JPA			11 000			11 000			11 000		ISU, volunteers, APA rangers	CNF/GEF/UNDP
	BKhNP (Tabatskuri)			3 000			3 000			3 000			
Forest (permanent plots)	ANP		6 000									NACRES, NFI experts, volunteers, APA & Forestry rangers	CNF/GEF/UNDP
	MtNP		10 000										
	KinPA		9 000										
	MaNP								10 000				
	TPA & TPL			12 000									
	LPA		13 000										

		Estimated cost in USD											
INDICATOR	**PARK**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**Potential impl. Partners & Participants**	**Potential funding source**
Grasslands (pastures)	VPA		5 000					5 000				NACRES, Institute of Botany, volunteers, APA rangers	CNF/GEF/UNDP
	ANP			6 000					4 000				
	JPA				8 000					8 000			
	TPA & TPL			10 000					10 000				
	PKhPA			10 000					10 000				
	LPA		5 000					5 000					
	KPA		10 000					6 000					
	BKhNP (Ktsia Tabatskuri)		8 000					5 000					
	BKhNP					10 000					10 000		
Invasive plants	MtNP	x				5 500				5 500		Institute of Botany, Batumi Botanical Gardens, NACRES, volunteers, APA rangers	CNF/GEF/UNDP
	KinPA	x				5 500				5 500			
	LPA			5 500		5 500		5 500		5 500			
TOTAL			**226 500**	**178 000**	**98 000**	**154 000**	**121 000**	**86 000**	**222 000**	**147 000**	**114 000**		

7 Plan review and evaluation

A full review and evaluation of the monitoring plan will be conducted in 2025. The process will look at the overall implementation in order to reveal any general gaps and constraints and propose relevant adjustments and recommendations to improve the implementation process. The review will also critically assess the practical implementation of the monitoring activities including the field and data processing protocols and methodologies. It will be expected to detect any gaps and needs for the adjustment or modification of the protocols and/or applied field methods.

The review should be conducted by an independent evaluator(s).

Annex 1. High Priority Indicators for Specialised Monitoring Activities

Indicator	Current status of indicator (trend, population size)	Direct threat/pressure affecting indicator; Relation to ecosystem/habitat health	Possible management response	Comment
ALGETI NATIONAL PARK				
Mammals				
1. Brown bear (*Ursus arctos*)		- Poaching - Disturbance	- Strengthen law enforcement; - Reduce/control human presence in certain areas/times - Awareness raising	Important indicator in the national monitoring context; Emerald species. Suggested method: Census by non-invasive genetic method
2. European hare (*Lepus europaeus*)		- Poaching - Overgrazing - Disturbance by dogs etc.	- Strengthen law enforcement; - Ensure sustainable grazing	
Birds				
3. Woodpeckers		– Indicator of forest condition	Reduce pressure on forests and/or implement special measures	Relatively easy to monitor; Some are Emerald spp.
MTIRALA NATIONAL PARK				
Mammals				
1. Brown bear (*Ursus arctos)*		– Poaching, – Persecution as a result of human-bear conflict (HBC)	– Strengthen law enforcement; – Mitigate HBC – Awareness raising	Important indicator in the national monitoring context; Emerald species. Suggested method: Census by non-invasive genetic method
2. Ungulates: chamois and roe deer		– Poaching, – Disturbance	– Strengthen law enforcement; – Regulate tourism	Suggested method: index counts by camera trapping.
Birds				

Indicator	Current status of indicator (trend, population size)	Direct threat/pressure affecting indicator; Relation to ecosystem/habitat health	Possible management response	Comment
3. Woodpeckers		Indicator forest condition	– Reduce pressure on forests and/or implement special forest conservation measures	Relatively easy to monitor; Some are Emerald spp.
Reptiles and Amphibians				
4. Caucasian salamander (*Mertensiella caucasica*)	Total survey throughout the range conducted in 2019	Indicator of non-conservation friendly forestry practices (such as log pulling in stream beds)	- Eradicate harmful forestry practices - Awareness raising	
Fishes				
5. Brown trout (Salmo spp.)		- illegal fishing	- Strengthen law enforcement;	
KINTRISHI PROTECTED AREAS				
Mammals				
1. Brown bear (*Ursus arctos)*		– Poaching, – Persecution as a result of human-bear conflict (HBC)	– Strengthen law enforcement; – Mitigate HBC – Awareness raising	Important indicator in the national monitoring context; Emerald species. Suggested method: Census by non-invasive genetic method
2. Ungulates: chamois and roe deer		– Poaching, – Disturbance	– Strengthen law enforcement; – Regulate tourism	Suggested method: index counts by camera trapping and direct observation
Birds				
3. Woodpeckers		Indicator of forest condition	Reduce pressure on forests and/or implement special forest conservation measures	Relatively easy to monitor; Some are Emerald spp.
Reptiles and Amphibians				
4. Caucasian salamander (*Mertensiella caucasica*)	Total survey throughout the range	Indicator of non-conservation friendly forestry practices (such as log pulling in stream beds)	- Eradicate harmful forestry practices	

Indicator	Current status of indicator (trend, population size)	Direct threat/pressure affecting indicator; Relation to ecosystem/habitat health	Possible management response	Comment
	conducted in 2019			
Fishes				
5. Brown trout (*Salmo trutta*)		- illegal fishing	- Strengthen law enforcement;	
MACHAKHELA PROETCED AREAS				
Mammals				
1. Brown bear (*Ursus arctos)*		- Poaching, - Persecution as a result of human-bear conflict	- Strengthen law enforcement; - Mitigate HBC - Awareness raising	Important indicator in the national monitoring context; Emerald species. Suggested method: Census by non-invasive genetic method
2. Ungulates: chamois and roe deer		– Poaching, – Disturbance	– Strengthen law enforcement; – Regulate tourism	Suggested method: index counts by camera trapping and direct observation
Birds				
3. Woodpeckers		Indicator of forest condition	Reduce pressure on forests and/or implement special forest conservation measures	Relatively easy to monitor; Some are Emerald spp.
Reptiles and Amphibians				
4. Caucasian salamander (*Mertensiella caucasica*)	Total survey throughout the range conducted in 2019	Indicator of non-conservation friendly forestry practices (such as log pulling in stream beds)	- Eradicate harmful forestry practices	
VASHLOVANI PROTECTED AREAS				
Mammals				

