

HPDA service for estimating the brown bear population in Bulgaria



EURO²

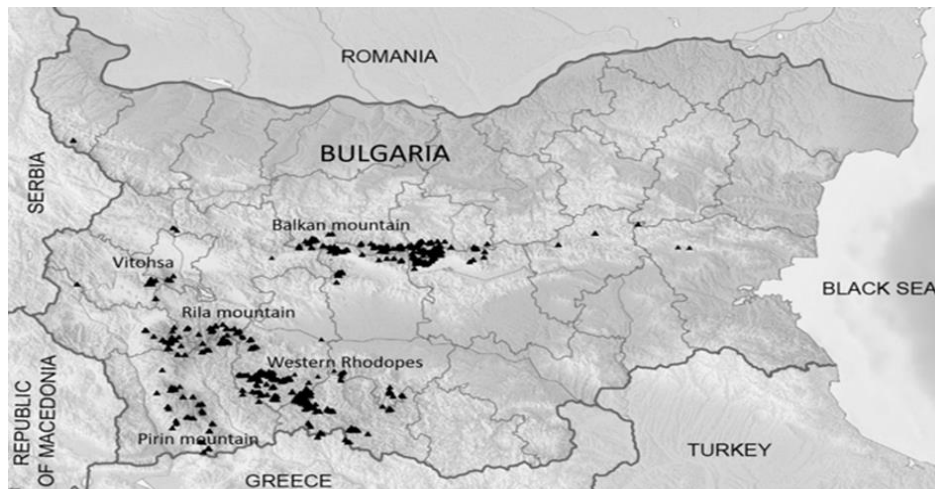
HPC FORUM, 16.11.2023, Sofia, Bulgaria

**Todor Gurov, NCC Bulgaria, ICT-BAS
(Тодор Гуров, НКЦ България, ИКТ-БАН)**

Motivation

- The Habitat directive requires a strict protection of the species and declaration of special protected areas for conservation of its habitats.
- Brown Bear (*Ursus arctos*) is a priority species for conservation of mammals in the European Union. Conservation status: in Bulgaria endangered EN [C2a (i)], BA-II, III, International: Beck-II; CITES-II; DH-II, IV.
- Red Data Book of the Republic Bulgaria, Vol. 2 – Animals, Sofia, 2011.

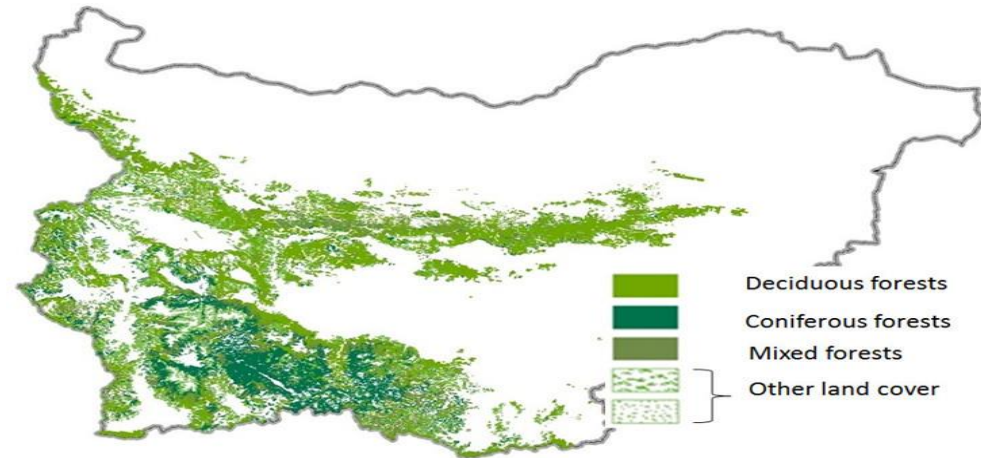
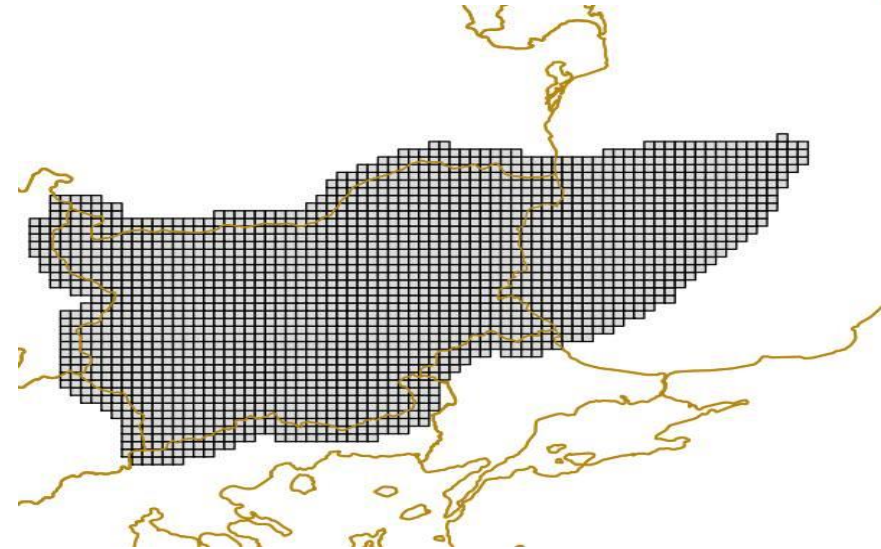
<http://e-ecodb.bas.bg/rdb/en/>



