Feasibility study on enhancing connectivity conservation in the PONT Focus Region: Albania and North Macedonia

Description of the selected Connectivity Conservation Areas

Contents

Annex I – Species modelling 2

a. Balkan lynx 2

b. Brown bear 6

c. Balkan chamois 9

d. Black Woodpecker 14

e. Scadar Gudgeon *(Gobio skadarensis)* - (Endemic Drin Basin) 19

f. Ohrid Spirlin (*Alburnoides ohridanus*) - (Endemic Drin Basin) 21

Annex II – List of Stakeholders 23

Annex III – Protected areas connected to CCAs 37

Annex IV - High Nature Value Forests in North Macedonia 47

Annex V – forest loss analysis 50

Annex I – Species modelling

a. Balkan lynx

Dataset of 1464 unique observations (one observation per 1x1 km UTM square) was used, heavily biased towards the territory of North Macedonia, coming from camera-traps, GPS-tracked lynx and other sources. The model had excellent[1] explanatory power (AUC = 0.925,), with 10 variables contributing towards the model with >3% (Table A1). The independent response curves (functions of the variables used) show how the predicted probability of presence changes as each environmental variable is varied, keeping all other environmental variables at their average sample value.

The first prediction map showed highly biased results towards North Macedonia, completely omitting the Munella Mountain in Albania from where majority of Albanian lynx data comes from. On another hand, the model strongly supported the corridors Ilinska-Plakenska Planina and Bukovikj – Poreche in North Macedonia, identifies possible corridors in the lower sections of Shar Planina NP, in the transboundary region between Albania and Kosovo connecting Shar Planina/Mavrovo NP with Prokletije massif, possible corridor at Stogovo-Karaorman-Jablanica leading towards Polis-Guri I Zi-Vallamara. Alternative corridor to Poreche/Jakupica Massif is also identified via Dobra Voda Mt – Busheva Mt. corridor in North Macedonia.

Due to the heavily imbalanced sample, in order to highlight potential habitats for Albania better, we run the model again only using the Albanian data (Fig. 1). The dataset consists of 58 unique observations in total. The explanatory power of the model was again excellent (Fig. A2), and the 9 variables contribution to its construction with at least 3%, as well as their respective effect, are shown in Fig. A3 and Fig A4.

1 From (Guisan et al., 2017, p. 263): “Araújo et al. (2005a) proposed a refined AUC scale, with: AUC > 0.90 being “excellent”; 0.80 < AUC < 0.90 being “good”; 0.70 < AUC < 0.80 “fair”; 0.60 < AUC < 0.70 “poor”; 0.50 < AUC < 0.60 “fail”, and AUC < 0.5 being “counter-predictions””.

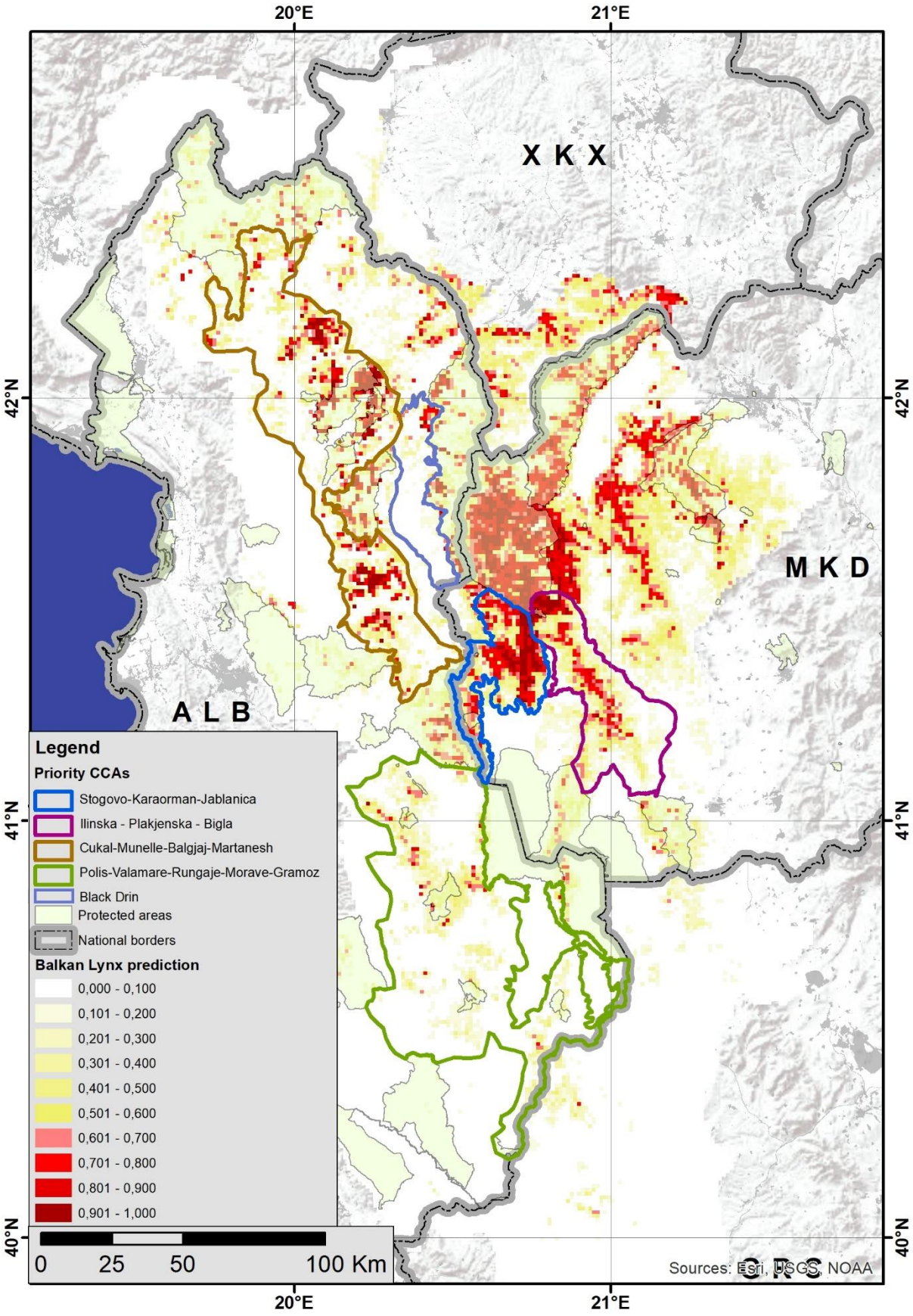


Figure A1. Map of modelled distribution of the Balkan lynx, in relation of protected areas and identified possible corridors.

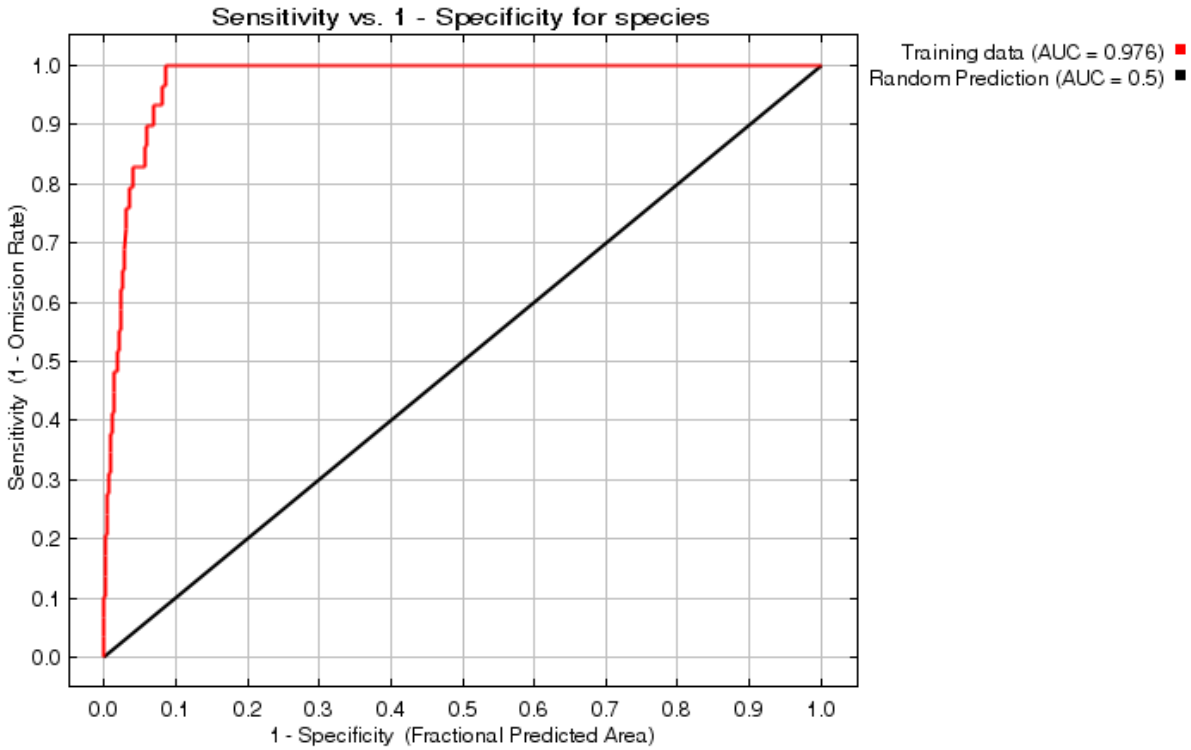


Figure A2. Receiver operating characteristic (ROC) curve calculated on the training presence records (n=29). The AUC from the train data is 0.976, and the AUC of the test data is 0.937.

Table A1. Most important variables for the MaxEent model of the Balkan lynx.

Variable	Percent contribution	Permutation importance
bio18_16	26.6	12.2
bio11_16	12.8	0.6
bio17_16	12	31.7
Maquis_.arb.matorr.and.thermo.Medi.brushes	7.8	1.4
bio13_16	6.4	20.8
bio12_16	6.2	6.2
Slope_MEAN	5.8	1.6
DEM_Mean	5.3	9.8
bio16_16	4.3	0.9
Broadleaved.deciduous.woodland	3.3	1.4

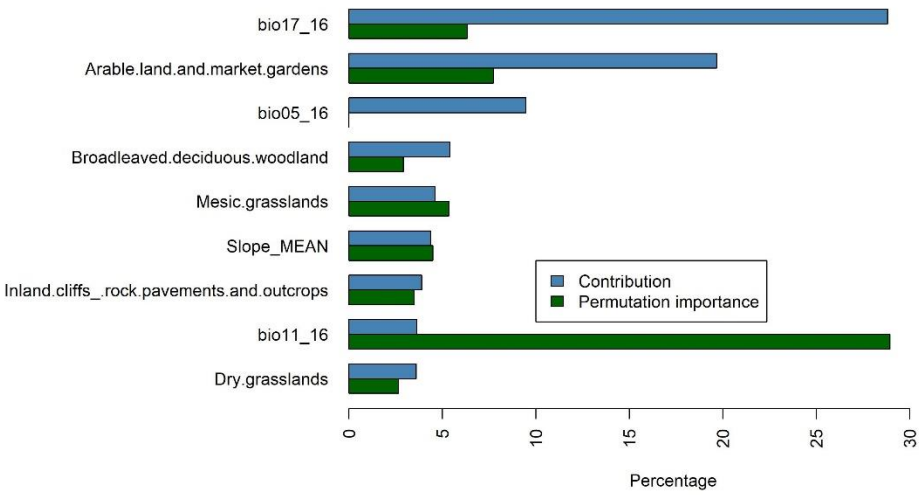


Figure A3. Contribution of different variables towards the habitat suitability model for the Balkan Lynx in Albania only. Note that only 3 of these variables (bio17_16 - Precipitation of driest quarter, Slope MEAN and Broadleaved deciduous woodland) also contribute with at least 3% in the region-wide lynx habitat model.

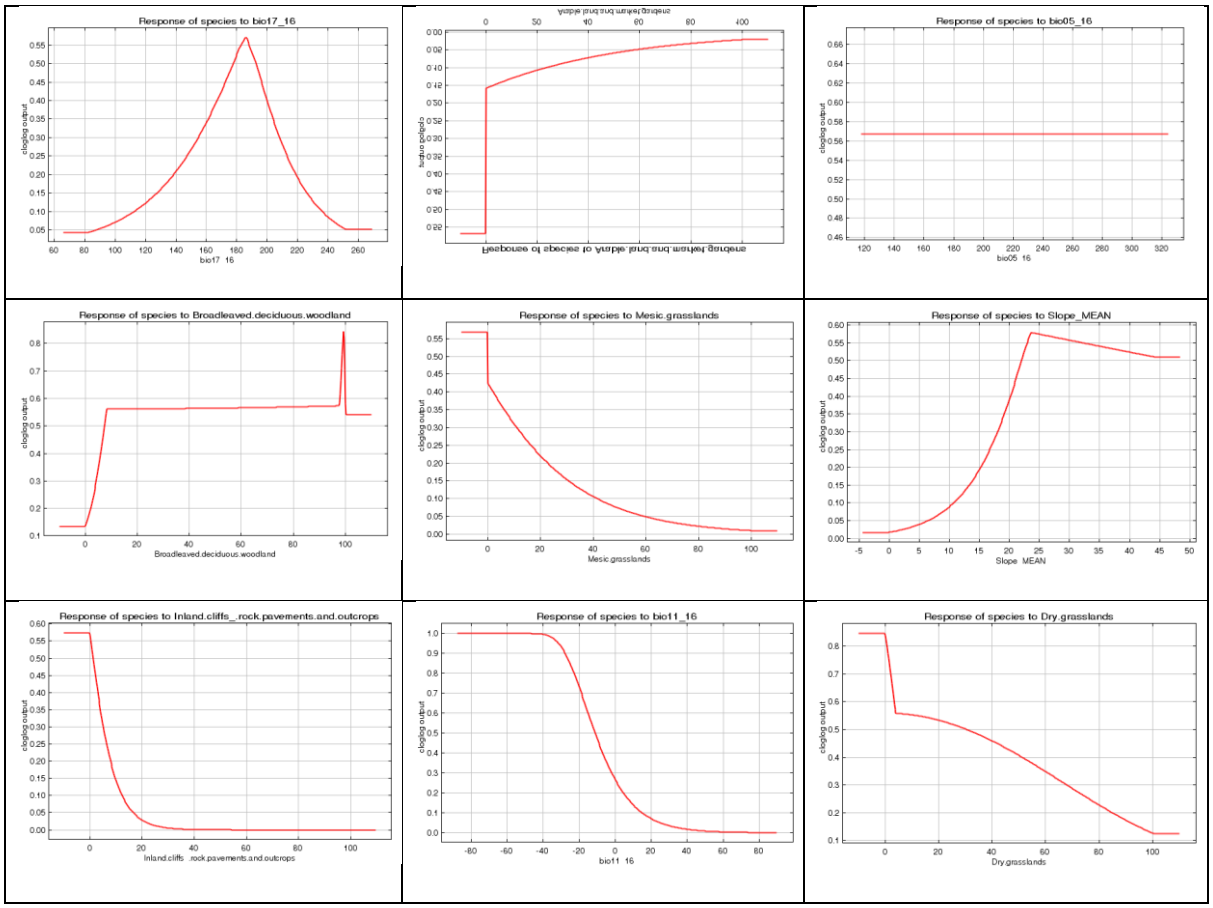


Figure A4. Function plots of the six most important variables that explain the predicted distribution of the Balkan Lynx in Albania. The distribution model does obviously not depend on Biol05-16 (Max temperature of warmest month) although it is constantly selected as important variable. This stresses out the need for a) further distribution data and b) model fine-tuning.

b. Brown bear

Similarly, to the Balkan lynx results, we present the ROC curve with the respective AUC value (Fig. A5), the most important variables (Tab. A2) and their respective function plots (Fig. A6), as well as the map of the predicted distribution of the brown bear (Fig. A4). The dataset consists of 394 unique observations in total.