Indicator	Current status of indicator (trend, population size)	Direct threat/pressure affecting indicator; Relation to ecosystem/habitat health	Possible management response	Comment
1. Brown bear (*Ursus arctos)*	Extremely small population; Up 10 individuals.	- Poaching, - Illegal killing at nearby agricultural fields	- Strengthen law enforcement; - Reduce/control human presence in certain areas/times - Awareness raising	Important indicator in the national monitoring context; Emerald species. Suggested method: Census by non-invasive genetic method
2. Goitered gazelle (*Gazella subguturosa*)	Increasing	- Poaching; - Disturbances associated with livestock grazing and tourism.	- Strengthen law enforcement; - Reduce/control human presence in certain areas/times - Expand PA - Awareness raising	Suggested method: Direct observation on standardized transects
3. Eurasian lynx *(Lynx lynx)*	10-15 individuals	- Poaching; - Depletion of food base (chukar, hare, etc.).	- Strengthen law enforcement;	L:ast assessment was carried out in 2012
4. European hare (*Lepus europaeus*)		- Poaching - Overgrazing (indicator of condition of grasslands) - Sheep dogs	- Strengthen law enforcement; - Sustainable pasture management	
Birds				
5. Vultures: Egyptian vulture, Griffon		- Persecution	- Strengthen law enforcement; - Awareness raising	Monitoring site: the Eagle canyon. Suggested approach/method: Monitor active nests. Need to be seen in the light of national monitoring context. National priority.
6. Pheasant (*Phasianus colchicus*)		- Poaching;	- Strengthen law enforcement;	

Indicator	Current status of indicator (trend, population size)	Direct threat/pressure affecting indicator; Relation to ecosystem/habitat health	Possible management response	Comment
		- Disturbance associated with grazing; - Field fires.	- Awareness raising	
7. Black stork		- Tourism and other disturbance	- Regulate visitor numbers and behaviour	Eagle canyon
JAVAKHETI PROTECTED AREAS				
Birds				
1 Migratory water birds		- Illegal hunting - Disturbance	- Strengthen law enforcement; - Awareness raising	
2 Nesting colonial water birds (Armenian gull, Dalmatian pelican, great white pelican)		- Illegal hunting; - Disturbance.	- Strengthen law enforcement; - Awareness raising	
3 Ruddy shellduck (*Tadorna ferruginea)*		- Illegal hunting; - Disturbance.	- Strengthen law enforcement; - Awareness raising - Strictly protect moulting sites at lakes Bughdasheni and Kartsakhi	
4 Common crane (*Grus grus*)		- Indicator of undisturbed area/protection level	- Reduce disturbance	Important in the national and global context
Fishes and freshwater invertebrates				
5. Benthic macroinvertebrates and fish composition	Baseline exist	Indicator of water quality and overfishing	- Fishing management; - livestock watering management at lakes	Kartsakhi assessed in 2019. Khanchali and Madatapa assessed in 2014-2017 by ilia state university. Yearly monitoring is recommended
TUSHETI PROTECTED AREAS AND TUSHETI PROPTECTED LANDSCAPE				
Mammals				
1. Bezoar Goat (*Capra aegagrus)*	Approx. 310 individuals	– Poaching; – Disturbance	– Strengthen law enforcement; – Improve tourism management;	Suggested approach/method: Direct observations.

Indicator	Current status of indicator (trend, population size)	Direct threat/pressure affecting indicator; Relation to ecosystem/habitat health	Possible management response	Comment
			– Awareness raising	Last assessment was carried out in 2013
2. East Caucasian tur (*Capra cylindricornis*)	Approx. 1500 individuals	– Poaching; – Disturbance	– Strengthen law enforcement; – Improve tourism management; – Awareness raising	Suggested approach/method: Direct observations. Last assessment was carried out in 2014
3. Red deer (*Cervus elaphus*)		– Poaching; – Disturbance	– Strengthen law enforcement; – Improve tourism management; – Awareness raising	Suggested approach/method: Direct observations, camera trapping.
Birds				
5. Woodpeckers		Indicator of forest condition	Improve or accordingly plan forest management.	Relatively easy to monitor; Some are Emerald spp.
Fishes				
6. Brown trout (*Salmo trutta*)		- illegal fishing	- Strengthen law enforcement;	
PSHAV-KHEVSURETI PROTECTED AREAS				
Mammals				
1. Bezoar Goat (*Capra aegagrus)*	About 50 individuals	– Poaching; – Disturbance – Tourism	– Strengthen law enforcement; – Awareness raising	Suggested approach/method: Direct observations. Last assessment was carried out in 2013.
2. Eastcaucasian tur (*Capra cylindrcornis*)	70-143 individuals	– Poaching; – Disturbance	– Strengthen law enforcement; – Awareness raising	Suggested approach/method: Direct observations. Last assessment was carried out in 2014

Indicator	Current status of indicator (trend, population size)	Direct threat/pressure affecting indicator; Relation to ecosystem/habitat health	Possible management response	Comment
3. Brown bear (*Ursus arctos*)		– Poaching		Suggested approach/method: non-invasive genetic method Important in the context of the national monitoring.
Birds				
4. Woodpeckers		Indicator of forest condition	Improve forest management practices as appropriate	Pshavi area. Easy to monitor; Some are Emerald spp. (in managed reserve)
Fishes				
5. Brown trout (*Salmo trutta*)		- illegal fishing	- Strengthen law enforcement;	
LAGODEKHI PROTECTED AREAS				
Mammals				
1. Red deer (*Cervus elaphus*)	Minimum 74 individuals	- Poaching; - Disturbance incl. from tourists	- Strengthen law enforcement; - Improve tourism management; - Awareness raising	Suggested approach/method: pallet group counts. Last assessment was carried out in 2018
2. Eastcaucasian tur (*Capra cylindricornis*)	Minimum 505 individuals	- Poaching; - Disturbance incl. from tourists	- Strengthen law enforcement; - Improve tourism management; - Awareness raising	Suggested approach/method: Direct observations. Last assessment was carried out in 2019
3. Brown bear (*Ursus arctos*)		- Poaching; - Disturbance incl. from tourists	– Strengthen law enforcement; – Reduce/control human presence in certain areas/times	Suggested method: Census by non-invasive genetic method Important indicator in the national monitoring context; Emerald species.
Birds				