National monitoring

National Monitoring at the main mountain's habitats (2016):

- Width/length of the front footprint and/or back footprint 79
- Excrements 75
- Found bear marking 26
- A place where the bear has fed itself 8
- Visual observation of a bear 17
- Found winter dens 3
- Bear bed 1
- **Total: GPS coordinates of all bear's traces/signs 209**

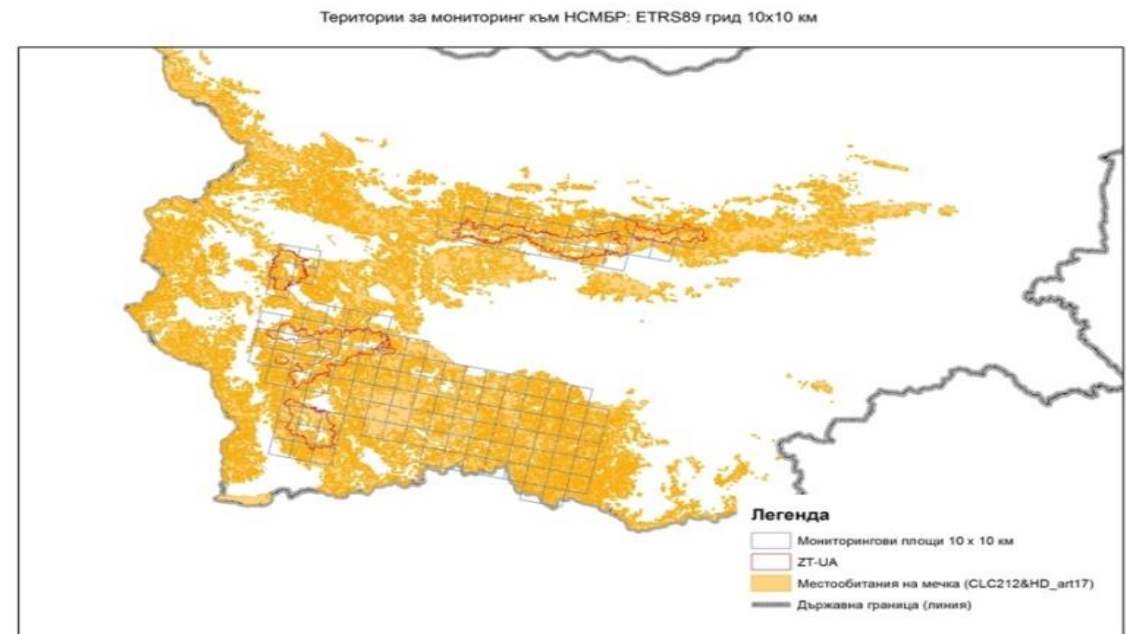
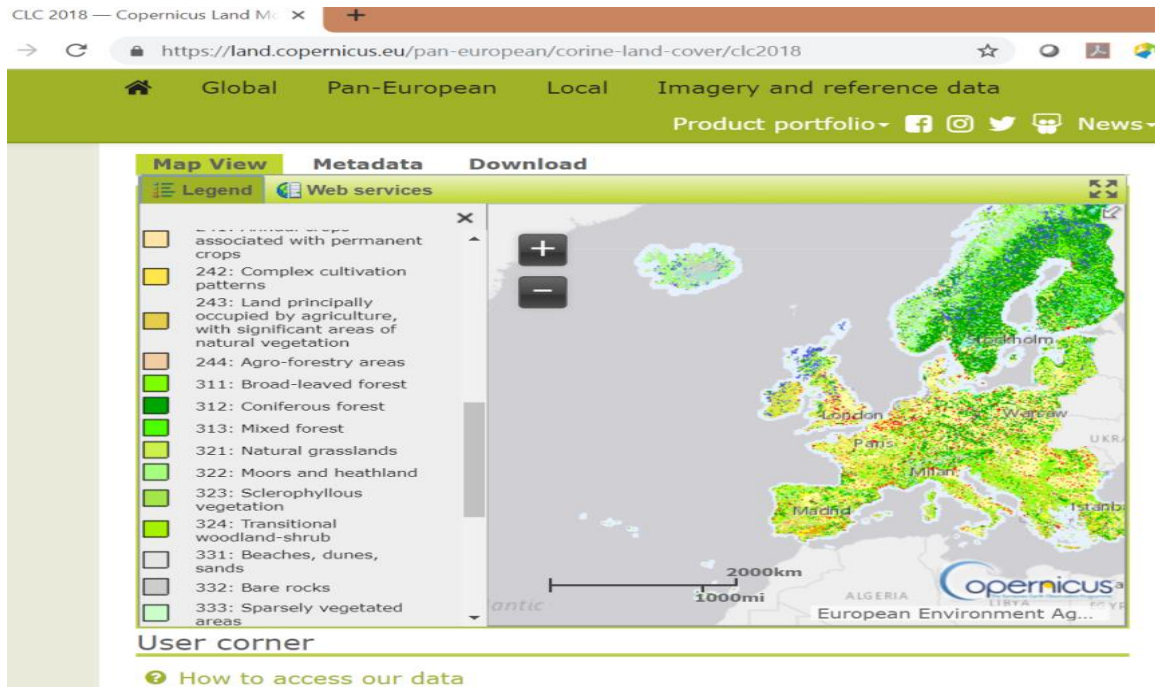