The possible distribution map supports the importance of the corridors Bukovikj – Poreche and Ilinska Plakenska Planina in North Macedonia, reconfirms the additional stretch Stogovo-Karaorman-Jablanica and Dobra Voda – Busheva Planina also in North Macedonia, the lower sections of Shar Planina in both North Macedonia and Kosovo, the border line between Albania and Kosovo towards Prokletije Mt, as well as sections of Korrab-Koritnik-Albanian Alps, Munella-Mali Zebes-Bjeshket e Terbunit and Polis-Sopot-Valamare-Gramoz in Albania.

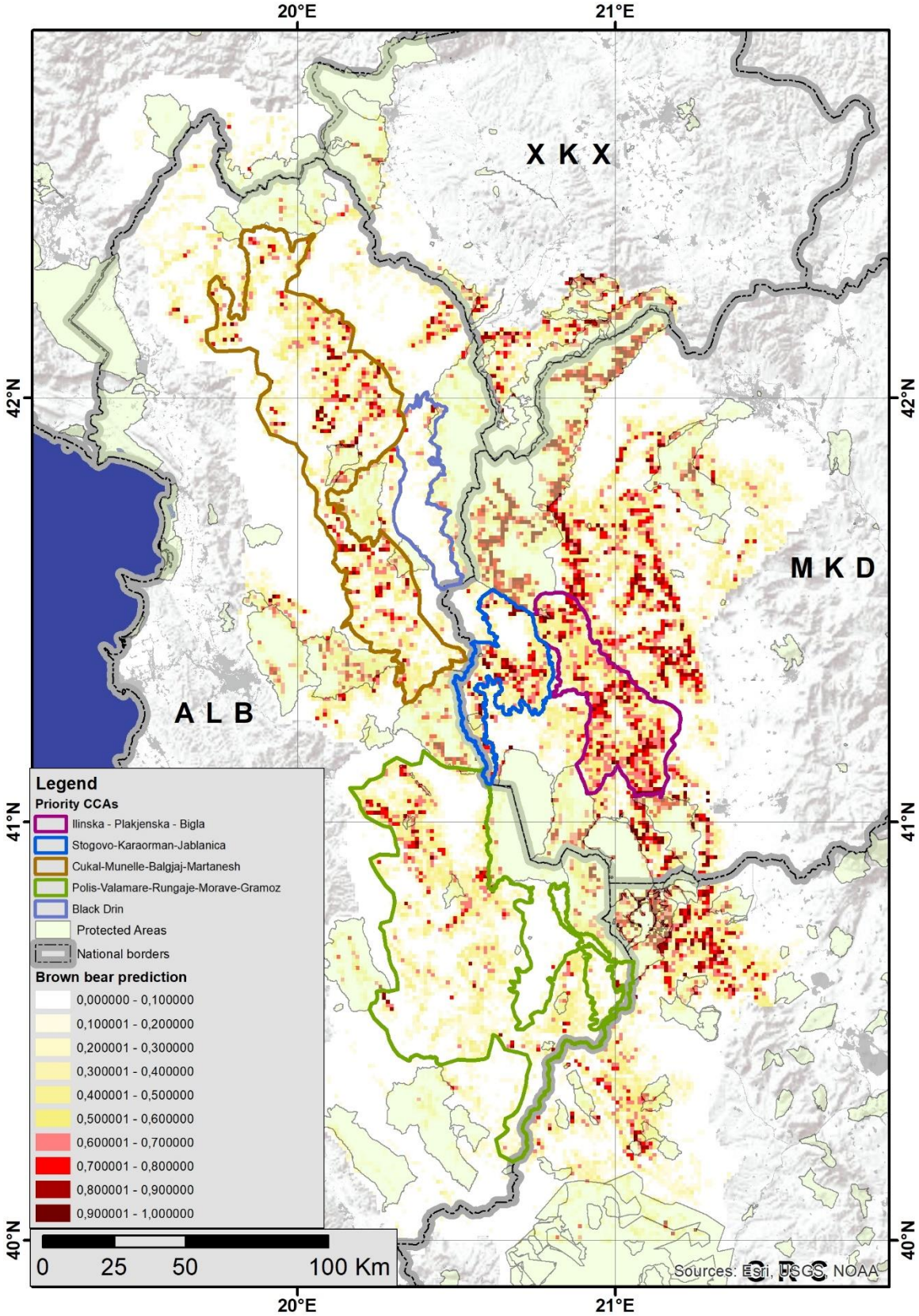


Figure A4. Map of modelled distribution of the brown bear, in relation of protected areas and identified possible corridors.

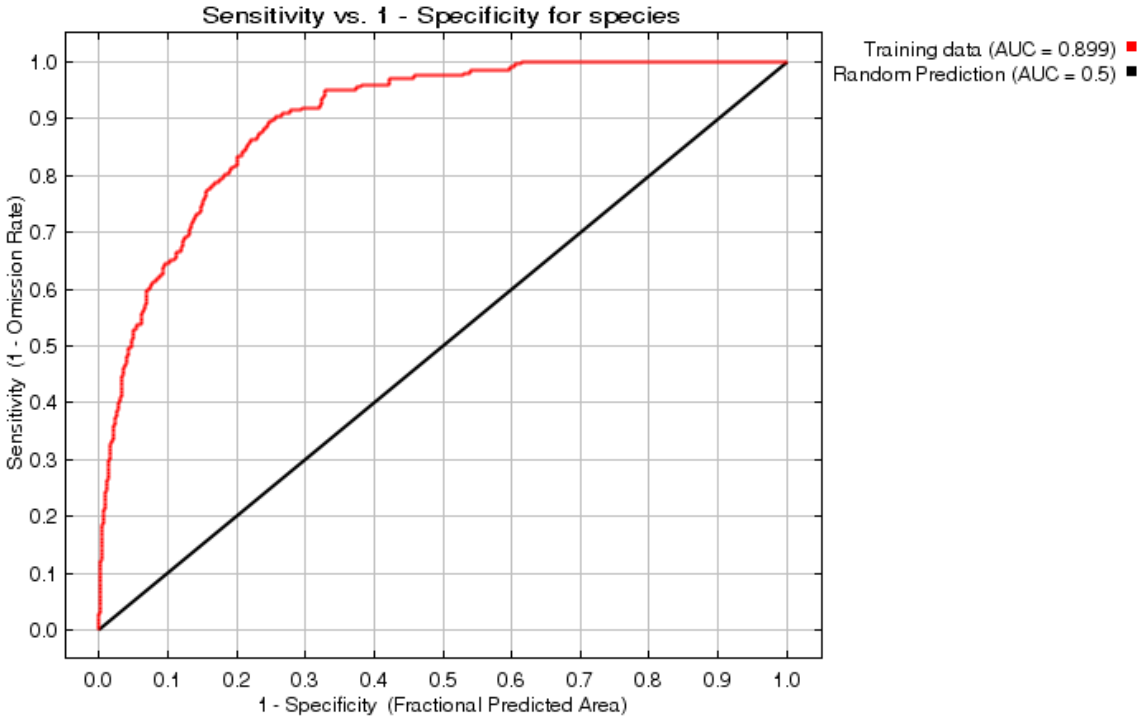


Figure A5. Receiver operating characteristic (ROC) curve calculated both on the training presence records (n=197) and on the test records (n=196). The AUC from the train data is 0.903, and the AUC of the test data is 0.831.

Table A2. The most important six variables explaining the presence of the brown bear, with relative importance above 3%.

Variable	Percent contribution	Permutati importan
Broadleaved.deciduous.woodland	21.1	
DEM_Mean	20.1	
bio11_16	7.2	
bio17_16	7	
Unpaved.road	6.2	
Sedge.and.reedbeds_.normally.without.free.standing.water	4	

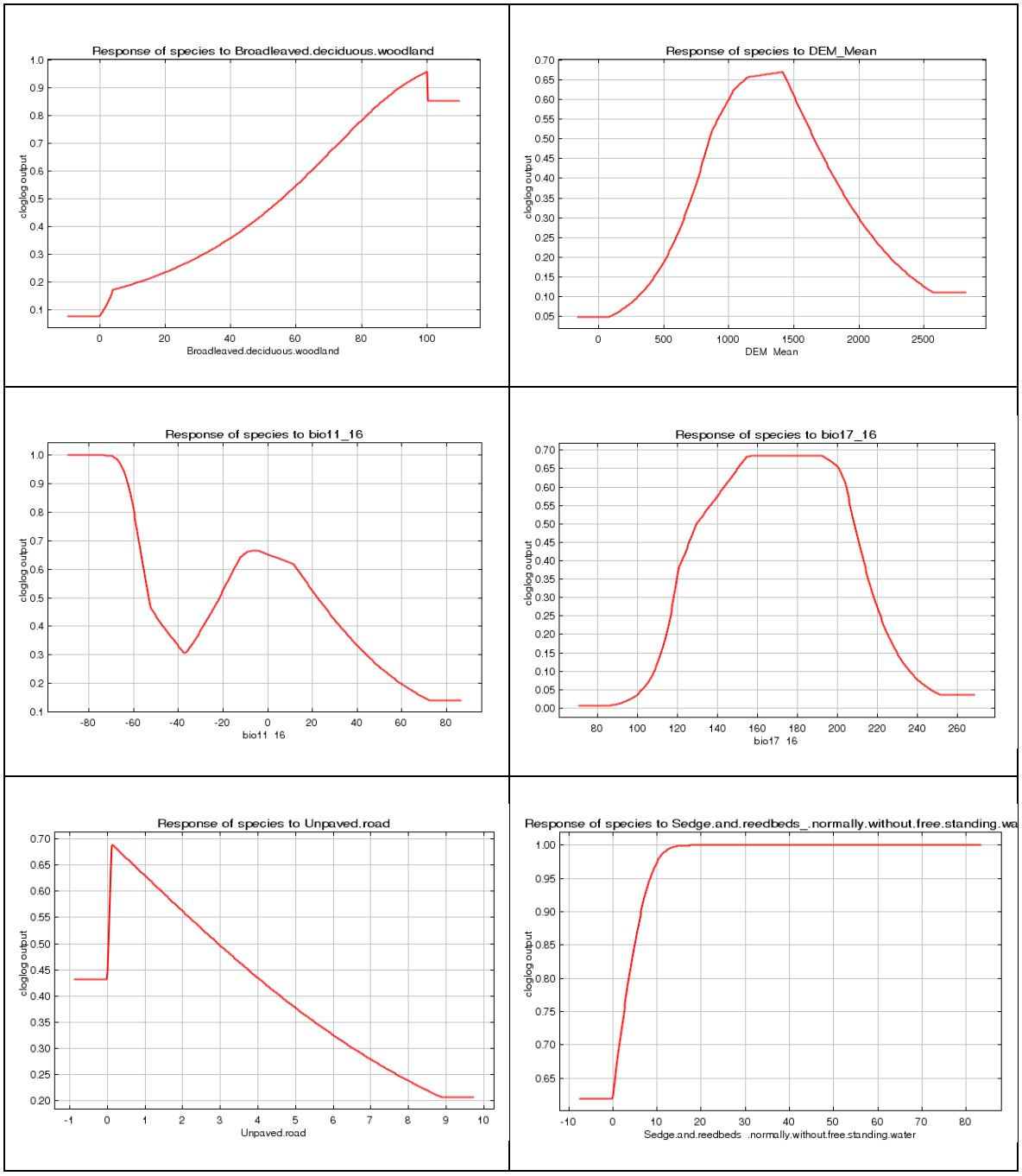


Figure A6. Function plots of the six most important variables that explain the predicted distribution of the brown bear. The importance of the reedbed habitats seems an artefact from concentration of data in the Prespa region, collected with the earlier Prespa conservation project, while the graphs also show possible disturbance that the network of unpaved roads have on this species.

c. Balkan chamois

This species is traditionally related with alpine habitats, but it actually also uses forest habitats in between the alpine pastures, where it takes cover. We present the ROC curve with the respective AUC value (Fig. A8), the most important variables (Tab. A3) and their respective function plots (Fig. A9), as

well as the map of the predicted distribution of the chamois (Fig. A7). The dataset consists of 84 unique observations in total.

The possible distribution map supports the importance of the corridor Ilinska-Plakenska Planina in North Macedonia, especially towards Galichica NP where the chamois has reinstated itself during the last two decades, but not towards Pelister NP, which might explain the apparent absence of the species from this region although good habitat exists. The Bukovik-Poreche corridor possibly has a better role as a series of stepping-stones towards Jasen Multipurpose area which holds significant chamois population. Stogovo-Karaorman-Jablanica stretch is reconfirmed, as well as corridor along the ridge of Shar Planina NP, continuing towards Korrab-Koritnik-Albanian Alps, and also corridors towards possible core areas in Munella-Mali Zebes-Bjeshket e Terbunit and Polis-Sopot-Valamare-Gramoz in Albania.