Indicator	Current status of indicator (trend, population size)	Direct threat/pressure affecting indicator; Relation to ecosystem/habitat health	Possible management response	Comment
4. Woodpeckers		Indicator of forest condition	Improve forest management practices as appropriate	Easy to monitor; Some are Emerald spp. (in managed reserve)
KAZBEGI PROTECTED AREAS				
Mammals				
1. Eastcaucasian tur (*Capra cylindricornis*)	About 800 individuals	– Poaching; – Disturbance incl. from tourists and sheep grazing	– Strengthen law enforcement; – Improve tourism management; – Awareness raising	Suggested approach/method: Direct observations. Last assessment was carried out in 2014
2. Brown Bear (*Ursus arctos*)		– Poaching; – Disturbance	– Strengthen law enforcement; – Reduce/control human presence in certain areas/times	Important indicator in the national monitoring context; Emerald species. Suggested method: Census by non-invasive genetic method
3. Long-clawed mole vole (*Prometheomys schaposchnikovi*)		– Overgrazing; – Disturbance	- Improve pasture management and/or grazing practices as appropriate - Restrict human presence in specific areas	Very sensitive species; Endemic genus/species with fragmented range.
Birds				
4. Bearded vulture (*Gypaetus barbatus*)		– Persecution	– Strengthen law enforcement; – Awareness raising	
5. Eurasian griffon (*Gyps fulvus*)		– Persecution – Helicopter flights – Tourism (such as recreational infrastructure incl. a zipline and operation)	– Strengthen law enforcement; – Awareness raising	
6. Great rosefinch (*Carpodacus rubicilla*)		– Habitat destruction	Protect habitat/wintering sites	Monitor wintering sites.

Indicator	Current status of indicator (trend, population size)	Direct threat/pressure affecting indicator; Relation to ecosystem/habitat health	Possible management response	Comment
7. Guldenstadt's Redstart (*Phoenicurus erythrogastrus*)		– Habitat destruction	Protect habitat/wintering sites	Monitor wintering sites
BORJOMI-KHARAGAULI NATIONAL PARK				
Mammals				
1. Red deer (*Cervus elaphus*)	300-500 individuals	– Poaching; – Disturbance incl. from tourists – Large infrastructure development	– Strengthen law enforcement; – Reduce/control human presence in certain areas/times	Suggested approach/method: pallet group counts. Last assessment was carried out in 2015
2. Brown bear (*Ursus arctos*)	38-47 individuals	– Poaching; – Disturbance incl. from tourists Large infrastructure development	– Strengthen law enforcement;	Important indicator in the national monitoring context; Emerald species. Suggested method: Census by non-invasive genetic method Last assessment was carried out in 2014.
Birds				
3. Caspian Snowcock (*Tetraogallus caspiuss*)		– Poaching; – Disturbance incl. from tourists and sheep grazing	– Strengthen law enforcement; – Improve tourism and grazing management	Monitoring should focus on the Zekari pass area (Important in the light of new road infrastructure project)
4. Caucasian grouse (*Lyrurus mlokosiewiczi*)		– Poaching; – Disturbance incl. from tourists and sheep grazing.	– Strengthen law enforcement; – Improve tourism and grazing management.	Monitoring should focus on the Zekari pass area (Important in the light of new road infrastructure project)
5. Velvet scoter (*Melanitta fusca)*		– Poaching; – Egg collection; – Unsustainable mowing	– Strengthen law enforcement; – Ban/control egg collection – Protect specific sites.	Monitoring site: Ktsia-Tabatskuri Lake
6. Woodpeckers		Indicator of forest condition	– Improve forest management / fuelwood extraction practices	Relatively easy to monitor; Some are Emerald spp.

Indicator	Current status of indicator (trend, population size)	Direct threat/pressure affecting indicator; Relation to ecosystem/habitat health	Possible management response	Comment
Reptiles and Amphibians				
7. Caucasian salamander (*Mertensiella caucasica*)	Total survey throughout the range conducted in 2019	Indicator of non-conservation friendly forestry practices (such as log pulling in stream beds)	- Eradicate harmful forestry practices	
Fishes				
8. Brown trout (*Salmo trutta*)		- illegal fishing	- Strengthen law enforcement;	
9. Benthic macroinvertebrates and fish composition in lake Tabatskuri	Baseline exist	Indicator of water quality and overfishing	- Fishing management; - livestock watering management at lakes	Only in Tabatskuri lake. Baseline carried out by Guchmanidze

Annex 2. Short list of indicators for flora, habitats and forest pathogens

Algeti NP

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment
1. Forests		- Timber/fuelwood extraction		
2. Meadows		- Grazing	- Strengthen law enforcement; - Ensure sustainable grazing	Suggested method: permanent sample plots.