Number of grids in each subpopulation area

Areas for Monitoring	ETRS89 Grids 10x10 km	Number
Vitosha-Verila-Plana	E541N226; E541N225; E540N226; E540N225; E540N224; E540N223; E541N223;E541N224;E542N224; E542N225	10
Rila	E540N220; E540N221; E540N222; E541N219; E541N220; E541N221;E541N222; E542N219; E542N220; E542N221; E542N222; E542N223;E543N219; E543N219; E543N220; E543N221; E543N222; E544N220; E544N221; E544N222; E544N223; E545N220; E545N221; E546N222; E545N223; E543N223	26
Pirin	E542N215; E542N216; E542N217; E542N218; E543N215; E543N216; E543N217; E544N215; E544N216; E544N217	10
Rhodops	E546N217; E547N222; E548N219; E552N218; E552N220; E556N220; E545N218; E545N219; E546N219; E546N220; E547N217; E547N220; E547N218; E547N219; E547N221; E548N217; E548N218; E548N220; E548N221; E549N216; E549N217; E549N218; E549N219; E549N220; E549N221; E550N216; E550N217; E550N218; E550N219; E550N220; E550N221; E551N216; E551N217; E551N218; E551N219; E551N220; E551N221; E552N216; E552N217; E552N219; E552N221; E553N216; E553N220; E554N220; E556N218; E553N217; E553N218;E553N219; E553N221; E554N215; E554N216; E554N217; E554N218; E554N219; E554N221; E555N215; E555N216; E555N217; E555N218; E555N219; E555N220; E555N221; E556N216; E556N217; E556N219; E545N220	60
Middle Balkan	E555N229; E551N230; E547N229; E549N229; E549N230; E556N231; E557N230; E558N231; E548N229; E548N230; E549N231; E550N229; E550N230; E551N229; E552N229; E552N230; E553N229; E553N230; E554N229; E554N230; E554N231; E555N230; E555N231;E556N230; E557N231	25
Kotlen mountain	E564N233;E564N234;E565N234; E566N234	4

CORINE Land Cover (CLC)

- CORINE Land Cover (CLC) is one of the most well-known and used products from the Copernicus Land Monitoring Service.
- It has previously been produced in 1990, 2000, 2006 and 2012 and now the 2018 edition is available.