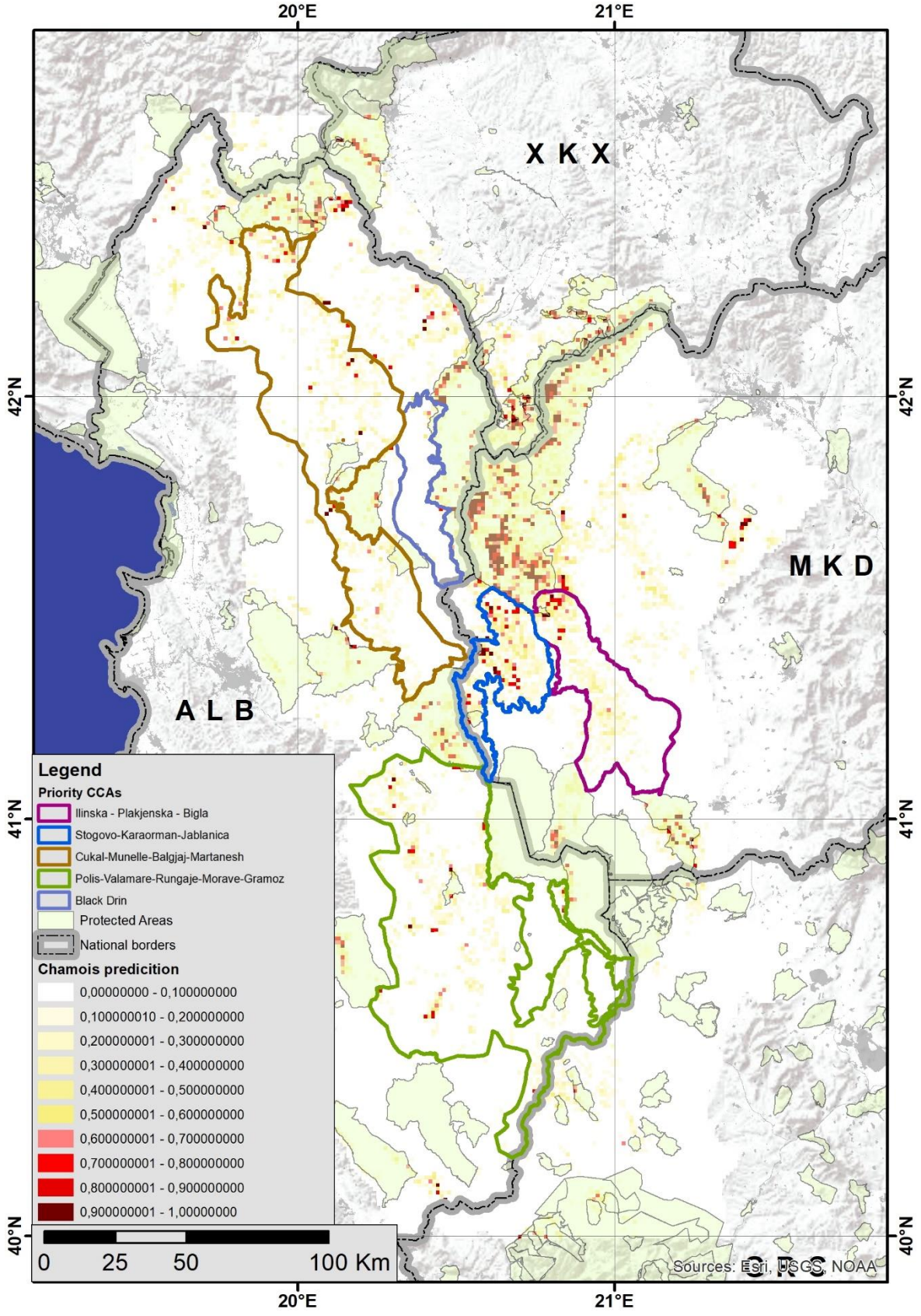


Figure A7. Map of modelled distribution of the chamois, in relation of protected areas and identified possible corridors

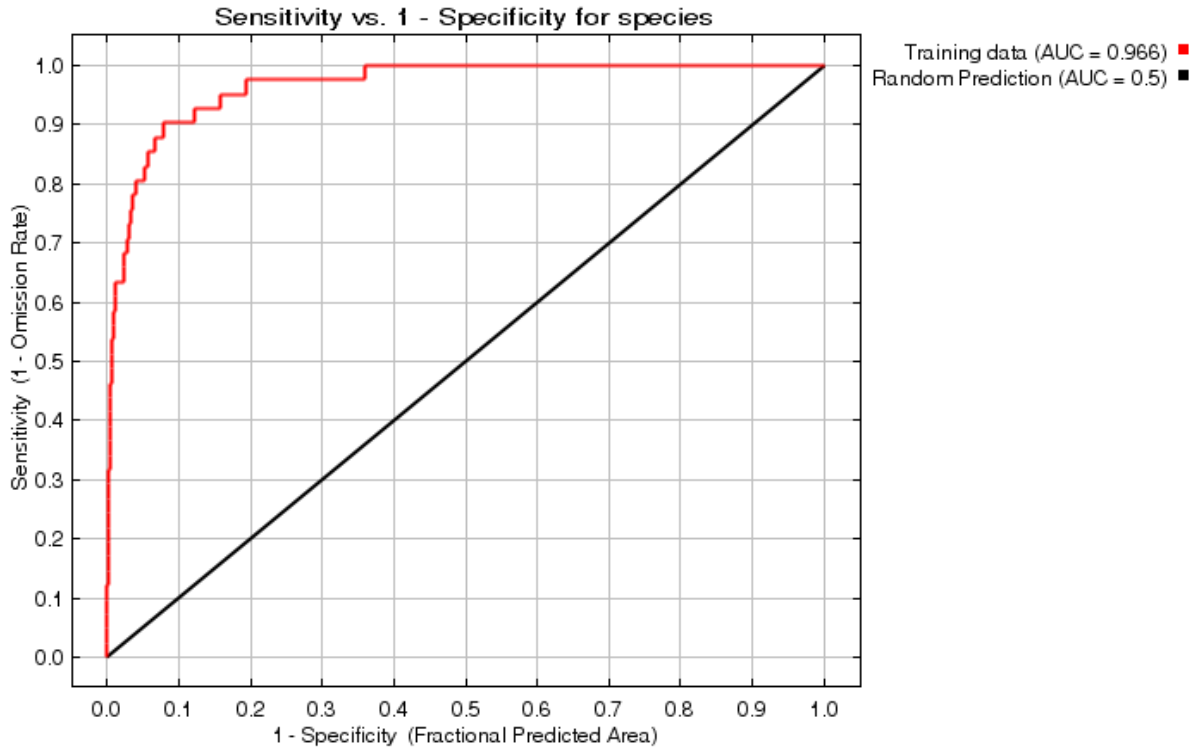
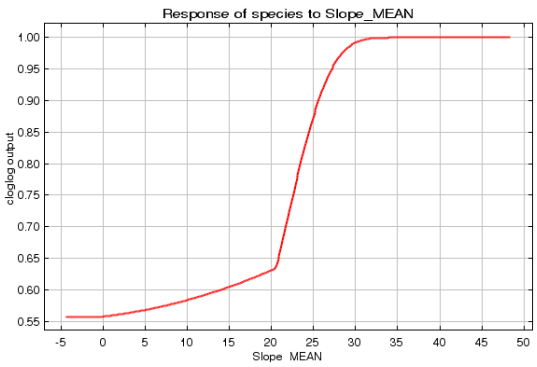
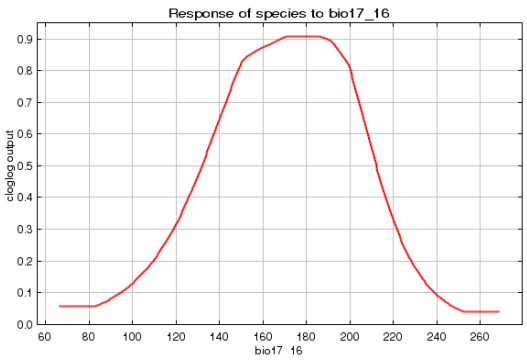


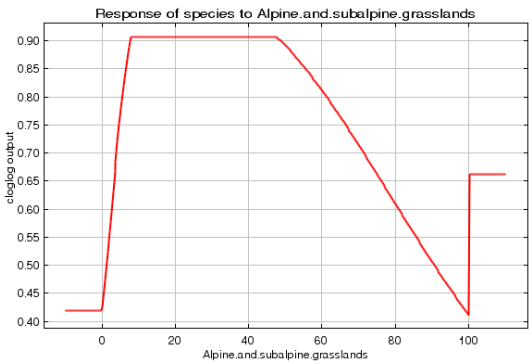
Figure A8. Receiver operating characteristic (ROC) curve calculated both on the training presence records (n=41) and on the test records (n=41). The AUC from the train data is 0.967, and the AUC of the test data is 0.923.

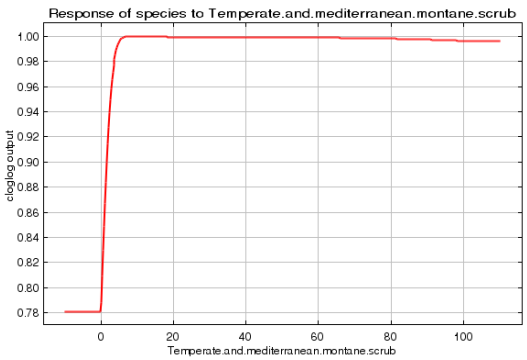
Table A3.The most important nine variables explaining the presence of the chamois, with relative importance above 3%.

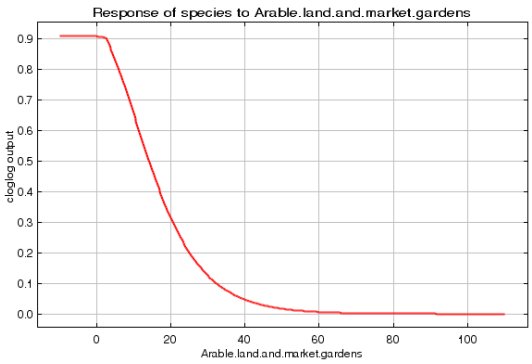
Variable	Percent contribution	Permutation importance
Slope_MEAN	24.8	3.2
bio17_16	17.7	4.4
Alpine.and.subalpine.grasslands	10.6	2.6
Temperate.and.mediterranean.montane.scrub	5.8	0.7
Arable.land.and.market.gardens	5.1	22.2
Main.road	4.6	2.8
River	4	0
Maquis_.arbores.mato.and.thermo.Mediterr.brushes	3.7	10.2
bio05_16	3.6	0

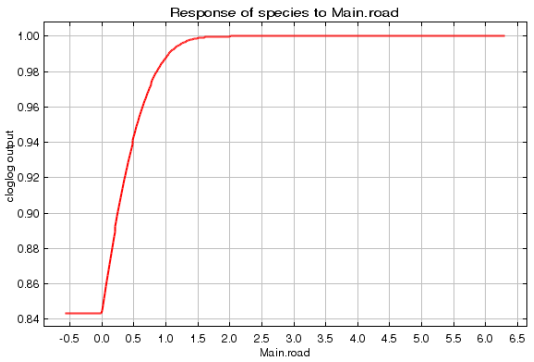

Response of species to Slope_MEAN
cloglog output
Slope_MEAN

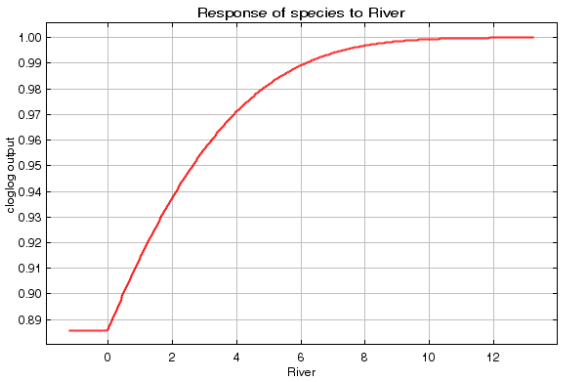

Response of species to bio17_16
cloglog output
bio17_16

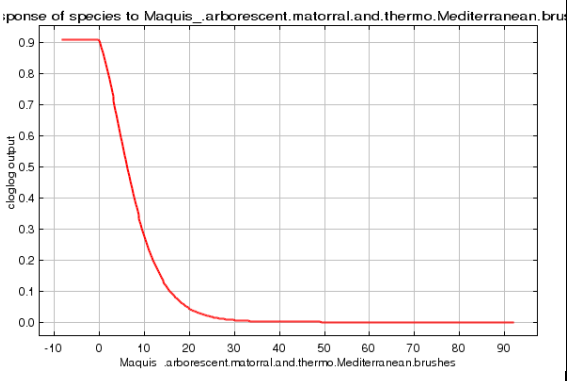

Response of species to Alpine.and.subalpine.grasslands
cloglog output
Alpine.and.subalpine.grasslands


Response of species to Temperate.and.mediterranean.montane.scrub
cloglog output
Temperate.and.mediterranean.montane.scrub


Response of species to Arable.land.and.market.gardens
cloglog output
Arable.land.and.market.gardens


Response of species to Main.road
cloglog output
Main.road


Response of species to River
cloglog output
River


ponse of species to Maquis_.arborescent.matorral.and.thermo.Mediterranean.brus
cloglog output
Maquis_.arborescent.matorral.and.thermo.Mediterranean.brushes

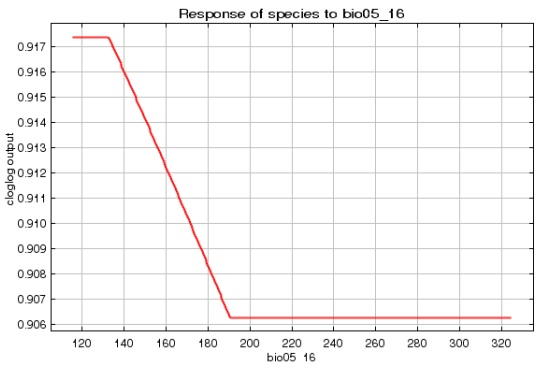


Figure A9. Function plots of the nine most important variables that explain the predicted distribution of the chamois. Contra intuitive is the (relatively small) importance of the main roads as positively related variable with the probability of presence. One possibility of explanation is that roads are often found in the bottom of river valleys (therefore, small rivers are also shown as important variable) with steep slopes, which is actually the main predictor for the presence of this species.

d. Black Woodpecker

This forest species has expanded its range during the last 20 years also in habitats that are now not considered only to represent old or well preserved forests. It shows the potential of the species to adapt and thrive in suboptimal habitats, and shows why they should not be easily dismissed in the conservation planning. As usual, we present the ROC curve with the respective AUC value (Fig. A11), the most important variables (Tab. A4) and their respective function plots (Fig. A12), as well as the map of the predicted distribution of the Black Woodpecker (Fig. A10). The dataset consists of 97 unique observations in total.