Mtirala NP

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment
1. Colchic forest			- Reduce pressure on forests and/or implement special measures; - Awareness activities.	Suggested method: permanent sample plots.
2. Forest pathogens			Implement measures that are compatible with PA regulations and conservation objectives.	
3. Alien invasive plants			Implement measures to control/eradicate alien plants as appropriate	

Kintrishi PA

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment
1. Colchic forest			- Reduce pressure on forests and/or implement special measures;	Suggested method:

			- Awareness activities.	permanent sample plots.
2. Pontic oak (*Quercus pontica)*		Ilegal felling.		Important rare endemic
3. Forest pathogens			Implement measures against forests pests that are compatible with PA regulations and conservation objectives.	
4. Alien invasive plants			Implement measures to control/eradicate alien plants as appropriate	

Machakhela PA

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment
1. Colchic forest			- Reduce pressure on forests and/or implement special measures; - Awareness activities.	Suggested method: permanent sample plots.
2. Forest pathogens			Implement measures against forests pests that are compatible with PA regulations and conservation objectives.	
3. Alien invasive plants			Implement measures to control/eradicate alien plants as appropriate	

Vashlovani PA

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment
5. Arid light woodlands	Decreasing	Illegal cutting for fuelwood; fire Grazing.	Improved law enforcement incl. control and preventing of illegal cutting	Suggested method: permanent sample plots.
6. Grasslands		Grazing	- Strengthen law enforcement; - Ensure sustainable grazing	Suggested method:

				permanent sample plots.
7. Decideous forest on Shavi Mta		Illegal cutting for fuelwood and timber.	Improved law enforcement incl. control and preventing of illegal cutting	Suggested method: permanent sample plots.

Javakheti PA

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment
Wetland vegetation		- Grazing - Drainage	- Control grazing; - Resore hydrological regeme.	Suggested method: permanent sample plots.
Alien invasive plants			Implement measures to control/eradicate alien plants as appropriate	

Tusheti PA and Tusheti PL

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment
4. Pine and deciduous forests		- Timber extraction - Grazing	- Reduce pressure on forests and/or implement special measures; - Awareness activities.	Suggested method: permanent sample plots.
5. High mountain meadows		- Grazing; - Climate change.	Sustainable pasture management	Suggested method: permanent sample plots.
6. Forest pathogens			Implement measures against forests pests that are compatible with PA regulations and conservation objectives.	

Pshav-Khevsureti PA

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment
1. Forest		- Timber extraction - Grazing	- Reduce pressure on forests and/or implement special measures; - Awareness activities.	Suggested method: permanent sample plots.
2. High mountain meadows		- Grazing; - Climate change.	Sustainable pasture management	Suggested method: permanent sample plots.

Lagodekhi PA

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment
1. Forest in Managed Reserve		- Timber extraction	- Reduce pressure on forests and/or implement special measures;	Suggested method: permanent sample plots.
2. Meadows in upstream Kabali		- Grazing; - Climate change.	Sustainable pasture management	Suggested method: permanent sample plots.
3. Alien invasive plants			Implement measures to control/eradicate alien plants as appropriate	

Kazbegi PA

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment

1. Forest		- Timber extraction	- Reduce pressure on forests and/or implement special measures;	Suggested method: permanent sample plots.
2. High mountain meadows		- Grazing; - Climate change.	Sustainable pasture management	Suggested method: permanent sample plots.

BKNP

Indicator	Current status of indicator (if avaialble)	Direct threat/pressure affecting indicator	Possible management response	Comment
1. Forest		- Timber extraction	- Reduce pressure on forests and/or implement special measures;	Suggested method: permanent sample plots.
2. Meadows		- Grazing; - Climate change.	Sustainable pasture management	Suggested method: permanent sample plots.
3. Forest pathogens		-	Implement measures against forests pests that are compatible with PA regulations and conservation objectives.	

Annex 3: Monitoring protocols for the selected priority indicators

Brown bear (*Ursus arctos*)

Justification

Poachers target brown bear among other game species in the protected areas. Brown bear has slow reproductive rate – females give birth once in two year. Hence, bear population is sensitive to illegal hunting pressure and responds to the threat with rapidly decline of the population.

Human – bear conflict is very high in some protected areas. Bear ride agricultural fields and attack livestock. Locals try to protect their agricultural fields with lethal methods (traps, el fences powered by house electricity etc.), or even hunt on the species. Local population's attitude toward protected areas becomes negative due to conflict. Hence, it is important to have good understanding of the species status and trend in those protected areas where the conflict is intense. Bear monitoring data would help managers to better understand the conflict root causes, address the issue through public awareness and justifying importance of nonlethal protection methods among the local population.

Brown bear sometimes called umbrella species – protecting the species and its habitat let many other species to thrive. The conservation approach can be used to assess effectiveness of the protected areas. If the brown bear population conservation status is favourable it means that the protected area highly effective and many other large mammals that share bear habitat can be considered well protected.

Brown bear is included in the national red list as EN. It is Emerald species too and Bern convention obligates Georgia to monitor the species. The species assessment in the selected protected areas will greatly contribute to the species monitoring on national level.

Baseline data

Robust baseline data is available for Borjomi-Kharagauli protected areas. In 2004 NACRES team estimated the minimum bear numbers using non-invasive genetic sampling method in Borjomi-Kharagauli PAs and nearby territories (areas around Bakuriani town). We were able to calculate minimum number only and according DNA analysis of the bear fecal samples at least 28 bears were present in the study area (Murtskhvaladze and Tarkhnishvili 2006). Based on these results, we calculated minimum bear density within our study area as approximately 1.3 bears/100 km2 (Lortkipanidze B. 2010).

In 2014 NACRES estimate bear population in Borjom-Kharagauli protected area with the same field method. We fulfilled all method requirements and counted 38-47 individuals with 95% CI. Bear density was 1.9 - 2.3 bears per 100 km^2.

Robust data on bear population number in other protected areas are not available.

Sampling protocol

a) **Selecting field method**

Bear population assessment was always one of the difficult tasks for wildlife managers and conservationist. Scientists used track count method to assess brown bear population number during Soviet Union period. The method was based on the assumption that individual identification is possible via track measurements. The method is not recognized by scientific world as it is extremely biased. Species assessment method with camera traps without individual recognition was developed by Rowcliffe and their colleagues (2008). However, field tests showed that the method prone to overestimation.

Non-invasive genetic sampling method is the most accurate and robust method to count elusive animals in forested study areas. The method is not cheap as it comprises expensive DNA test for individual identification. However, the results are undisputable unless study is properly designed and all main method requirements are met.