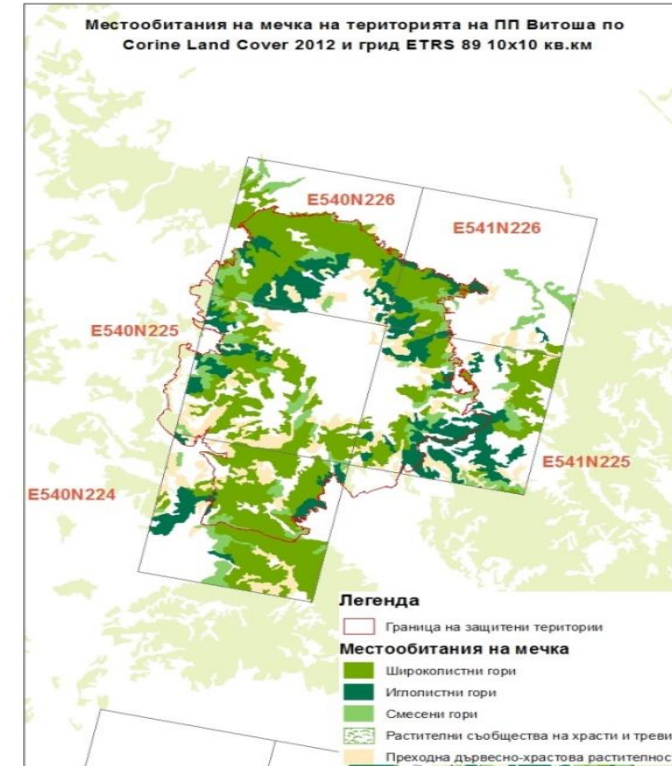
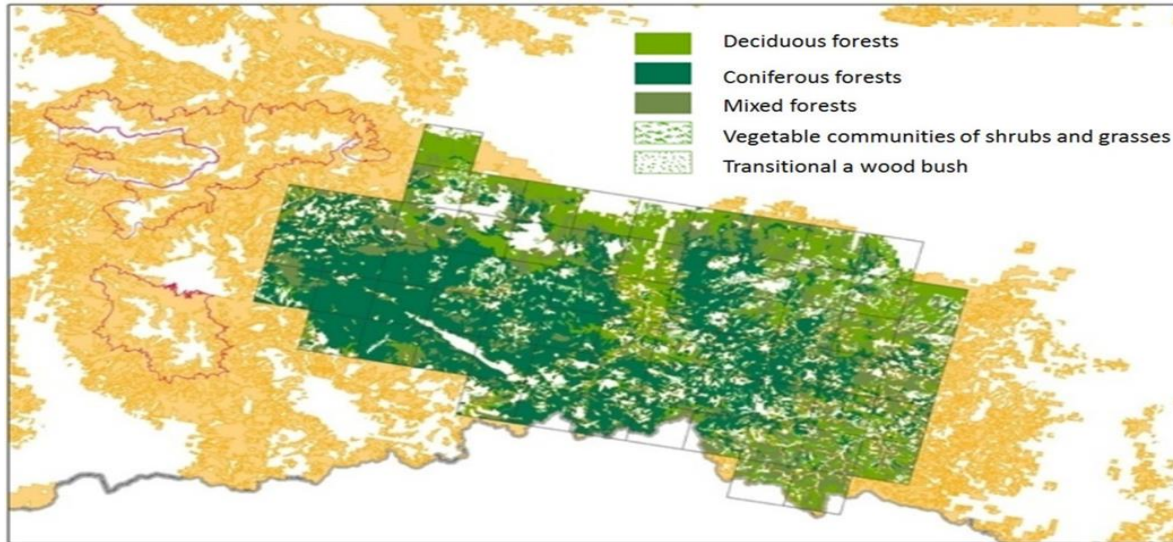
Transect method

It is based on the collection of brown bear sign on predefined set of routes (transects) and the determination of the unique traces (especially footprints).

Statistical estimates for population size of the brown bears using data of national monitoring and developed HPDA service.

- **Type of the forests:**

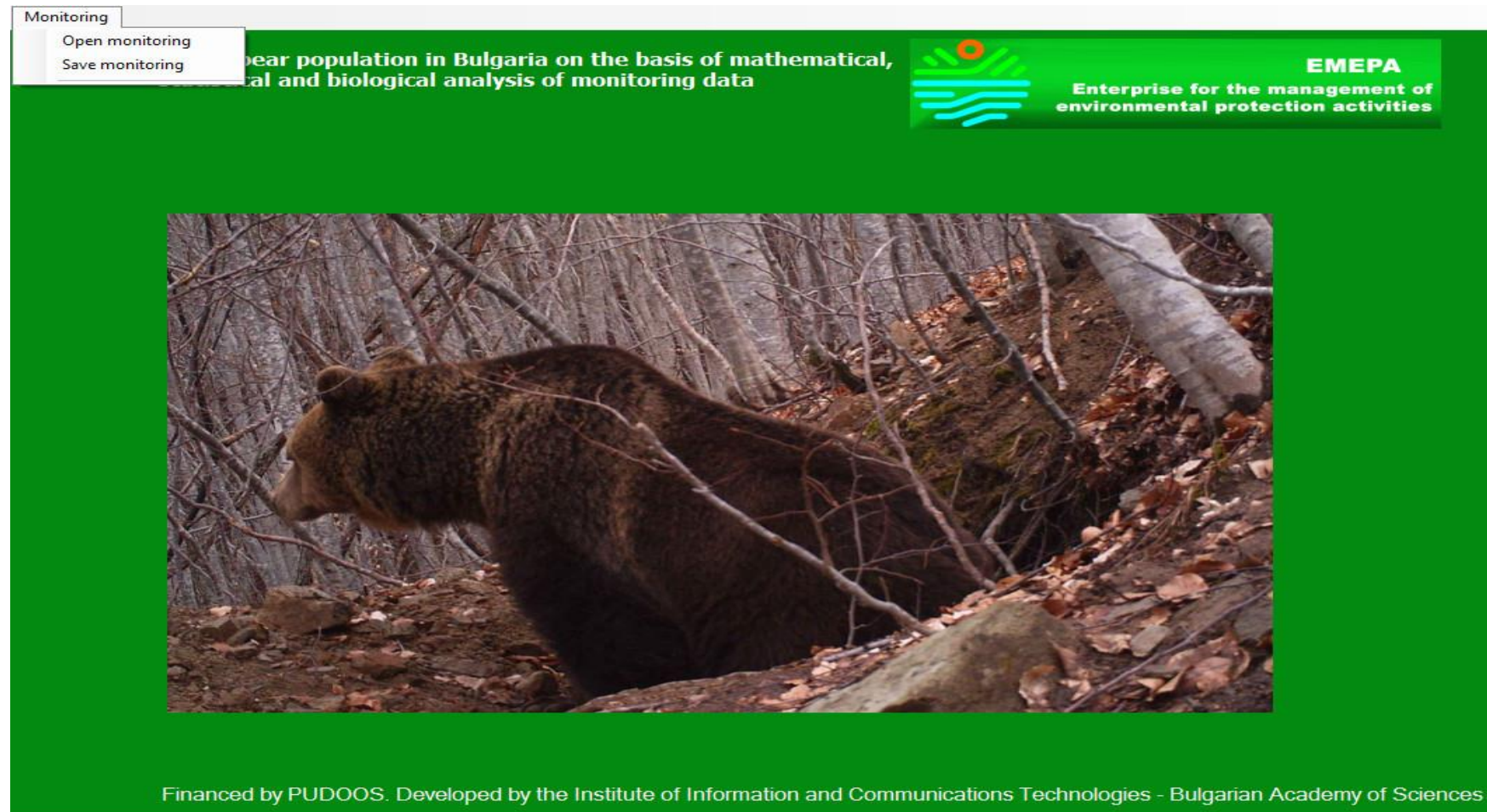
- **Deciduous forests** 311
- **Coniferous forests** 312
- **Mixed forests** 313
- **Vegetable communities of shrubs and grasses** 322
- **Transitional a wood bush** 324
- **Other land cover** no code