The map of possible distribution (Fig. A10) confirms the already identified corridors for the mammal species, here somewhat more emphasised since the Woodpecker is more ubiquitous towards the physical characteristics of the landscape.

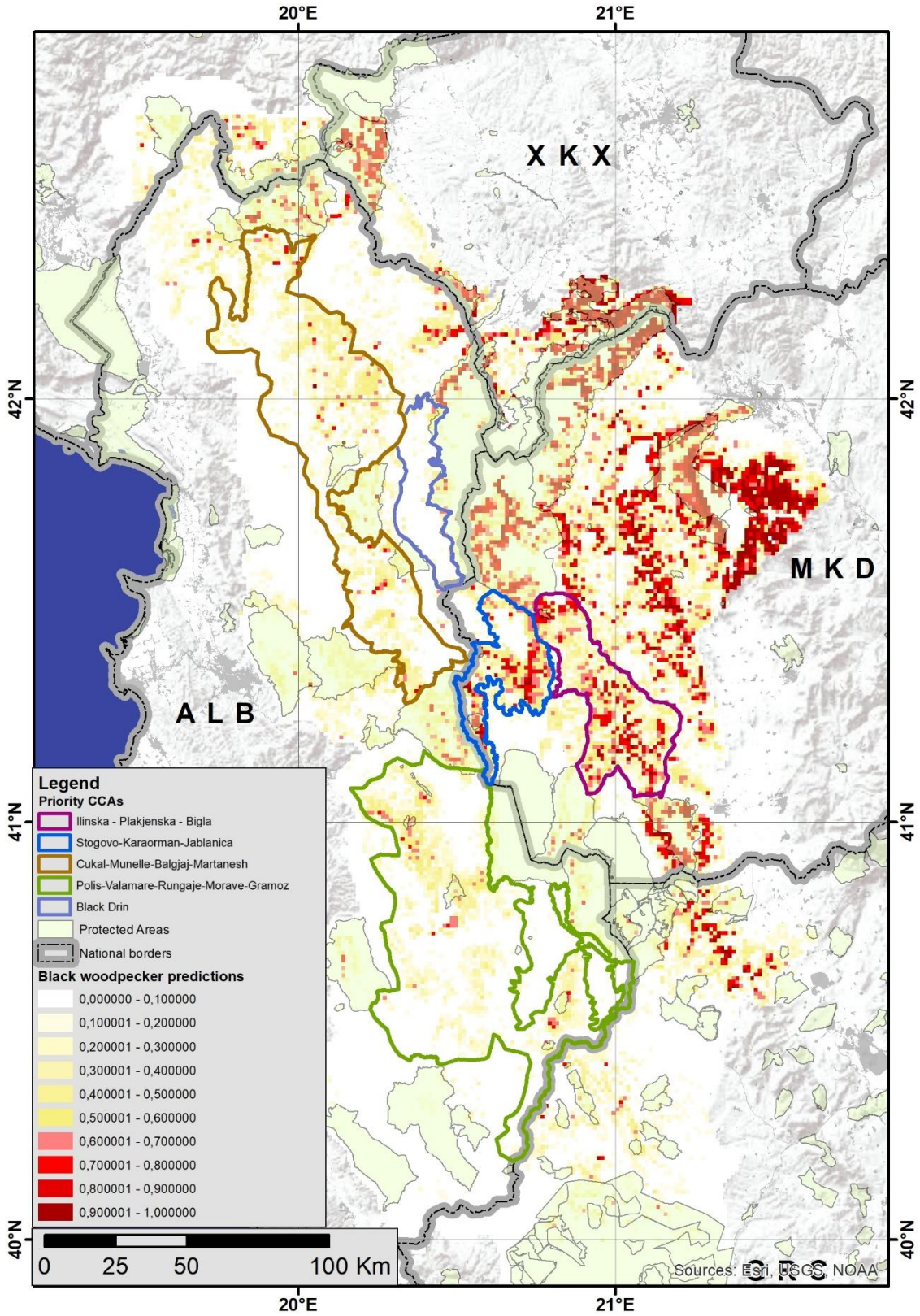


Figure A10. Map of modelled distribution of the Black Woodpacker, in relation of protected areas and identified possible corridors.

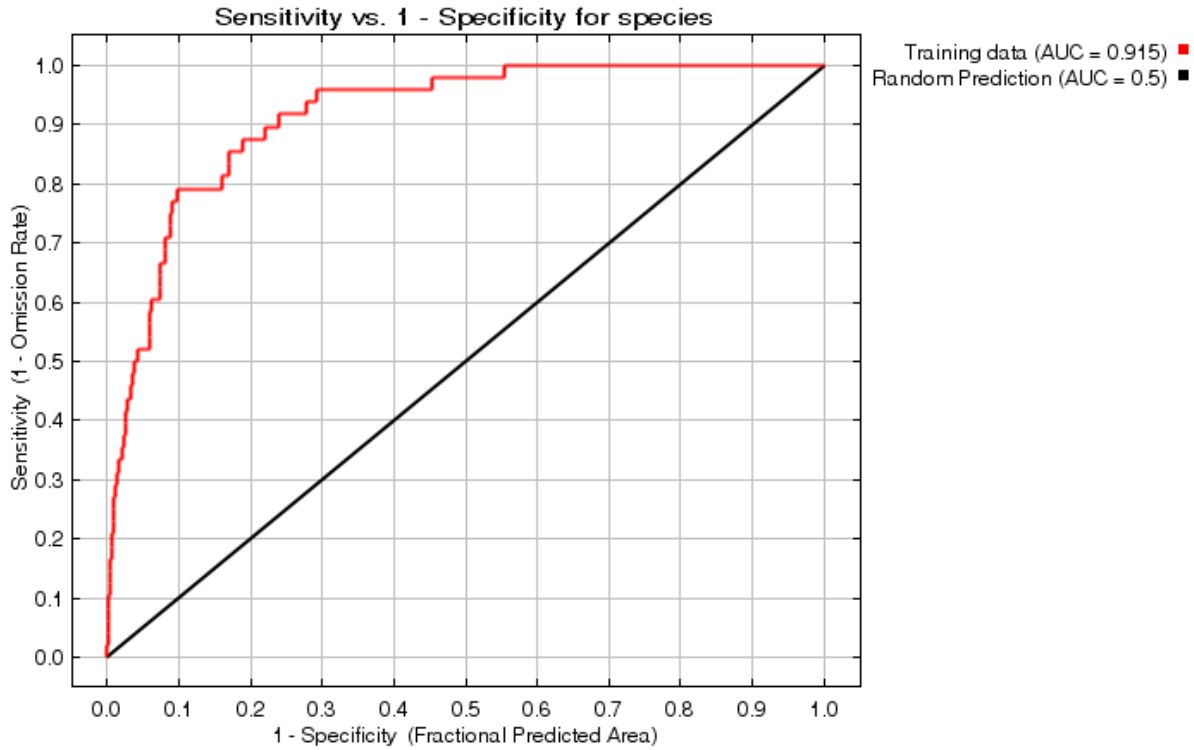
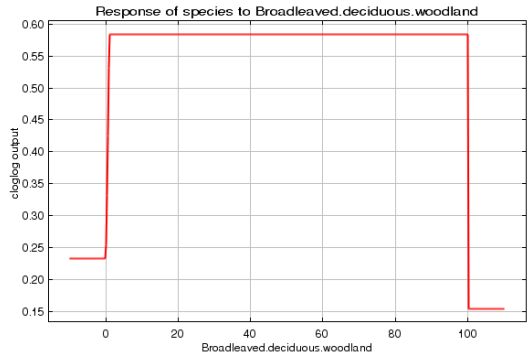
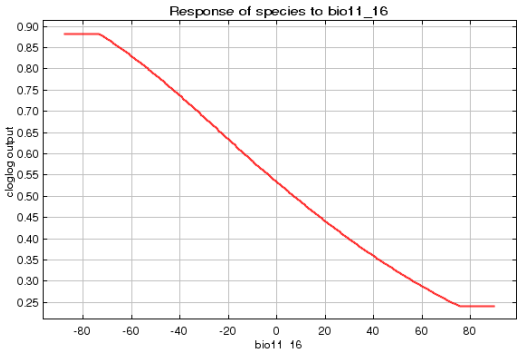


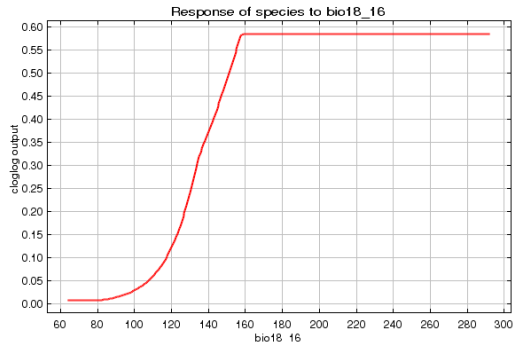
Figure A11. Receiver operating characteristic (ROC) curve calculated both on the training presence records (n=48) and on the test records (n=49). The AUC from the train data is 0.916, and the AUC of the test data is 0.853.

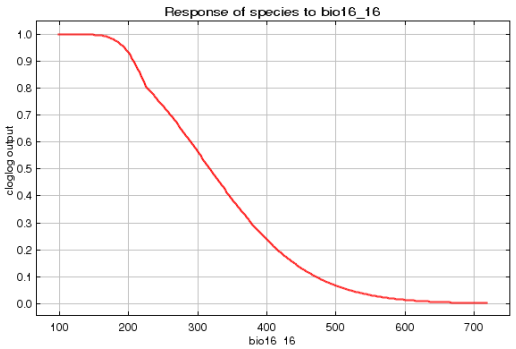
Table A4. The most important nine variables explaining the presence of the Black Woodpecker, with relative importance above 3%.

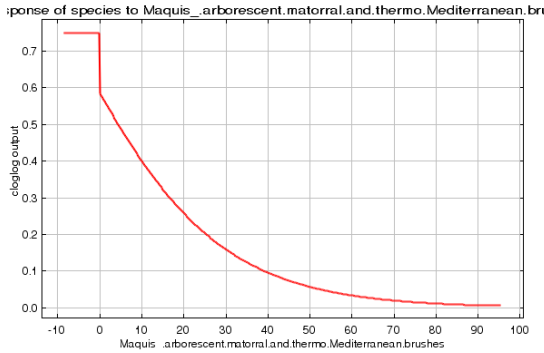
Variable Black	Percent contribution	Permutation importance
Broadleaved.deciduous.woodland	22.1	1.4
bio11_16	18.5	1.6
bio18_16	9.9	10.4
bio16_16	8	18.8
Maquis_.arborescent.matorral.and.thermo.Mediterranean.brushes	5.2	2.8
Mesic.grasslands	4.4	5.4
DEM_std	3.8	2.3
Dry.grasslands	3.5	7
Unpaved.road	3.3	0.7

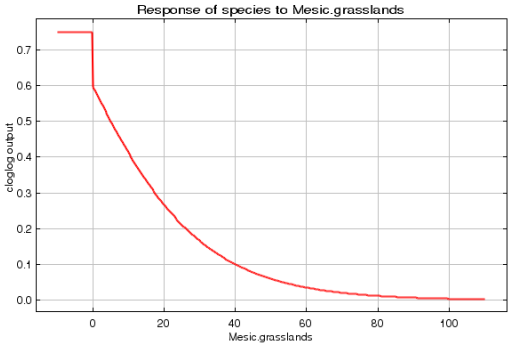

Response of species to Broadleaved.deciduous.woodland
cloglog.output
Broadleaved.deciduous.woodland

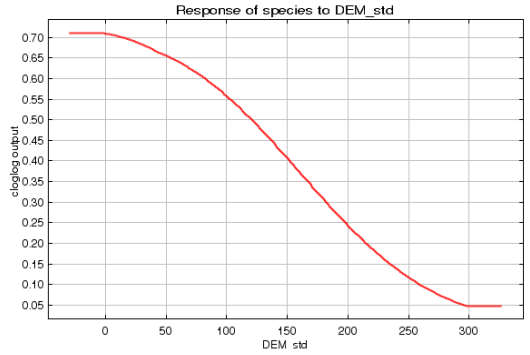

Response of species to bio11_16
cloglog.output
bio11_16

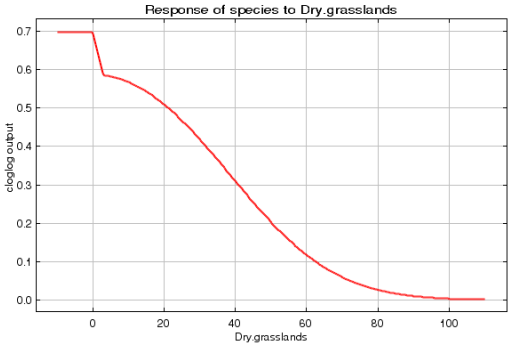

Response of species to bio18_16
cloglog.output
bio18_16


Response of species to bio16_16
cloglog.output
bio16_16


ponse of species to Maquis_.arborescent.matorral.and.thermo.Mediterranean.brus
cloglog.output
Maquis_.arborescent.matorral.and.thermo.Mediterranean.brushes


Response of species to Mesic.grasslands
cloglog.output
Mesic.grasslands


Response of species to DEM_std
cloglog.output
DEM_std


Response of species to Dry.grasslands
cloglog.output
Dry.grasslands

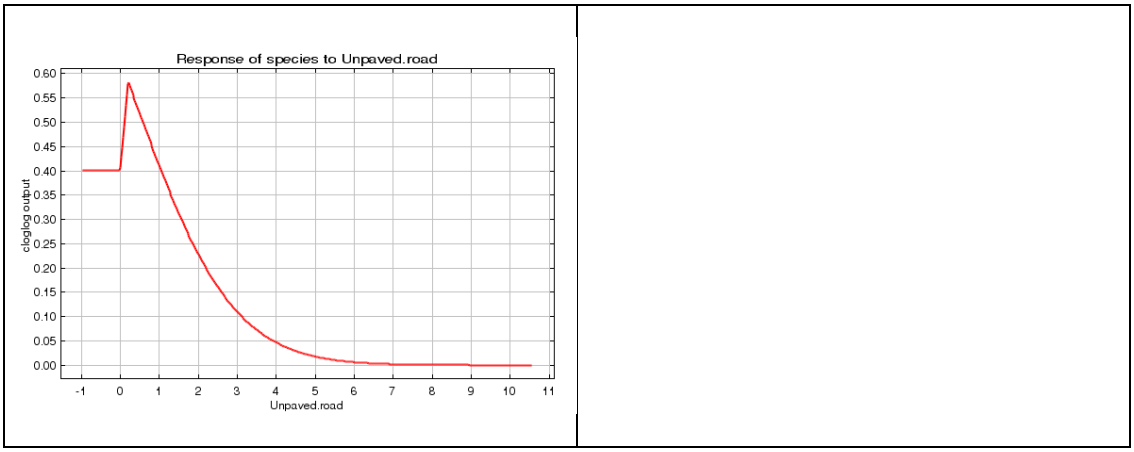


Figure A12. Function plots of the nine most important variables that explain the predicted distribution of the Black Woodpecker. Plots depict that species' distribution is mostly explained by which factors/environment it tends to avoid, rather than it is affiliated to, with the notable exception of the deciduous forest, including deciduous forests in the relatively flat areas/lowlands.