Non-invasive genetic sampling has different approaches depending on experience, available funds and time. NACRES team tested and successfully implemented collecting fecal samples for genetic analysis and using Capture Mark Recapture model for population assessment. The method has the following advantages: data collection is very simple and could be done by everyone after short field trainings; data collection can be done in relatively short period of time and the assessment result is robust.

b) Field method

Conventional Capture Mark Recapture (CMR) model has the following general requirements: (1) data collection process had to be as short as possible to ensure population closure; (2) data had to be collected during independent set of fieldworks and time interval between these sets should be no longer than 1 week (preferable 5 days); (3) Study area had to be sampled evenly so that all bear individuals had equal detection probability.

Study area should be outlined so that it includes bear subpopulation in the region. Study area borders can follow geographic formations and/or infrastructures that potentially restrict bear movement (at least during sampling period). Grid should be placed on the study area and each grid should be sampled. Grid cell size should be less than minimum bear home range size to ensure that each bear has equal detection probability.

Fieldwork should be conducted in late summer – beginning of autumn. First fieldwork should be dedicated to test the preliminary outlined routes and clear the rout from all bear fecals. Data collection should be started after a week on the tested routes. At least 5 set of fieldwork should be carried out and complete data collected before intensive snowing has begun.

Series of meeting should be carried out with protected area administrations. The method should be carefully explained to the PA administration and rangers. The fieldwork schedule and routes should be carefully planned together with PA staff. Short training of the rangers and volunteers should be carried out just before the field exercise.

NACRES used sample collecting protocol that was mainly based on the recommendations and guidelines described in “Common Guidelines for the Genetic Study of Brown Bears (*Ursus arctos*) in Southern Europe” (Karamanlidis et al. 2009). Some field technics were adapted to local environment and designed sample labelling system included in the guidelines (please see appendix #1).

Ilia state university has genetic laboratory and experience to carry out bear fecal sample analysis. The lab carried out genetic analysis of bear fecals samples from Borjomi-Kharagauli PA in 2014. However, genetic labs from Europe can be also considered as potential partner in the bear genetic study.

Testing the genetic laboratory work is also advisable. Up to 20 bear fecal samples should be copied and sent to independent, highly experienced laboratory that specialised on bear research. The independent laboratory should do genetic analysis with the same protocol and send results to for evaluation. The result should be compared and possible bias identified.

Sampling frequency and seasons

Bear assessment should be carried out once in five years.

Fieldwork should be conducted in late summer – beginning of autumn. Preferably fieldwork should start in September. If target protected area locate in high mountains fieldwork should be started already in August.

Required human resources

Zoologist, experienced field experts, trained rangers. Some PA administrations are busy to distribute firewood to locals in autumn and they cannot possibly mobilize enough rangers for the fieldworks. Therefore, Involving volunteers in the data collection process can be essential to collect enough data to meet the method requirements.

Data base, data analysis and outputs

Collected samples should be evaluated (fecal volume in tubes, level of the ethanol, label and etc.) and stored in freezer, before sending them to genetic lab. Sample data should be sorted in simple database and locations should be mapped. Results of sample gen analysis should be analysed by an experienced personal. Bear population number with 95% confidence interval is desirable.

The assessment outputs will include population density and size.

Equipment and service needs and costs

At least three field teams composed of 2 trained collectors will collect data in the field. Fieldwork planning and data analysis is performed by an expert aided by a GIS expert. Each field team should equipped with a GPS, bear sampling protocol, topographic maps, 50 ml. sample tubes filled with 95% ethanol, pencils, markers, notebooks. Transportation: a 4X4 field vehicle in all 9 protected areas is needed and horses for Lagodekhi, Pshav-Khevsureti and Borjomi-Kharagauli PA.

The estimated total cost is USD 104,000 for nine protected areas.

Bezoar goat (*Capra aegagrus*)

Background and baseline data

The first comprehensive baseline studies of biodiversity and threats to species and habitats in Tusheti protected areas were conducted by NACRES in 2004 within the *Georgia Protected Areas Development Project* (GEF/WB). As a result of those studies, the abundance and other population parameters were estimated for the bezoar goat population and relevant distribution maps were produced. The population was estimated at about 100 individuals in 2004. We carried out the next bezoar goat assessments in Tusheti in the autumn of 2010 and then of 2011. Those assessments found that a total of about 180 individuals inhabited Tusheti protected areas. We conducted surveys in Khevsureti in summer 2013 and found that only 40-50 individuals remained in northern part of the region, close to the Russian border. Ilia state university carried out two bezoar goat assessments throughout its range and counted 200 individuals in 2012 and 310 individuals in 2013.

Hence, solid baseline data are available for the national bezoar goat population (in Georgia, the species only occurs in Tusheti and Khevsureti. Thus the population of those regions is technically the national population too).

Methodology

Two surveys, the first during the post-parturition season in June-July and the second during the rut in November-December are recommended in the Mountain Ungulates Monitoring Protocol developed by P. Weinberg[1]. However, during the rutting season i.e. late autumn through December, the access to the study areas is extremely limited. The only way to reach the wild goat areas during that time of year would be by a helicopter, which is not only very expensive but also logistically challenging to organize, among other things due to unpredictable weather. Therefore, we need to modify the above protocol to adapt it to the given circumstances; we will begin field surveys in the end of September and continue through the beginning of October, which is the latest possible time for the fieldwork. The second count will be conducted in 2021.

The last bezoar goat survey was carried out 7 years ago. Therefore, we need to reconsider the range of the species in both parks. Short meetings/workshops will be organized at the Tusheti and Khevsureti administrations and NACRES field team will obtain the most recent bezoar goat location data from the park rangers. Based on the local knowledge, the bezoar goat ranges will be updated and fieldwork will be planned accordingly.

Bezoar goat population assessment will largely rely on direct observations. We intend to use the same observation points that we used during the previous surveys. We had 18 points in Tusheti PA and 6 observation points in Khevsureti. Those observation points were distributed in a way that minimized the risk of double counts (that is counting one and the same individual more than once).