Bears' habitat for monitoring in the Western Rhodopes and Vitosha mounting

Start of the HPDA service

- Input the monitoring data to start the preproduction process

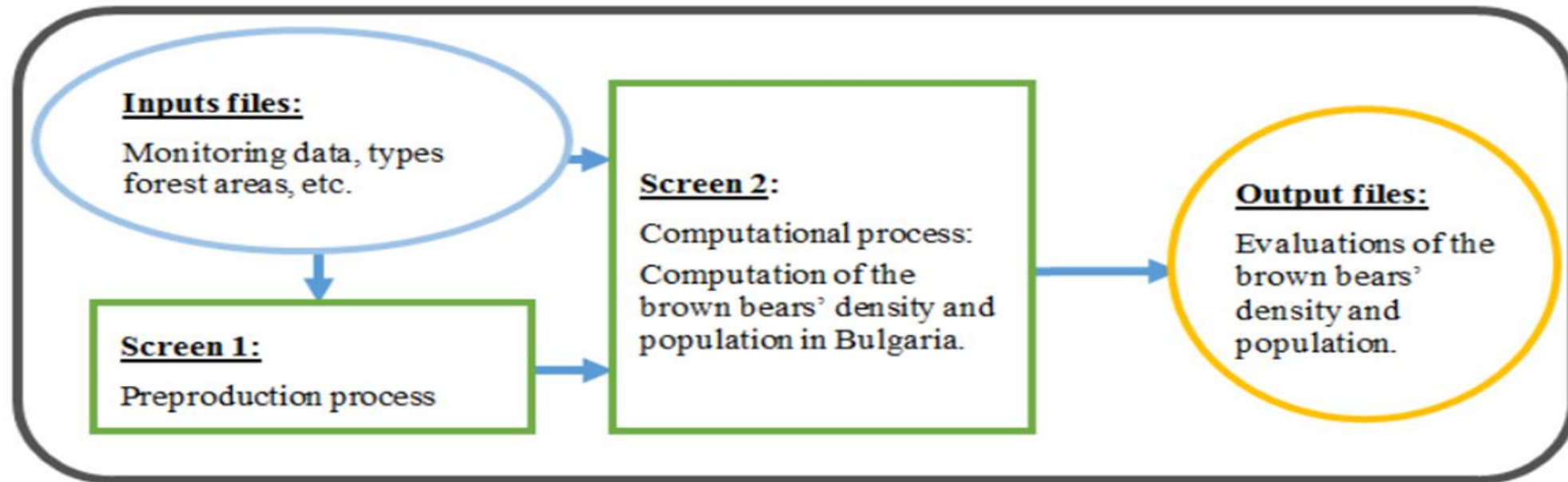


The screenshot shows a web application interface with a green background. At the top left, there is a 'Monitoring' menu with options 'Open monitoring' and 'Save monitoring'. The main header text reads 'Bear population in Bulgaria on the basis of mathematical, statistical and biological analysis of monitoring data'. To the right of the header is the EMEPA logo, which consists of a stylized sun and waves, with the text 'EMEPA Enterprise for the management of environmental protection activities'. Below the header is a large photograph of a brown bear in a forest. At the bottom of the interface, there is a footer text: 'Financed by PUDOOS. Developed by the Institute of Information and Communications Technologies - Bulgarian Academy of Sciences'.

Estimation of the population size of the brown bears (1/2)

The evaluation is done in two steps.

First step: Identify unique traces based on collected observations in the national monitoring. The number of unique traces is determined by experts using the developed software product. Once the unique number of traces has been obtained, the program automatically allocates them by number in the respective 5 types of forest and in the residual area.