Table A5. List of all variables used for the Habitat suitability modelling.

Variable	**Explanation**
River	length in km
Small river	length in km
Highway	length in km
Main road	length in km
Other paved road	length in km
Unpaved road	length in km
Aspect_MEAN	angle
Aspect_STD	
DEM_Mean	meters asl, from digital elevation model (DEM)
DEM_std	
Slope_MEAN	degrees, from DEM
Slope_STD	standard deviation of the slope, as measure of ruggedness
Alpine and subalpine grasslands	area in km2
Arable land and market gardens	area in km2
Arctic_ alpine and subalpine scrub	area in km2
Base-rich fens and calcareous spring mires	area in km2
Broadleaved deciduous woodland	area in km2
Broadleaved evergreen woodland	area in km2
Buildings of cities_ towns and villages	area in km2
Coniferous woodland	area in km2
Cultivated areas of gardens and parks	area in km2
Dry grasslands	area in km2
Extractive industrial sites	area in km2
Highly artificial man-made waters and associated structures	area in km2

Inland cliffs_ rock pavements and outcrops	area in km2
Inland saline and brackish marshes and reedbeds	area in km2
Lines of trees_ small anthropogenic woodlands_ recently felled woodland_ early-stage woodland and coppice	area in km2
Littoral zone of inland surface waterbodies	area in km2
Low density buildings	area in km2
Maquis_ arborescent matorral and thermo-Mediterranean brushes	area in km2
Mesic grasslands	area in km2
Miscellaneous inland habitats with very sparse or no vegetation	area in km2
Mixed deciduous and coniferous woodland	area in km2
Screes	area in km2
Seasonally wet and wet grasslands	area in km2
Sedge and reedbeds_ normally without free-standing water	area in km2
Shrub plantations	area in km2
Surface running waters	area in km2
Surface standing waters	area in km2
Temperate and Mediterranean-montane scrub	area in km2
Transport networks and other constructed hard-surfaced areas	area in km2
Waste deposits	area in km2
bio05_16	Max Temperature of Warmest Month
bio11_16	Mean Temperature of Coldest Quarter
bio12_16	Annual Precipitation
bio13_16	Precipitation of Wettest Month
bio16_16	Precipitation of Wettest Quarter
bio17_16	Precipitation of Driest Quarter
bio18_16	Precipitation of Warmest Quarter
bio19_16	Precipitation of Coldest Quarter

e. Scadar Gudgeon *(Gobio skadarensis)* - (Endemic Drin Basin)

Rather widespread but found in areas without significant hydropeaking or level changes caused by hydropower plants along Black Drini River and its tributaries (Fig. A13). Populations are susceptible to hydropeaking flooding from upstream dams (similar to several fish species, even the strongly rheophylic *Chondrostoma ohridanum*). This species is a weakly rheophilic fish, but lives in many parts of the Black Drin River, Shkumbin, Mati, Valbona, etc. It also lives in parts of Fierza Reservoir and is tributaries; however populations are not abundant in the reservoir lake. So, populations in reservoirs are very low compared to slow moving waters with a rich littoral zone; however if there is littoral vegetation and shallow stable areas in lentic waters, it can survive and breed there (however these conditions are

not common in normal dam reservoir lakes). The species is characterized as Endangered on a global level (IUCN).

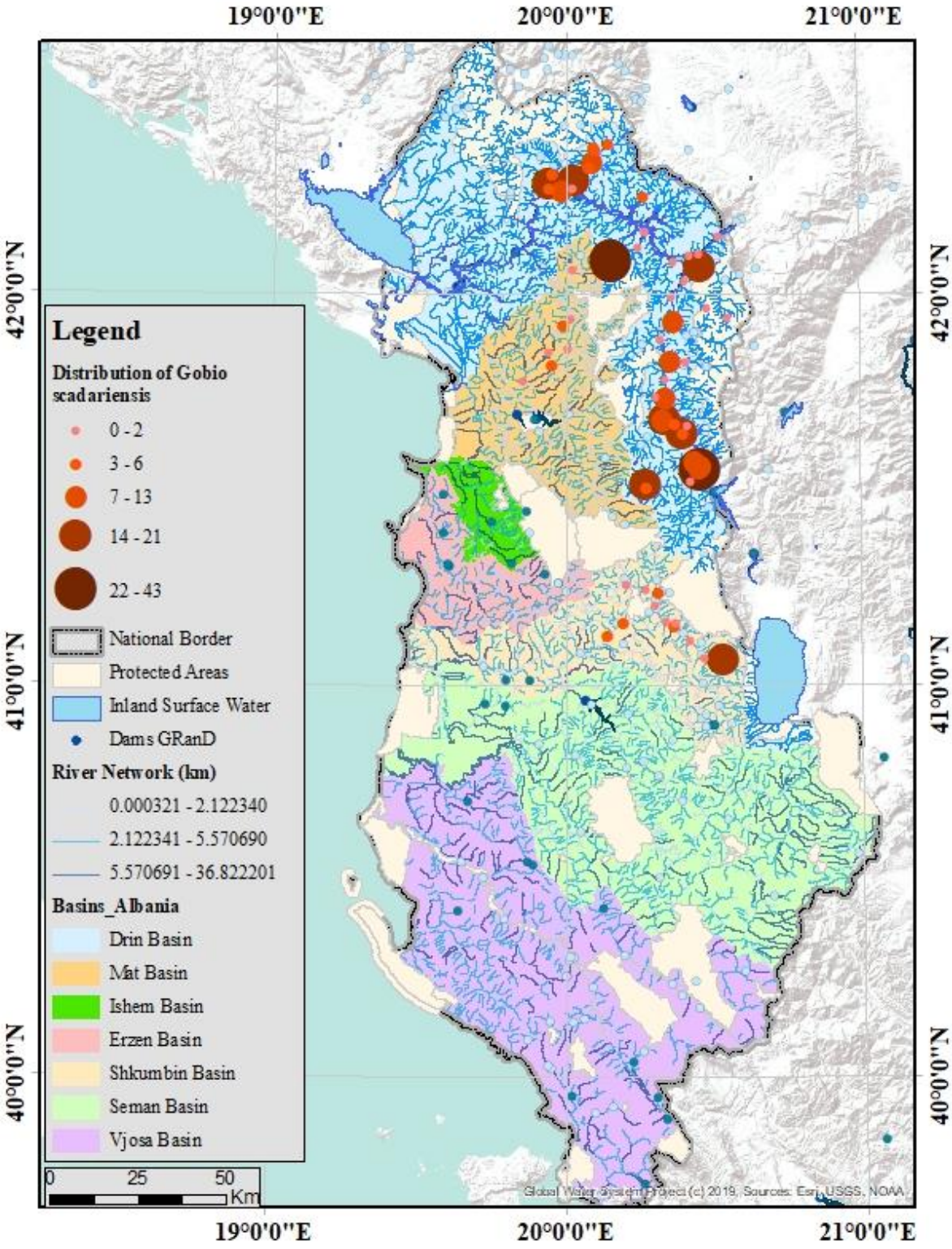


Figure A13. Distribution of *Gobio scadarensis* in Albania

f. Ohrid Spirlin (*Alburnoides ohridanus*) - (Endemic Drin Basin)

Rare in the Black Drini River (Shumka, unpublished survey data of 2021 and 2022); a single specimen was located during this studies in Fierza Reservoir. The species usually does not tolerate warm water reservoir waters (it is however very common in Lake Ohrid and in the White Drin of Kosovo; Fig. A14). It has been found in parts of incoming stream in the Fierza reservoir. It's near absence in the major part of the Black Drin and the area survey in Fierza Reservoir (near Kukes) in 2021 and 2022 is a mystery: one hypothesis is that perhaps its local population is disturbed by hydropeaking in the upper Black Drin and by barriers to re-colonization from upstream areas. This species does not normally tolerate warm water reservoirs and it may be impacted by hydropeaking flood effects from Debar dam. It also undergoes migrations during the reproductive period along the main stem of the river and its populations may be blocked by existing dams (i.e. in North Macedonia). Populations may decline further due to the proposed dam and changes created by the dam construction. The species is also susceptible to increased predators that will thrive in the new dam reservoir environment (i.e. aliens piscivorous fish species; Great Cormorant *Phalacrocorax carbo*, etc.). The species is characterized as Vulnerable on a global level (IUCN).

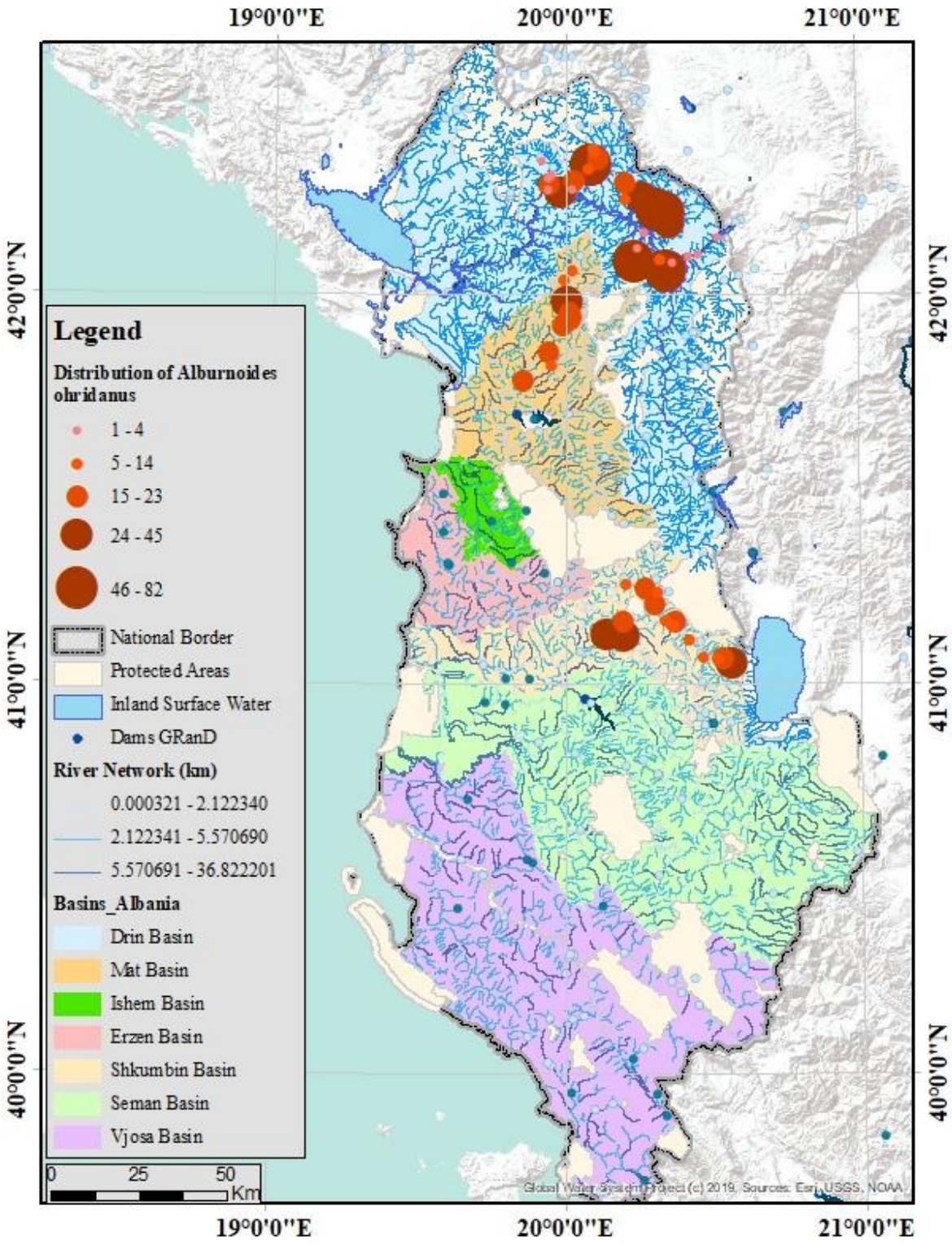


Figure A14. Distribution of *Alburnoides ochridanus* in Albania

Annex II – List of Stakeholders

Connectivity conservation is a relatively new term and approach in landscape and ecosystem management. The national and local context within a country (or bordering countries) needs to be very well studied and considered when comes to planning and implementation of future actions related to connectivity conservation approach. Having this in mind, planning process is very important so every stakeholder can state its opinion and role in this. The word “conservation” is not perceived the same among different stakeholders. By good communication among different groups of stakeholders, the word “conservation” or “connectivity conservation” becomes very different too. It is important for it to be presented as opportunity, since it has many benefits for people and nature, and provides natural solutions for better livelihood and solutions for helping to migrate climate change of which we all witnessed last 15 years.