[1] *Veynberg, P. (2012). Monitoring Programme for Mountain Ungulates in Azerbaijan. Baku: GIZ Programme on Sustainable Management of Natural Resources, Southern Caucasus;*

Three observation teams will work simultaneously. Each field team will include at least two trained observers, if possible, accompanied by a ranger. The team will conduct visual counts of bezoar goat herds from predefined observation points. Each team will be equipped with a spotting scope and at least two pairs of binoculars (a spotting scope is necessary for detailed counting of individuals and sex and age identification; binoculars will be used for scanning the area and to spot bezoar goat herds or individual animals). Weather permitted, two observations will be carried out each day; the first will begin at dawn and will continue for the duration about 2 hours; the second will be conducted in late evening. A special field form (similar to that used earlier for the East Caucasian tur counts in Lagodekhi) will be filled in for each observation session. The highest number of individuals recorded per observation point for the day will be used in the final analysis. We will also map bezoar group locations to help data analysis. The observers will also write down any additional data such as interesting behavior of the observed animals.

East C. tur (*Capra cylindricornis*)

Red deer (*Cervus elaphus*)

Background and baseline data

There are two main red deer populations in Georgia, in Borjomi-Kharagauli NP and in Lagodekhi PAs. In 2013, a red deer was spotted in Tusheti for the first time in many years. Since then, this species was sighted regularly by the rangers as well as locals and visitors. According to Tusheti PA administration, the population is growing and has presently reached about 50 individuals. However, the Tusheti red deer population has never been surveyed by experts. Therefore, the first step should involve (i) mapping the red deer range in Tusheti and (ii) assessing the overall status of the population via camera trapping. Hence, these will be the main objectives of the 2020 red deer survey in Tusheti. Based on the survey findings i.e. a very rough estimate of population density, we will be able to determine if more robust population assessment techniques are appropriate.

The method of fecal pellet group count is a widely used field technique to count deer populations in forested habitats[2]. This method provides density indices as well a true population number. It is relatively cheap, not requiring any expensive equipment, and is relatively easy to use after some training. The population size calculation by this method involves *the fecal pellet group decay rate*. A special experiment is required to calculate this value specifically for the given study area. We ran such an experiment in Borjomi-Kharagauli protected areas in 2014 and calculated the average fecal pellet group decay rate for the study area. T*he fecal pellet group decay rate* is not available for Lagodekhi. Therefore, we plan to initiate a red deer fecal pellet group decay experiment in Lagodekhi in ordered to prepare for the red deer population counts, presumably next year.

[2] Mayle B. A., Peace A. J., Gill M. A. R. (1999) How Many Deer – A field guide to estimate deer population size, book, pages: 46-59;

Red deer range mapping

As a first step, we will have a short meeting with Tusheti PA administration in order to outline the preliminary red deer range in Tusheti. We will use all the data, available at the administration such as observations by rangers, camera trap data and anecdotal information from local population. We will subsequently plan field surveys.

We plan to install up to 20 camera traps throughout the potential red deer range and leave them in the field to collect data for about six months. The cameras will collect data on red deer presence and their activity. The cameras will not be placed at high elevations to avoid damage or interruption of data collection due to deep snow during the winter months (the animals are also anyway likely to migrate to lower elevations). Camera trap sites will be carefully selected after detailed study of the area, during which time we will also record all red deer signs such as footprints, pellet groups, etc. GPS locations will be recorded for each sign or sighting for subsequent mapping.

Fecal pellet group decay experiment

We plan to start the *Fecal pellet group decay experiment* in October. We will collect 10 - 15 fresh red deer fecal pellet groups and place them in different areas throughout the deer habitat at varying altitude. Each site will be marked to help us locate them in subsequent regular visits. Park rangers will be involved in monitoring the red deer pellet groups. The observers, who will be trained in advance, will visit each site once a month and document the condition of the fecal pellet group as well as take photos. We will intensify the observations (i.e. make more frequent visits to the sites) if there is a sign of the pellet groups decaying at a faster rate than expected. The fecal pellet group will be considered decayed if pellets are no longer visible or if there are less than 6 pellets left. The decay rate will be calculated using the period from the day the experiment began till the last visit.

Eurasian lynx (*Lynx lynx*)

Goitered gazelle (*Gazella subguturosa*)

Ungulates: chamois and roe deer

NACRES conducted training in biodiversity monitoring technics and methodology for Mtirala, Kintrishi and Machakhela administrations in 2017. Nevertheless, those admirations are not capable of planning and implementing of robust large mammal studies with camera traps or more so, of analyzing field data. Yet, the camera trap data collected by the local rangers and natural resources specialists are very valuable and will serve as a good basis for planning of more intensive camera trapping in Mtirala, Kintrishi and Machakhela PAs.

While the main focus will be on roe deer and chamois, the planned comprehensive camera trapping will produce valuable data on other wildlife too.

Methodology

Camera trapping can be successfully used to obtain overall status of an ungulate population in forested ecosystem. NACRES has been using this technique for field data collection on larger mammals throughout Georgia for more than two decades and we consider it a suitable method for ungulate survey in Adjara PAs too.

Camera trapping in Adjara PAs will help collect data on the following:

- Roe deer and chamois distributions
- Some aspects of habitat use by roe deer and chamois
- Animals' daily activity
- Ungulate response to disturbance such as tourism, grazing, etc.
- Data on other mammal species

In order to collect credible data on the above aspects, the camera trapping need to be planned and implemented properly, camera traps sites must be carefully chosen and each device need to be installed correctly. We will collect existing camera trap data from each protected area, sort, map and analyze them. Then, using GIS analysis, we will identify key habitats, place grid on the study area and evenly distribute about 20 camera locations in each protected areas.

Sufficient number of camera traps will be purchased and their installation will begin in November. We will avoid higher elevation sites, as snow cover can interrupt data collection process during the winter. We will identify trails that are actively used by the ungulates to place camera traps. Camera traps will be visited and checked regularly at least once in three month and preferably remain in the field for a full year. All data obtained by the camera traps will be entered into a special database and analyzed at NACRES office.