Preproduction process: Define the unique traces



Estimate of brown bear population in Bulgaria on the basis of mathematical, statistical and biological analysis of monitoring data

Enterprise for the management of environmental protection

Bears Results

FID	Shape	Label	Form_ID	Form_N:	Date	Type	Width_n	Length_	Width_n	Length_	Soil_Typ	Notes	X	Y	Forest Type	Area	Delete	Skip	Select
65	Point	00011...	00011...	Brown...	4.11.2...	Trace	14						23.9912	41.9163	Conif...	E547...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42	Point	00011...	00011...	Brown...	4.11.2...	Trace		12	20				24.0041	41.8688	Conif...	E548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
78	Point	00014...	00014...	Brown...	4.11.2...	Trace	11				mud		24.0738	41.9304	Mixed...	E548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
79	Point	00014...	00014...	Brown...	4.11.2...	Trace	11				mud		24.0796	41.9304	Mixed...	E548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
0	Point	00012...	00012...	Brown...	4.11.2...	Trace	11		10	20	Sandy...	Conif...	24.0888	41.8902	Other	E548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27	Point	00011...	00011...	Brown...	4.11.2...	Trace					grass	The tr...	24.0905	41.7833	Conif...	E548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	Point	00012...	00012...	Brown...	4.11.2...	Trace	11				mud, ...	Conif...	24.1292	41.9036	Conif...	E548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25	Point	00011...	00011...	Brown...	4.11.2...	Trace	14						24.1513	41.8825	Mixed...	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24	Point	00011...	00011...	Brown...	4.11.2...	Trace	19						24.1513	41.8825	Mixed...	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Point	00012...	00012...	Brown...	4.11.2...	Trace	11		10	18	mud, ...	Conif...	24.1521	41.8951	Other	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21	Point	00012...	00012...	Brown...	4.11.2...	Trace	12		11	19	mud, ...	Conif...	24.1793	41.898	Mixed...	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
29	Point	00011...	00011...	Brown...	4.11.2...	Trace							24.1798	42.0692	Mixed...	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33	Point	00011...	00011...	Brown...	4.11.2...	Trace	13		11	18	mud	Old Tr...	24.207	41.8057	Conif...	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34	Point	00011...	00011...	Brown...	4.11.2...	Trace	13		10	18	Sand	Fresh ...	24.221	41.8083	Other	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
53	Point	00011...	00011...	Brown...	5.11.2...	Trace	12				Sand		24.3186	41.7337	Other	E550...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
52	Point	00011...	00011...	Brown...	5.11.2...	Trace	14		15	23	Sand		24.3196	41.7334	Other	E550...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
54	Point	00011...	00011...	Brown...	5.11.2...	Trace	10				mud		24.3335	41.728	Conif...	E551...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17	Point	00015...	00015...	Brown...	4.11.2...	Trace							24.3522	42.7819	Veget...	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
63	Point	00011...	00011...	Brown...	5.11.2...	Trace	14						24.3588	41.8092	Conif...	E551...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
72	Point	00015...	00015...	Brown...	4.12.2...	Trace							24.3603	42.7651	Veget...	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43	Point	00015...	00015...	Brown...	4.12.2...	Trace							24.3665	42.7618	Transi...	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
59	Point	00012...	00012...	Brown...	4.11.2...	Trace	12		12	19	old mud	Mixed...	24.3758	41.8837	Mixed...	E551...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
58	Point	00011...	00011...	Brown...	4.11.2...	Trace	12		12	19	mud	old	24.3758	41.8837	Mixed...	E551...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
37	Point	00012...	00012...	Brown...	5.11.2...	Trace							24.381	41.595	Other	E551...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38	Point	00012...	00012...	Brown...	5.11.2...	Trace							24.388	41.631	Decid...	E551...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22	Point	00011...	00011...	Brown...	6.11.2...	Trace	10				Forest...		24.4833	41.6103	Other	E552...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Point	00015...	00015...	Brown...	5.11.2...	Trace		12	23		Soil	mead...	24.493	42.7529	Decid...	E550...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Distance between traces Show on map Delete traces Re-color Re-count forests

Forest type	Count
Total	68
Other	12
324 - Transitional ...	1
322 - Vegetable c...	4
313 - Mixed forest	26
312 - Coniferous f...	15
311 - Deciduous f...	10

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Compute distances and show traces on the Gmap



Trace 1	Trace 2	Distance[km]
FID: 58, Type: Trace, 41.8837/24.3758	FID: 59, Type: Trace, 41.8837/24.3758	0
FID: 58, Type: Trace, 41.8837/24.3758	FID: 53, Type: Trace, 41.7337/24.3186	17.35
FID: 58, Type: Trace, 41.8837/24.3758	FID: 21, Type: Trace, 41.898/24.1793	16.36
FID: 59, Type: Trace, 41.8837/24.3758	FID: 53, Type: Trace, 41.7337/24.3186	17.35
FID: 59, Type: Trace, 41.8837/24.3758	FID: 21, Type: Trace, 41.898/24.1793	16.36
FID: 53, Type: Trace, 41.7337/24.3186	FID: 21, Type: Trace, 41.898/24.1793	21.63