Table A6. Stakeholders and their responsibility in North Macedonia

Group of SH	WHO	WHY	HOW	WHEN
Government organizations and agencies	• Ministry of Environment and Physical Planning of RNM; • Ministry of Agriculture, Forestry and Water Economy • Ministry of Transport and comunication of RNM • Ministry of Economy of RNM • PE for Pastures management of RNM • PE National Forests • Protected areas management bodies • Bureau for Regional Development within the Ministry of Local Self-government and Centers for development of planning regions (Regions within project area)	Forests, pastures and meadows are the ecosystems that domain in the study area hence the choice of the first drafted stakeholders in this group. All these are important in decision making processes. They are the ones who make plans, strategies, enforcement of laws etc.	The need for connectivity conservation needs to be supported by many legal instruments and tools that already exist in most national legal systems. A two-pronged approach is needed: making better use of existing instruments and strengthening existing frameworks with new and innovative tools and processes as feasible. It is extremely important for all relevant government organizations and agencies to be involved to synchronize the activities and future plans accordingly. If one is missing, any actions planned, risk with failure. Big issue in MK is the self-financed method of PAs, so most of them lean on finances provided by wood or tourism.	*Planning, Implementing, Evaluating, Leading

Group of SH	WHO	WHY	HOW	WHEN
Local stakeholders	• Hunting societies • Mountaineering societies + other mountain related sports • Municipalities and village communities • different community groups (religion based or other)	Corridor management must take into account a long history of prior government and community decisions. It is also important to understand the capacity and skills of local communities.	Constant communication is a must when comes to these SH. There are several hunting societies within both corridors. The concessions for hunting are issued by the Ministry of Agriculture, Forestry and Water supply, but not consulted with the rest of the other relevant Ministries. There are active Mountain based sport societies and some cultural societies with whom MES has established connections. This group of SH make the "local movement" and are crucial part in drafting ideas for solving some cross-cutting issues.	*Planning, Implementing, Evaluating
Vulnerable groups who may be impacted by the Project	• Private forest owners • Agriculture land owners	Landholders are key stakeholders who must be supportive to take action to help restore and manage	Big issue in RNM when comes to private forest owners. First of all, detailed map of private and state	*Planning, Implementing, Evaluating

Group of SH	WHO	WHY	HOW	WHEN
		landscapes. Without their support and cooperation little can be achieved. Key delivery partner organizations can offer on-ground conservation programs using a range of voluntary conservation instruments that can include incentive payments.	forest units needs to be made within the corridors so any future possible conflicts can be avoided. Frequent communications and gatherings of these stakeholders leaded by project are highly recommendable. Campaigns can be effective too. Payments for Ecosystem Services (PES) schemes can be taken in consideration as possible negotiation tool.	
Civil society organizations	• National NGOs • Local NGOs			*Planning, Implementing, Evaluating, Leading
International organizations	• Donors • Conservation organizations			*Planning, Implementing, Evaluating, Leading
Private sector organizations	• Tourism providers • Private companies and businesses – hydropower dams • Private companies and businesses (various)		Very good communication and maybe additional education is needed with these economically driven group of SH. The most	*Planning, Implementing, Evaluating, Leading

Group of SH	WHO	WHY	HOW	WHEN
			challenging in North Macedonia is the communication (many times absent) about the hydropower dams. The tourism and other private companies are like: the smaller the scale of business is the better the understanding and the communication is. This is according MES's so far experience with these stakeholders. Small incentives can be very helpful and supportive for the small businesses or the ones that are up to come. Rural tourism is becoming more popular after the COVID, so important lesson needs to be taken from here.	
Media	Tv, radio, internet based	Connectivity conservation requires frequent effective communication and marketing of an inspiring vision as well as feedback about the programs, projects and	A strategic communication plan for both corridors is important and, in some cases, a communication plan in parts of a corridor or for	*Planning, Implementing

Group of SH	WHO	WHY	HOW	WHEN
		individual contributions that have been implemented to help achieve this vision (Pulsford et al. 2013).	specific projects. Products include corridor information brochures, corridor science books, videos and a website that is actively managed and from which press releases, audio/radio technologies, progress reports, scientific and technical reports and other downloadable material can be made available to the widest possible audience. Communication tools that use social media may be employed including technology such as smart-phone and specialist applications for citizen science data recording (such as wildlife observations) and reporting threats to and impacts on corridors (Pulsford et al. 2013).	
Scientific community	Independent scientists, research organizations, institutes	An understanding of conservation biology provides an important contribution to connectivity		*Planning, Implementing, Evaluating

Group of SH	WHO	WHY	HOW	WHEN
		conservation management principles and actions. Spatial analysis of biological values provides the ability to priorities investment for on-ground conservation activities that need to be delivered in the right places in the most cost-effective way. Connectivity conservation research provides a basis for understanding the changes taking place in corridor landscapes, for evaluating threats and for measuring the corridor condition and the effectiveness of conservation actions, which often need to be assessed at multiple scales.		

*** LEADING Establish and promote the vision. Establish the political, social, and national capacity to implement the vision. Integrate the connectivity vision into the regional landscape PLANNING Develop a strategic plan for the whole of the connectivity conservation area**

IMPLEMENTING Achieve a capacity to operate. Respond to critical connectivity conservation area threats

EVALUATING Establish evaluation needs and systems

Adapted from Worboys et al. (2010)

Table A7. Stakeholders and their responsibility in Albania

Group of SH	WHO	WHY	HOW	WHEN
Government organizations and agencies	• Ministry of Tourism and Environment of Albania; • Ministry of Agriculture, and Rural Development of Albania • Ministry of Infrastructure and Energy of Albania • Ministry of Finance and Economy of Albania • Ministry of Interior • NAPA-National Agency of the Protected Areas within Ministry of Tourism and Environment • National Forest Agency, Albania • National Environmental Agency within Ministry of Tourism and Environment • National Agency of Natural Resources withinMinistry of Infrastructure and Energy of Albania • The Agency for Water Resources Management	Natural values, forests, aquatic resources, pastures and meadows are the ecosystems that domain in the study area hence the choice of the first drafted stakeholders in this group. All these are important in decision making processes. They are the ones who make plans, strategies, enforcement of laws etc.	The ecological networking and connectivity conservation needs to be supported by many legal instruments and tools that already exist in most national legal systems. A two-pronged approach is needed: making better use of existing instruments and strengthening existing frameworks with new and innovative tools and processes as feasible. It is extremely important for all relevant government organizations and agencies to be involved to synchronize the activities and future plans accordingly. If one is missing, any actions planned, risk with failure. Enhancement of Financing mechanism for the PAs in Albania remains a	*Planning, Implementing, Evaluating, Leading

Group of SH	WHO	WHY	HOW	WHEN
	(executive body of National Water Council)		challenging issue, while generated incomes so far are almost very insignificant.	
Local stakeholders	• RAPA-Regional Administration of Protected Areas within National Agency of the Protected Areas • Water Basin councils within Agency for Water Resources Management • LAG Korab-Koritnik • Municipalities and village communities • Different community groups (religion based or other)	Corridor management must take into account a long history of prior government and community decisions. It is also important to understand the capacity and skills of local communities.	Constant communication is a must when comes to these SH. There are several small scale HPPs and mining activities particularly in both selected corridors, and the concessions for the operation are issued by the Ministry of Infrastructure and Energy. Forest concessionaries and forest exploitation permits are provided by Ministry of Tourism and Environment, and solid cooperation with local municipalities is required. There are active Tour operators/tour guides and local groups, and PPNEA has established solid communication and connection. This group of SH	*Planning, Implementing, Evaluating

Group of SH	WHO	WHY	HOW	WHEN
			make the “local movement” and are crucial part in drafting ideas for solving some cross-cutting issues.	
Vulnerable groups who may be impacted by the Project	• Private forest owners • Agriculture land owners	Landholders are key stakeholders who must be supportive to take action to help restore and manage landscapes. Without their support and cooperation little can be achieved. Key delivery partner organizations can offer on-ground conservation programs using a range of voluntary conservation instruments that can include incentive payments.	While the land tenure issues (including forest areas) are remaining issues, particularly the northeastern part of Albania, the cooperation is demanded. So, forest delineation map following the ownership need to be developed. Frequent communications and gatherings of these stakeholders leaded by project are highly recommendable. Campaigns can be effective too. Payments for Ecosystem Services (PES) schemes can	*Planning, Implementing, Evaluating

Group of SH	WHO	WHY	HOW	WHEN
			be taken in consideration as possible negotiation tool.	
Civil society organizations	• National NGOs • Local NGOs			*Planning, Implementing, Evaluating, Leading
International organizations	• Donors • Conservation organizations			*Planning, Implementing, Evaluating, Leading
Private sector organizations	• Tourism providers/tour operators, hiking tour organizations/individuals • Private companies and businesses – hydropower dams • Private mining/excavation companies, particularly in the area of Munella • Private companies and businesses (various)		Further communication, awareness, education and public participation is needed with this economically driven group of SH. Similarly to RNM, in Albania the consolations and communication with regard to HPPs and other activities (mining, quarries, etc) is required. There are no single incentive provided in benefit or advancement of nature conservation, while small incentives can be very helpful and supportive for the small businesses or the ones that	*Planning, Implementing, Evaluating, Leading

Group of SH	WHO	WHY	HOW	WHEN
			are up to come. Rural tourism is becoming more popular after the COVID, so important lesson needs to be taken from here.	
Media	Tv, radio, internet based	Connectivity conservation requires frequent effective communication and marketing of an inspiring vision as well as feedback about the programs, projects and individual contributions that have been implemented to help achieve this Vision (Pulsford et al. 2013).	A strategic communication plan for both corridors is important and, in some cases, a communication plan in parts of a corridor or for specific projects. Products include corridor information brochures, corridor science books, videos and a website that is actively managed and from which press releases, audio/radio technologies, progress reports, scientific and technical reports and other downloadable material can be made available to the widest possible audience. Communication tools that use social media may be employed including technology such as smart-	*Planning, Implementing

Group of SH	WHO	WHY	HOW	WHEN
			phone and specialist applications for citizen science data recording (such as wildlife observations) and reporting threats to and impacts on corridors (Pulsford et al. 2013).	
Scientific community	Independent scientists, research organizations, institutes	An understanding of conservation biology provides an important contribution to connectivity conservation management principles and actions. Spatial analysis of biological values provides the ability to priorities investment for on-ground conservation activities that need to be delivered in the right places in the most cost-effective way. Connectivity conservation research provides a basis for understanding the changes taking place in corridor landscapes, for evaluating threats and for measuring the corridor condition and the effectiveness of conservation actions, which often		*Planning, Implementing, Evaluating

Group of SH	WHO	WHY	HOW	WHEN
		need to be assessed at multiple scales.		

Annex III – Protected areas connected to CCAs

In North Macedonia, the protected areas are still being perceived like there are places with obligatory limitations. So, not rarely, the pressure goes to others, unprotected sites along the country. Designation of new protected areas goes very slowly, and if done, the process of starting with their management and functioning is even slower. Nevertheless, the last two newly designated protected areas are a very good example when comes to total involvement of all groups of stakeholders in every phase of proclamation process. Yet, a question still stands: are there sufficient capacities, both, financial and human, to manage protected areas in North Macedonia? The answer is probably "no", since the PAs are still self-financed bodies. Having new officially protected areas is probably not a good idea up until something changes in a different direction. But, using the "connectivity conservation" in a well-planned way and strategy for involving and communicating with various target groups without maybe even planning to have new officially protected sites (following the country context) has a very good chances to be an effective solution to many environmental and socio-economically issues. This, on the other hand will request a lot of work and synergies of Laws, development plans or strategies.