Bearded vulture (*Gypaetus barbatus*)

Eurasian griffon (*Gyps fulvus*)

Vultures: Egyptian vulture, Griffon

Black stork (*Ciconia nigra*)

Pheasant (*Phasianus colchicus*)

Caspian Snowcock (*Tetraogallus caspius*)

Caucasian grouse (*Lyrurus mlokosiewiczi*)

Velvet scoter (*Melanitta fusca)*

Great rosefinch (*Carpodacus rubicilla*)

Guldenstadt's Redstart (*Phoenicurus erythrogastrus*)

Migratory water birds

Nesting colonial water birds

Rubby shelduck (*Tadorna ferruginea*)

Common crane (*Grus grus*)

Woodpeckers

Caucasian salamander (*Mertensiella caucasica*)

Trout (*Salmo spp.)*

Benthic macroinvertebrates and fish composition

Forest ecosystems

Grasslands (Pastures)

Justification

Sustainable use of natural pastures is a problem for many Protected Areas of Georgia. Hay meadows and pastures of Georgia are natural and semi-natural habitats which require sustainable management to prevent their degradation. The types of grassland vegetation in Georgia includes ecologically different phytocoenosis, which significantly varies under the influence of different elevations above sea level, moisture, exposition and other biophysical parameters. The unsustainable use of pastures and forest areas leads to erosion, degradation, desertification and loss of biodiversity in high mountain areas of the South Caucasus. Natural grasslands, which have been used as pastures and hay meadows for centuries, are especially affected.

Grazing still remains one of the most important factors, which affects the ecological condition of the pastures – in the Greater Caucasus region in general. Unfortunately in many cases, the pace of degradation of pasture vegetation significantly exceeds that of restoration that in most cases excludes the possibility of natural self-regeneration of vegetation. An extremely dire situation can be observed on winter pastures, where along with overgrazing a process of desertification has started.

Climate change has an extremely negative impact on hay meadows and pastures. Alpine and semi-arid hay meadows and pastures are especially sensitive to changes in climate. It is obvious that the rise in global temperature will have a strong effect on high montane plant species which are adopted to low

temperatures. Due to influence of climate change factors and decrease in population of livestock in high mountainous regions, it is observed that subalpine and alpine pastures are being naturally forested.

More than 100 000 ha of actual grassland used as pastures in Protected Areas (PAs) represent a mix of different geobotanical vegetation types. The responsibility for managing these pasture was assigned to the Agency of Protected Areas some years ago. Most of them are classified as natural alpine grasslands, naturally occurring above timberline in Greater and Lesser Caucasus region. In addition, semi-arid natural grasslands are important part for such protected areas as Vashlovani National Park and Chachuna Managed Reserve.

There were miscellaneous opinions about the condition of pastures in PAs, since there was no information about de-facto users, borders and conditions of pastures. In recent years, investigations to assess pasture conditions in Protected Areas, have taken place via the Technical Assistance of international organizations. With the support of international donors and local partners. The pastures in several Protected Areas have already been assessed and respective management plans are developed.

The state of the pastures was evaluated using "Monitoring Manual for Summer Pastures in the Greater Caucasus in Azerbaijan (Jonathan Etzold and Regina Neudert 2013)", which has been adapted to the Georgian conditions. The quantity and quality of fodder of grasslands were determined by its composition of plant species and growing conditions and human land use practices.

Monitoring protocol

Approximation of spatial distribution of pasture types

At the beginning of the implementation process, available data will be compiled for the project area. The collection of spatial data includes a digital elevation model, ortho- and/or satellite images, administrative borders, information on existing infrastructure (roads, settlements, etc.), existing land use and/or land cover maps (e.g. from national management plan development) and data on historical land use data (e.g. old pasture zonation or land lease maps). Pasture classification and definition of the main different pasture types will be based on geobotanical criteria.

Based on the results of the satellite image analysis, a basic land cover map for Pas' pasture land area will be prepared. Based on the descriptive information on the different pasture vegetation types (elevation, exposition, inclination, geology/soil, biomass etc.) and the coordinates of the vegetation samples collected in the field, a spatial break down (extrapolation) will be done. This will give spatial information on the distribution of plant communities and biomass.

To analyse the spatial distribution at a local level, the focus area will be divided into watersheds. The watersheds are representing ecological sub-units and will be described with regard to available area of pastures, potential fodder biomass, and vegetation cover including also the elevation, exposition and inclination of each catchment.

Assessment of pasture types

To describe the different geobotanical vegetation types, a set of vegetation plots needs to be assessed in the field. The assessment of plots will be done in accordance of the methodology of Etzold & Neudert 2013.

The methodology enables assessment of erosion indicators. The base format is 10x10m. The sample has to cover different elevations, exposition and inclination as well as different stand conditions (water: dry/balanced/wet sites; nutrients: poor to rich sites; pH: basic to acid sites). The plots should be located along linear transects from the valley to the upper edge of pastures. The species richness will be indicated for each plot. Indicator plant species (like legumes, grasses or invasive species) will be selected for each type of pasture.

Experience from Tusheti National Park shows that 70-80 plots can be done by a team of three people in difficult terrains (subalpine and alpine pastures) in one season. For a total number of 70-100 samples is expected to be adequate.

To describe the different geobotanical vegetation types a set of vegetation plots needs to be assessed in the field. The methodology will be extended by a vegetation plot of 5x5 m in the upper left corner of the main plot. As the focus of the assessment is the geobotanical classification of the pasture types a reduced set of indicators will be assessed on each plot. The indicators will include site information (elevation, inclination, soil type …) and full botanic information. Particular attention will be paid on endangered (red listed) and endemic species or habitats in project area, as well as legume species. A list of target species and habitats will be selected in close cooperation with the authorities responsible for conservation (APA, Protected Area administration).

Assessment of fodder quality and quantity

To assess the quality of the fodder harvesting samples from most frequent pasture-vegetation types will be selected. From each pasture type three samples from different location will be collected.