**Enterprise for the ma
environmental protect**

67

65

42

78

79

0

27

1

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24

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53

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54

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63

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43

59

58

37

38

22

Gmap

ea	Delete	Skip	Select
:547...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:548...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:550...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
:550...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:551...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:551...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
:551...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
:551...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:551...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
:552...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Distance between traces

Show on map

Delete traces

Re-color

Re-count forests

Forest type	Count
Total	68
Other	12
324 - Transitional ...	1
322 - Vegetable c...	4
313 - Mixed forest	26
312 - Coniferous f...	15
311 - Deciduous f...	10

HPC Forum, 16.11.2023, Sofia, Bulgaria

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Skipping, re-coloring and re-counting

Monitoring

Estimate of brown bear population in Bulgaria on the basis of mathematical, statistical and biological analysis of monitoring data

EMEPA
Enterprise for the management of environmental protection activities

Bears Results

FID	Shape	Label	Form_ID	Form_N	Date	Type	Width_n	Length_n	Width_n	Length_n	Soil_Typ	Notes	X	Y	Forest Type	Area	Delete	Skip	Select
24	Point	00011...	00011...	Brown...	4.11.2...	Trace	19						24.1513	41.8825	Mixed...	E549...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20	Point	00012...	00012...	Brown...	4.11.2...	Trace	11	10	18	mud...	Conif...		24.1521	41.8951	Other	E549...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
21	Point	00012...	00012...	Brown...	4.11.2...	Trace	12	11	19	mud...	Conif...		24.1793	41.898	Mixed...	E549...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
29	Point	00011...	00011...	Brown...	4.11.2...	Trace							24.1798	42.0692	Mixed...	E549...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
33	Point	00011...	00011...	Brown...	4.11.2...	Trace	13	11	18	mud	Old Tr...		24.207	41.8057	Conif...	E549...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
53	Point	00011...	00011...	Brown...	5.11.2...	Trace	12			Sand			24.3186	41.7337	Other	E550...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
52	Point	00011...	00011...	Brown...	5.11.2...	Trace	14	15	23	Sand			24.3196	41.7334	Other	E550...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
54	Point	00011...	00011...	Brown...	5.11.2...	Trace	10			mud			24.3335	41.728	Conif...	E551...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
17	Point	00015...	00015...	Brown...	4.11.2...	Trace							24.3522	42.7819	Veget...	E549...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
63	Point	00011...	00011...	Brown...	5.11.2...	Trace	14						24.3588	41.8092	Conif...	E551...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
72	Point	00015...	00015...	Brown...	4.12.2...	Trace							24.3603	42.7651	Veget...	E549...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
43	Point	00015...	00015...	Brown...	4.12.2...	Trace							24.3665	42.7618	Transi...	E549...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
59	Point	00012...	00012...	Brown...	4.11.2...	Trace	12	12	19	old mud	Mixed...		24.3758	41.8837	Mixed...	E551...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37	Point	00012...	00012...	Brown...	5.11.2...	Trace							24.381	41.595	Other	E551...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
38	Point	00012...	00012...	Brown...	5.11.2...	Trace							24.388	41.631	Decid...	E551...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
22	Point	00011...	00011...	Brown...	6.11.2...	Trace	10			Forest...			24.4833	41.6103	Other	E552...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
8	Point	00015...	00015...	Brown...	5.11.2...	Trace		12	23	Soil	mead...		24.493	42.7529	Decid...	E550...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26	Point	00011...	00011...	Brown...	5.11.2...	Trace	10						24.5413	41.7865	Conif...	E552...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
23	Point	00011...	00011...	Brown...	4.11.2...	Trace	12	10		Forest...	trace		24.553	41.93	Conif...	E552...	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
56	Point	00011...	00011...	Brown...	6.11.2...	Trace	10	12					24.5824	41.6789	Other	E553...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
55	Point	00011...	00011...	Brown...	4.11.2...	Trace	13						24.5873	41.9402	Conif...	E552...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
62	Point	00015...	00015...	Brown...	4.11.2...	Trace							24.7404	42.838	Veget...	E552...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
76	Point	00015...	00015...	Brown...	4.11.2...	Trace	12	11					24.8236	42.7562	Mixed...	E552...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
61	Point	00015...	00015...	Brown...	4.11.2...	Trace	12	10		mud	The s...		24.8462	42.7447	Decid...	E553...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30	Point	00011...	00011...	Brown...	6.11.2...	Trace	13						24.8505	41.781	Decid...	E555...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
31	Point	00011...	00011...	Brown...	6.11.2...	Trace	15	9	17	Soil			24.8506	41.781	Decid...	E555...	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32	Point	00011...	00011...	Brown...	6.11.2...	Trace				mud			24.8512	41.7793	Mixed...	E555...	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Distance between traces Show on map Delete traces Re-color Re-count forests