Name of Protected area	**National Park Mavrovo**
IUCN Category	II
Established	Official Gazette of the People's Republic of Macedonia No. 10, from May 05, 1949
Surface	73323 ha
Location/central nearest point	20,666773 E, 41,686191 N (58639ha or 79,97% in Mavrovo and Rostushe, 13816 ha or 18,84% in Gostivar, 641 ha or 0,88% in Debar and 227 or 0,31% in Kichevo)
Bio-geographic region	Alpine 100%
Important habitat types	• 3220 Alpine rivers and the herbaceous vegetation along their banks • 3240 Alpine rivers and their ligneous vegetation with Salix elaeagnos • 4060 Alpine and boreal heaths • 6150 Siliceous alpine and boreal grasslands • 6170 Alpine and subalpine calcareous grasslands • 6220* Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea • 6230 *Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) • 62D0 Oro-moesian acidophilous grasslands • 6520 Mountain hay meadows • 6540 Sub-mediterranean meadows with Molinio-Hordeion secalini • 7220 *Petrifying springs with tufa formation (Cratoneurion) • 8210 Calcareous rocky slopes with chasmophytic vegetation • 8220 Siliceous rocky slopes with chasmophytic vegetation • 91AA *Eastern white oak woods

	• 91E0 *Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) • 91W0 Moesian beech forests • 9270 Hellenic beech forests with Abies borisii-regis • 92D0 Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae) • 9530 * (Sub-)Mediterranean pine forests with endemic black pines
Important wildlife species	Brown bear, Wolf (*Canis lupus*), Balkan chamois, Balkan lynx, Orsinii's viper (*Vipera ursinii*), Balkan whip snake (*Hierophis gemonensis*), Yellow-bellied toad (*Bombina variegata*), Scarce fritillary (*Euphydryas maturna*), Apollo (*Parnassius apollo*)
Land use	31,504 ha Forest, 28,594 Pasture, 10,119 ha Unproductive areas, 1593 ha Agricultural land, 1351 ha Waterbodies and 299 ha Urban areas.
State of Management Plan	No new management plan; the area hasn't been reproclaimed.
Administrated by	Public institution National Park Mavrovo

Name of Protected area	**National Park Galichica**
IUCN Category	II
Established	1958
Surface	24220 ha
Location/central nearest point	20,856634 E, 41,006726 N (15156,7 ha or 62,58% in Ohrid, 9063,7 ha or 37,42% in Resen
Bio-geographic region	Alpine 100%
Important habitat types	• 4060 Alpine and boreal heaths • 5110 Stable xero-thermophilous formations with Buxus sempervirens on rock slopes (Berberidion p.p.) • 5130 Juniperus communis formations on heaths or calcareous grasslands • 6170 Alpine and subalpine calcareous grasslands • 6220* Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea • 62D0 Oro-moesian acidophilous grasslands • 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels • 6510 Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) • 8120 Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)

	• 8140 Eastern Mediterranean screes • 8210 Calcareous rocky slopes with chasmophytic vegetation • 8310 Caves not open to the public • 9180 * Tilio-Acerion forests of slopes, screes and ravines • 9250 Quercus trojana woods • 9270 Hellenic beech forests with Abies borisii-regis • 9560 * Endemic forests with Juniperus spp. • 91K0 Illyrian Fagus sylvatica forests (Aremonio-Fagion) • 91W0 Moesian beech forests
Important wildlife species	Brown bear, Wolf, Balkan chamois, Balkan lynx, Dalmatian algyroides (*Algyroides nigropunctatus*), Balkan whip snake, Macedonian crested newt (*Triturus macedonicus*), Grey-Asian grayling (*P.geyeri*), Large cooper (*Lycaena dispar*), Large blue (*Phengaris arion*)
Land use	5714 ha Forest, 487 Pasture, 10470 ha Unproductive areas, 6331 ha Agricultural land, 487 ha Waterbodies and 730 ha Urban areas.
State of Management Plan	Revised and under implementation
Administrated by	Public institution National Park Galichica

Name of Protected area	**National Park Pelister**
IUCN Category	II
Established	1948
Surface	17147 ha
Location/central nearest point	21,184723 E, 40,99191 N (12482,4 ha or 79,85% in Bitola, 4655,3 ha or 27,15% in Resen)
Bio-geographic region	Alpine 100%
Important habitat types	• 3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea; • 3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation; • 4060 Alpine and Boreal heaths; • 5130 Juniperus communis formations on heaths or calcareous grasslands; • 6220 * Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea; • 6230 * Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe); • 62D0 Oro-Moesian acidophilous grasslands;

	• 6420 Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion; • 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels; • 6520 Mountain hay meadows; • 7140 Transition mires and quaking bogs; • 7160 Fennoscandian mineral-rich springs and springfens; • 7220 * Petrifying springs with tufa formation (Cratoneurion); • 8150-Medio-European upland siliceous screes; • 8220 Siliceous rocky slopes with chasmophytic vegetation; • 9180 * Tilio-Acerion forests of slopes, screes and ravines; • 91E0 * Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae); • 91W0 Moesian beech forests; • 91AA *Eastern white oak woods; • 91BA Moesian silver fir forests; • 9260 Castanea sativa woods; • 9280 Quercus frainetto woods; • 92A0 Salix alba and Populus alba galleries;
Important wildlife species	Brown bear, Wolf, Yellow-bellied toad, Adder (*Vipera berus*), Sand lizard (*Lacerta agilis*), Grecian grayling (*Pseudochazara graeca*), Balkan cooper (*Lycaena candens*)
Land use	8410 ha Forest, 1373 Pasture, 5134 ha Unproductive areas, 1887 ha Agricultural land, and 343 ha Urban areas.
State of Management Plan	Revised and under implementation
Administrated by	Public institution National Park Pelister

Name of Protected area	**Monument of nature Vevchanski izvori**
IUCN Category	III
Established	1999
Surface	1377 ha
Location/central nearest point	20,561983 E 41,2410855 N (1124 ha or 81,68% in Vevchani, 253 ha or 18,32% in Struga)
Bio-geographic region	Alpine 100%
Important habitat types	• 3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea • 3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp

	• 3230 Alpine rivers and their ligneous vegetation with Myricaria germanica • 3240 Alpine rivers and their ligneous vegetation with Salix elaeagnos. • 3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation • 6420 Mediterranean tall humid grasslands of the Molinio-Holoschoenion • 91E0 *Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae)
Important wildlife species	Brown bear, Hermann's tortoise (*Testudo hermanni*), Adder, Yellow-bellied toad
Land use	704 ha Forest, 275 ha Pasture, 330 ha Unproductive areas, 27 ha Agricultural land, and 41 ha Urban areas.
State of Management Plan	New management plan; recently started implementing it but low capacities.
Administrated by	Municipality of Vevchani

The Albanian trends in terms of protected areas coverage is in line with that of international community. Recent analyses (APA, 2019) reveal that the Government of Albania has approved a System of Environmentally Protected Areas. Currently the area of the Network of Protected Areas (NPA) of Albania reaches 504,826.3 ha, or 21% of the total area of the country. Of the total area, 98,180ha, are with the status of Ramsar areas, which cover 3.42% of the total area of the country.

The basis of this system consists mainly of: two Strict Nature Reserves; 14 National Parks; 721 units with the status of Nature Monument; 24 Managed Nature Reserves/Nature Park; six protected landscape and four protected area of managed resources. Planning and management process has been facilitated via different projects implemented so far.

Name of Protected area	**Korrab-Koritnik Nature Park**
IUCN Category	IV
Established	DCM, No.898, date 21.12.2011
Surface	55,506 ha
Location/central nearest point	40º 58' 48" N/ 20º 16' 32" E (34,882.29 ha or 62.9% in Kukes and 20,581.19 or 37.1% in Dibra)
Bio-geographic region	Alpine 100%

Dominant habitat types	• 6230 Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) • 62A0 Eastern sub-mediteranean dry grasslands (*Scorzoneratalia villosae*) • 9530 * (Sub-)Mediterranean pine forests with endemic black pines • 3220 Alpine rivers and the herbaceous vegetation along their banks • 3240 Alpine rivers and their ligneous vegetation with *Salix elaeagnos* • 8210 Calcareous rocky slopes with chasmophytic vegetation
Important wildlife species	Brown bear (*Ursus arctos*), Wolf (*Canis lupus*), Balkan chamois (*Rupicapra rupicapra balcanica*), Balkan lynx (*Lynx lynx balcanicus*)
Land use	22,342 ha Forest, 21,080 Pasture, 6,033 30 ha Unproductive areas, 5,893 ha Agricultural land and 156 ha Urban areas.
State of Management Plan	2015 (expired in 2020)
Administrated by	AdZM Kukes and AdZM Dibra

Name of Protected area	**Shebenik Jabllanica National Park**
IUCN Category	II
Established	DCM, No.640, date 21.05. 2007
Surface	33,894 ha
Location/central nearest point	41° 14' 50.3" N/ 20° 26' 49.9" E
Bio-geographic region	Alpine 100%
Dominant habitat types	6110 * Rupicolous calcareous or basophilic grasslands of the *Alysso-Sedion albi* 6230 * Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) 62B0 * Serpentinophilous grasslands of Cyprus 91K0-Illyrian *Fagus sylvatica* forests (*Aremonio-Fagion*) (Mostly degraded state due to over sue and lack of management) 9530 * (Sub-)Mediterranean pine forests with endemic black pines
Important wildlife species	Brown bear (*Ursus arctos*), Wolf (*Canis lupus*), Balkan chamois (*Rupicapra rupicapra balcanica*), Balkan lynx (*Lynx lynx balcanicus*)
Land use	23,186 ha forest; 7,053 ha pasture; 1,630 ha unproductive areas; 2,025 ha agriculture land.

State of Management Plan	Management plan, 2015
Administrated by	AdZM Elbasan

Name of Protected area	**Vlashaj Nature Monument**
IUCN Category	III
Established	DCM, No.102, date 15.01.1996
Surface	50 ha
Location/central nearest point	41º 51' 51.1" N / 20º 12' 2.9" E
Bio-geographic region	Alpine 100%
Dominant habitat types	• 6520 Mountain hay meadows • 91M0 Pannonian-Balkanic turkey oak- sessile oak forests • 9560 * Endemic forests with *Juniperus* spp.
Important wildlife species	Brown bear (*Ursus arctos*), Wolf (*Canis lupus*)
Land use	50 ha Forets
State of Management Plan	No Management plan
Administrated by	AdZM Dibra

Name of Protected area	**Tej Drini i Bardhe Nature Park**
IUCN Category	IV
Established	DCM, No.102, date 15.01.1996
Surface	30 ha
Location/central nearest point	42º 9' 28.1" N/ 20º 28' 22.4" E
Bio-geographic region	Alpine 100%
Dominant habitat types	91K0-Illyrian *Fagus sylvatica* forests (*Aremonio-Fagion*) (Mostly degraded state due to over sue and lack of management)
Important wildlife species	Brown bear (*Ursus arctos*), Wolf (*Canis lupus*), The western capercaillie (*Terao urogallus*)

Land use	30 ha forest
State of Management Plan	No management plan
Administrated by	AdZM Kukes

Name of Protected area	**Polis Nature Park**
IUCN Category	IV
Established	DCM, No.102, date 15.01.1996
Surface	45 ha
Location/central nearest point	40º 15' 41" N/ 20º 32' 33" E
Bio-geographic region	Alpine 100%
Dominant habitat types	• 6110 * Rupicolous calcareous or basophilic grasslands of the *Alysso-Sedion albi* • 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels • 9110 *Luzulo-Fagetum* beech forests
Important wildlife species	Brown bear (*Ursus arctos*), Wolf (*Canis lupus*), The western capercaillie (*Terao urogallus*), Balkan lynx (*Lynx lynx balcanicus*)
Land use	44.5 ha forest, 0.5 ha pasture
State of Management Plan	No management plan
Administrated by	AdZM Elbasan

Name of Protected area	**Stravaj Nature Park**
IUCN Category	IV
Established	DCM, No.102, date 15.01.1996
Surface	400 ha
Location/central nearest point	41º 0' 4" N/ 20º 21' 26.6" E
Bio-geographic region	Alpine 100%

Dominant habitat types	• 91M0 Pannonian-Balkanic turkey oak- sessile oak forests • 92C0 *Platanus orientalis* and *Liquidambar orientalis* woods (*Plantanion orientalis*) • 91K0-Illyrian *Fagus sylvatica* forests (*Aremonio-Fagion*)
Important wildlife species	Balkan lynx (*Lynx lynx balcanicus*), Brown bear (*Ursus arctos*), Wolf (*Canis lupus*), The western capercaillie (*Terao urogallus*)
Land use	400 ha Forest
State of Management Plan	No management plan
Administrated by	AdZM Elbasan

Name of Protected area	**Sopot Nature Park**
IUCN Category	IV
Established	DCM, No.102, date 15.01.1996
Surface	300 ha
Location/central nearest point	40º 59' 54.6"N/ 20º 20' 10" E
Bio-geographic region	Alpine 100%
Dominant habitat types	6110 * Rupicolous calcareous or basophilic grasslands of the • *Alysso-Sedion albi* • 9110 *Luzulo-Fagetum* beech forests • 8210 Calcareous rocky slopes with chasmophytic vegetation
Important wildlife species	Balkan lynx (*Lynx lynx balcanicus*), Brown bear (*Ursus arctos*), Wolf (*Canis lupus*), The western capercaillie (*Terao urogallus*)
Land use	400 ha Forest
State of Management Plan	No management plan
Administrated by	AdZM Elbasan

Name of Protected area	**Cangonj Nature Park**
IUCN Category	IV
Established	Regulation No.1 of Ministry of Agriculture, date 27.07.1977

Surface	250 ha
Location/central nearest point	40º 40' 53.4" N/20º 54' 51.5" E
Bio-geographic region	Mediterranean
Dominant habitat types	• 9250 *Quercus trojana* woods • 9260 *Castanea sativa* woods • 9280 *Quercus frainetto* woods
Important wildlife species	Wolf (*Canis lupus*)
Land use	241ha forest; 9 ha pasture
State of Management Plan	No management plan
Administrated by	AdZM Korça

Name of Protected area	**Bredhi i Drenoves National Park**
IUCN Category	II
Established	DCM, No.96, date 21.11. 1966
Surface	1,379 ha
Location/central nearest point	40º 34' 9.5" N/ 20º 49' 49.8" E
Bio-geographic region	Mediterranean
Dominant habitat types	• 9110 *Luzulo-Fagetum* beech forests • 9270 Hellenic beech forests with *Abies borisii-regis*
Important wildlife species	Brown bear (*Ursus arctos*), Wolf (*Canis lupus*)
Land use	1367 ha forest; 12 ha unproductive areas
State of Management Plan	No management plan
Administrated by	AdZM Korça

Annex IV - High Nature Value Forests in North Macedonia

With a previous project ("Identification of High Nature Value Forests in North Macedonia", implemented by MES on behalf of UNEP/GEF, with MoEPP as a beneficiary), several forest patches that meet the predefined criteria for HNVF were selected. Their locations are shown on Figure A15, while basic description per forest patch and per EUNIS habitat type are given in Table A8.