On a plot of 1x1m the whole living biomass above ground will be harvested with garden scissors and the fresh weight will be assessed directly in the field. The sample will be identified by a unique ID of the geobotanical sample plot. The biomass will be dried and stored for further analysis.

This analysis will give an overview on the amount of fodder growing per year and hectares and will give information on different components of the fodder. This will give important information which pastures are suitable for which type of livestock, the maximum carrying capacity and potential deficits in the nutrition of the livestock.

The outputs of the activities are the following:

After the season of field work a statistic analysis of the vegetation plots will be done and a first description of pasture types and maps will be prepared. All data will be incorporated in final database and presented in report. This document will assess vegetation and can give precise information on the biodiversity of pastures, fodder quality and ecological and floristic categories of the main pasture types in project area. These outputs provide indispensable base information for any sustainable resource management in PAs. Potential influence of grazing on biodiversity of pastures. These outputs provide indispensable base information for any sustainable resource management.

Invasive plants

Background

Invasive alien plants (IAPs) are considered worldwide the second most important threat to biodiversity after land use change and their impact is expected to increase under climate change. West Georgia and especially, Adjara is susceptible to considerable biological invasions being entry ports for many invasive alien plants originated in different parts of the world.

Kintrishi and Mtirala national parks established to protect and conserve Colchis forest and other important ecosystems as well as Lagodekhi PA are known to be impacted by invasive alien plant species. The monitoring of populations of most notorious species will assist in effective control and prevention of further spread of these harmful organisms.

Monitoring protocol

Most important, posing highest threat and/or those showing highest trend or potential of spreading and penetrating the natural ecosystems will be selected for the park in question. For each target species transects will be established in the protected area to identify and quantify the abundance of invasive plants in disturbed and undisturbed sites. Transects will be then completed to gather data on their distribution.

Forest ecosystems

Justification

Forests are a dominant vegetation type in most protected areas in Georgia covering a total of XXX ha throughout the PA system. The forests that are found in strict nature reserves and strict protection zones of national parks are strictly protected and no exploitation of forest resources is permitted there. Those that are found in traditional use zones of national parks or managed reserves are used for restricted and controlled extraction of fuelwood and timber or exclusively of fuelwood for the local communities. Biodiversity and forest cover monitoring is central to managing protected areas effectively. Monitoring programs should provide protected area managers with up-to-date information on deforestation and habitat degradation threats, as well as provide longer-term trends in forest cover. It is now widely recognized that assessments of forest biodiversity are essential if forest resources are to be effectively conserved and sustainably managed. However, any assessment of forest biodiversity faces a number of challenges. The assessment should address key indicators that might contribute towards a better understanding of the status and trends in forest biological diversity, specifically relating to the naturalness, habitat degradation and fragmentation of forest ecosystems. This requires methods which provide reliable data on species distribution and provides a useful basis for monitoring future changes in the status of forest ecosystems, and associated biodiversity. In addition, assessments are needed to provide information necessary to support biodiversity-related decision-making in forest management.

In 2018, the Ministry of Environmental Protection and Agriculture of Georgia with the support of the German Government (GIZ) started the implementation of the National Forest Inventory (NFI) in Georgia. The program supports the optimization of the Georgian Forest Management Inventory and planning a pilot activity in the municipality of Akhmeta.

The first National Forest Inventory (NFI) of Georgia will enable Georgia to obtain scientifically substantiated and reliable data on forest. Monitoring systems in forests includes the establishment of permanent vegetation plots. Total of 2020 permanent sample plots are selected and will be measured all over the country and the analysis of their aggregated data will result in detailed information on the current state of Georgia's forests.

National Forest Inventory covers all types of forests, regardless of forest category, governing body and ownership. At the expense of a unified approach, National Forest Inventory aims to collect information on key forest characteristics such as forest area, structure, level of degradation, timber reserves, natural regeneration rate, understory, soil, anthropogenic impact and more.

The forest monitoring on protected areas will employee exactly the same approach and methodology while increasing (doubling) the sampling effort in order to obtain more detailed information on PA forests. This will also help unify the data and interpret the obtained data at the national level.

Scope of forest monitoring

Forest ecosystem monitoring will be confined to the forested areas of (i) the traditional use zones of the national parks in question or (ii) managed reserves that are used for restricted and controlled extraction of timber and/or fuelwood for the local communities.

Monitoring protocol

Detailed methodology is provided in ***Field Manual for the Georgian National Forest Inventory****", Ministry Of Environmental Protection And Agriculture Of Georgia/GIZ 2018.*

During the assessment, information is collected on such variables as:

- Description
- Category
- Coordinates (X / Y)
- Elevation above sea level
- Terrain shape within the area of the sample
- The plot position on the slope
- The slope inclination

- Sample plot exposition
- Landscape features
- The erosion status
- The reason of erosion
- Forest degradation status
- Canopy closure
- Vertical structure of the sample plot
- Ground cover type
- Forest understory species
- Cattle grazing
- Down dead-wood / Woody debris
- Regeneration
- Single Forest Tree Specie
- Tree height
- Stem Diameter at Breast height
- Tree origin
- Habitat trees

In the NFI standard protocol, the points are selected at the points of intersection of the 3.6x3.6 km grid in the forested areas. The grid size was selected taking into account statistical considerations, international experience and other parameters. The collected information is extrapolated to 1 hectare and generalized to uniform forest massifs. It is important that future inventories to be conducted in the same places. Because of this, the coordinates of the sample plot centers are assigned and stored confidentially in the database to avoid targeted impacts on the sample area.

In order to increase the statistical reliability of the study, monitoring points will be selected by using not a 3.6 km grid, but a 1.8 km grid on protected area forests. This approach will significantly increase the number of sample plots, which will considerably improve the reliability of the results. It should also be noted that a similar approach is used in the current GIZ-supported project format, which aims to inventory the forests of the Akhmeta municipality. The approach is agreed with the leadership of the Agency of Protected Areas.

Sampling frequency

Forest ecosystem assessments will be carried out once in 10 years.

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