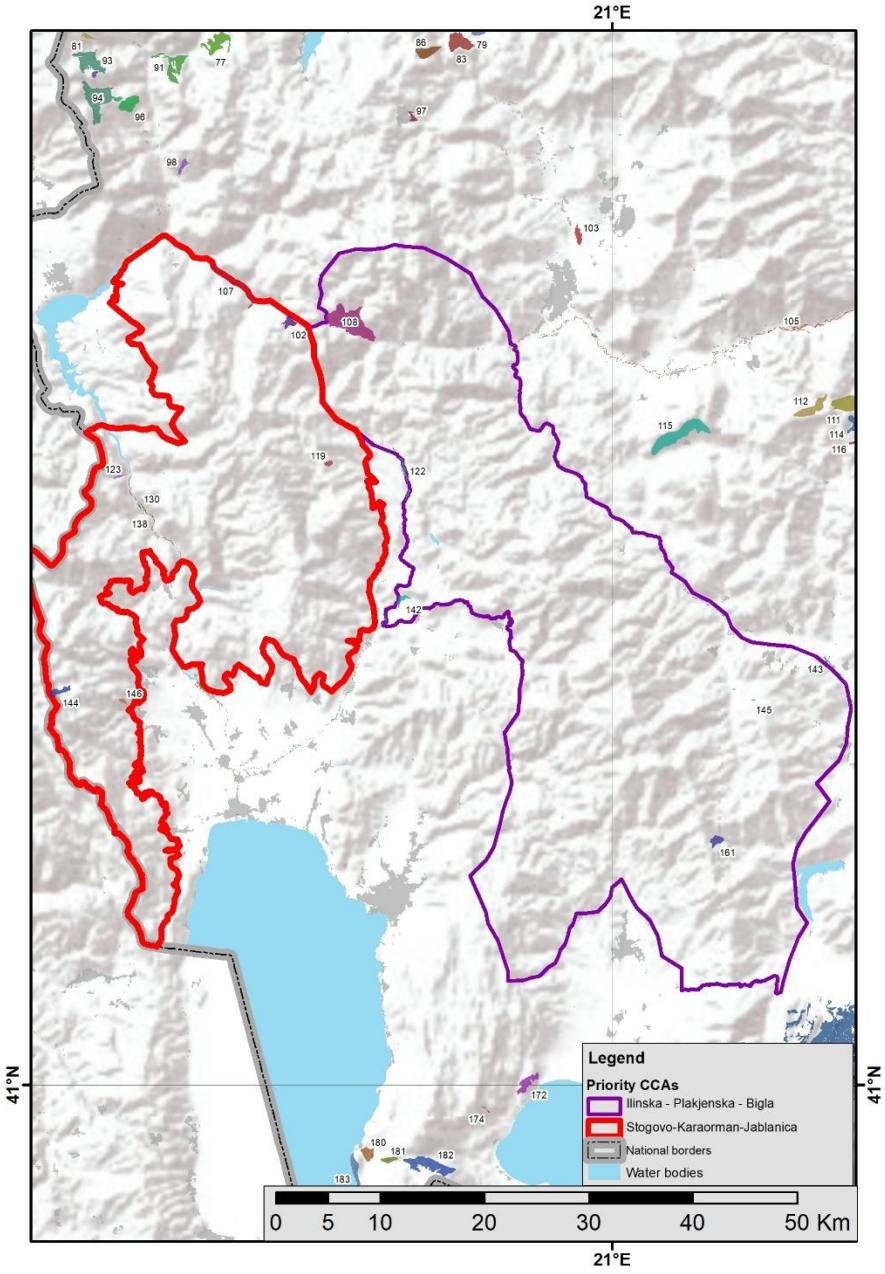


Figure A15. Identified High Nature Value forests within the two corridors. With notable exception of Suvi Dol, patches are small (Table A8), indicating the need for more careful forest management and restoration activities.

Table A8. Overview of the High Nature Value Forests in the identified corridor, according to the EUNIS habitat type. Numbers of the HNV Forests correspond with the numbers in the Figure A15. The table gives information of ne total surface of the HNVF (parts are not included in the corridor borders, but this is only due to technical precision of the borders) and the surface included in the corridor. Largest habitat types are G1.413 - Southern Helleno-Balkanic swamp alder woods and G1.692 : Southeastern Moesian beech forests with 69 and 52 ha respectively, and of course the G1.A46222 : Pelagonid horse-chestnut ravine forests in Suvi Dol. Ilinska-Plakenska corridor seems to hold larger surface area under HNVF than Jablanica-Stogovo-Karaorman, but if Suvi Dol is excluded, the values are comparable.

	G1.1 : Riparian and gallery woodland, with dominant Alnus, Betula, Populus or Salix		G1.3 - Mediterranean riparian woodland		G1.413 - Southern Helleno-Balkanic swamp alder woods		G1.692 : Southeastern Moesian beech forests		G1.76 : Balkano-Anatolian thermophilous Quercus forests		G1.7C1 : Ostrya carpinifolia woods		G1.A46222 : Pelagonid horse-chestnut ravine forests		G3.621 : Pelagonide Macedonian pine woods		**Total HNVF surface**	**HNVF surface in corridor**
Corridor/HNVF	Total HNVF surface	HNVF surface in corridor	Total HNVF surface	HNVF surface in corridor	Total HNVF surface	HNVF surface in corridor	Total HNVF surface	HNVF surface in corridor	Total HNVF surface	HNVF surface in corridor	Total HNVF surface	HNVF surface in corridor	Total HNVF surface	HNVF surface in corridor	Total HNVF surface	HNVF surface in corridor		
Ilinska - Plakenska - Bigla - Mazatar - Istok	**12.5**	**5.5**	**21.7**	**16.0**	**68.9**	**44.5**	**51.5**	**51.5**	**2.6**	**2.6**			**447.5**	**447.5**			**604.7**	**567.7**
105 - Treska - Poreche	5.7	4.2															**5.7**	**4.2**
108 - Suvi Dol													447.5	447.5			**447.5**	**447.5**
122 - Golema Reka - Arbinovo					37.4	13.4											**37.4**	**13.4**
142 - Sateska	6.7	1.2			31.4	31.2											**38.1**	**32.4**

143 - Crna Reka - Izvor			21.7	16.0													**21.7**	**16.0**
145 - Mrenoga									2.6	2.6							**2.6**	**2.6**
161 - s. Smilevo, Demir Hisar							51.5	51.5									**51.5**	**51.5**
Jablanica - Karaorman - Stogovo	**37.2**	**36.1**					**83.6**	**83.6**			**5.5**	**5.5**	**59.0**	**30.9**	**52.3**	**52.3**	**237.6**	**208.4**
102 - Krivi Dol							51.3	51.3									**51.3**	**51.3**
107 - Mala Reka													49.0	20.9			**49.0**	**20.9**
119 - Karaorman							18.7	18.7									**18.7**	**18.7**
123 - Drenochka Klisura													10.0	10.0			**10.0**	**10.0**
130 - Lukovo											5.5	5.5					**5.5**	**5.5**
138 - Crn Drim	37.2	36.1															**37.2**	**36.1**
144 - Molika on Jablanica															52.3	52.3	**52.3**	**52.3**
146 - Sv. Spas, Jablanica							13.7	13.7									**13.7**	**13.7**
Total	**49.7**	**41.6**	**21.7**	**16.0**	**68.9**	**44.5**	**135.2**	**135.2**	**2.6**	**2.6**	**5.5**	**5.5**	**506.5**	**478.5**	**52.3**	**52.3**	**842.3**	**776.1**

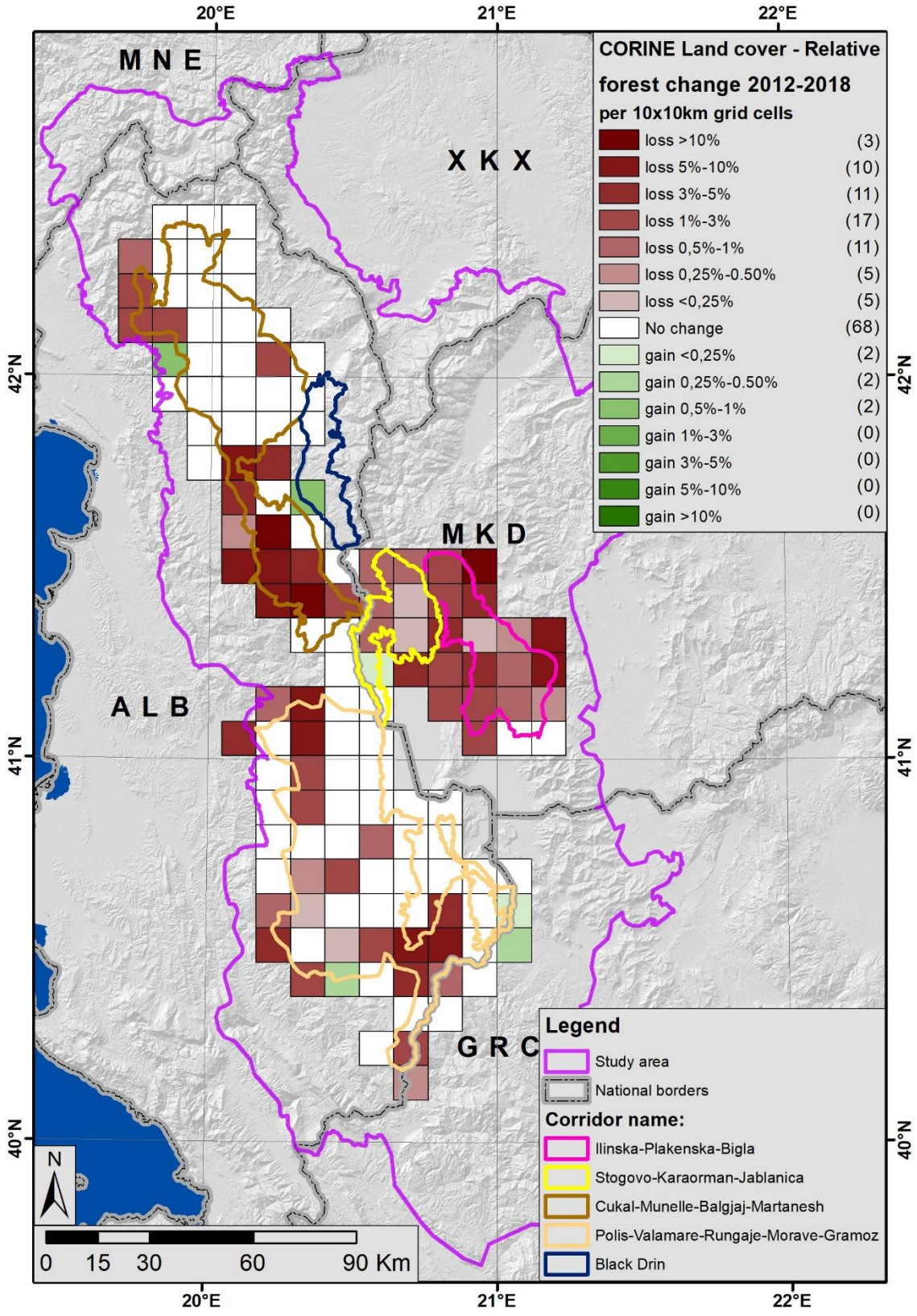


Figure A16. Forest loss map in the studied Connectivity Conservation Areas represented in 10x10 km grids based on the Corine Land Cover 2012-2018 changes and takin only the forest categories 311,312 i 313 into account.

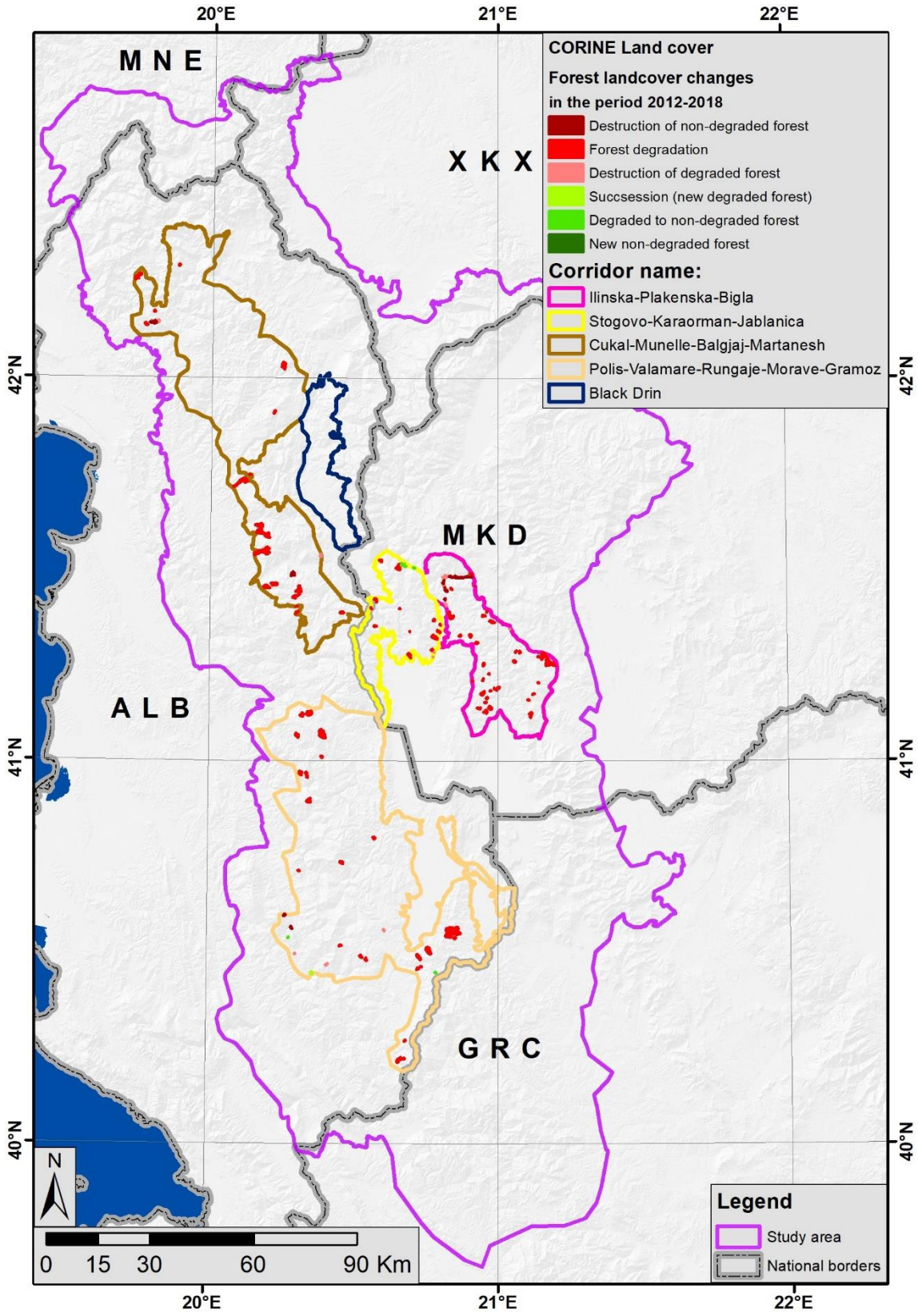


Figure A17. Exact representation of the forest land-cover changes over the period of 2012-2018.