Forest type	Count
311 - Deciduous f...	9
312 - Coniferous f...	14
313 - Mixed forest	21
322 - Vegetable c...	4
324 - Transitional ...	1
Other	11
Total	60

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Computational process

- Computation of the density and the population of the species

Estimate of brown bear population in Bulgaria on the basis of mathematical, statistical and biological analysis of monitoring data

Executive Environment Agency

Bears Results

Open areas Save areas Load areas

ETRS	visited	Mountain	Number of traces
E543N216	no	Pirin	not visited
E543N217	yes	Pirin	1
E543N219	yes	Rila	1
E543N220	yes	Rila	3
E543N221	yes	Rila	1
E543N222	yes	Rila	1
E543N223	no	Rila	not visited
E544N215	no	Pirin	not visited

Save distribution

Mountain	Number of traces
Kotlenska Planina	0
Pirin	3
Plana	0
Rila	18
Stara Planina	18
Verila	0
Vitosha	3
Western Rhodopes	44

Accuracy 10000 All monitoring-2017 Calculate Save Calculation

Mountain	Estimate	Lower boundary	Upper boundary	Threat Level
Stara Planina	72.99	49.64	96.34	Unfavorable-bad
Western Rhodopes	209.8	169.33	250.28	Favorable
Rila	69.89	58.12	81.67	Favorable
Pirin	35.46	31.34	39.58	Unsatisfactory
Vitosha	23.06	23.06	23.06	Unsatisfactory
Kotlenska Planina	8.75	7.52	9.99	Favorable
Verila	13.13	12.41	13.86	Unsatisfactory
Plana	6.28	6.28	6.28	Favorable
Alpine region	385.43	316.4	454.46	Favorable

Calculate Density Save Density

Forest type	Density
311 - Deciduous forest	2.9
312 - Coniferous forest	3.9
313 - Mixed forest	2.9
322/324 - Plant communities of shr...	2.1
other	1.9
Stara Planina	4.3
Western Rhodopes	3.8
Rila	4.1
Pirin	4.2

Show age structure Age structure by marks Calculate with threats Reference values

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New feature – age structures by unique traces

Estimate of brown bear population in Bulgaria on the basis of mathematical, statistical and biological analysis of monitoring data

Executive Environment Agency

Bears Results

Open areas Save areas Load areas Save distribution

ETRS	visited	Mountain	Number of traces
E543N216	no	Pirin	not visited
E543N217	yes	Pirin	1
E543N219	yes	Rila	1
E543N220	yes	Rila	1
E543N221	yes	Rila	1
E543N222	yes	Rila	1
E543N223	no	Rila	0
E544N215	no	Pirin	0

Accuracy: 10000 All monitoring-2017

Mountain	Estimate	Lower boundary
Stara Planina	72.99	49.64
Western Rhodopes	209.8	169.33
Rila	69.89	58.12
Pirin	35.46	31.34
Vitosha	23.06	23.06
Kotlenska Planina	8.75	7.52
Verla	13.13	12.41
Plana	6.28	6.28
Alpine region	385.43	316.4

Age structure by number of marks

Mountain	Bear up to one year	Bear up to two years	Young female / Young Male	Mature female / Immature Male	Mature male	Adult bear	Total
Rila	1.28	1.64	6.8	5.92	1.12	1.24	
Verla	0	0	0	0	0	0	
Vitosha	0	0	2	1	0	0	
Pirin	0.16	0.08	1.35	0.24	1.14	0.03	
Plana	0	0	0	0	0	0	
Western Rhodopes	2.12	2.56	22.45	10.68	4.98	1.21	
Stara Planina	2.76	0.88	4.85	6.64	2.54	0.33	
Kotlenska Planina	0	0	0	0	0	0	
Alpine	6.16	5.08	34.1	23.24	8.64	2.78	80
Continental	0.16	0.08	3.35	1.24	1.14	0.03	6
Total	6.32	5.16	37.45	24.48	9.78	2.81	86

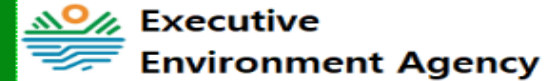
Show age structure Age structure by marks Calculate with threats Reference values

Save distribution

Financed by PUDOOS. Developed by the Institute of Information and Communications Technologies - Bulgarian Academy of Sciences

New feature – age structures of the estimated population

Estimate of brown bear population in Bulgaria on the basis of mathematical, statistical and biological analysis of monitoring data



ETRS	visited
E543N216	no
E543N217	yes
E543N219	yes
E543N220	yes
E543N221	yes
E543N222	yes
E543N223	no
E544N215	no

Accuracy:

Mountain	Estimate
Stara Planina	72.99
Western Rhodopes	209.8
Rila	69.89
Pirin	35.46
Vitosha	23.06
Kotlenska Planina	8.75
Verila	13.13
Plana	6.28
Alpine region	385.43

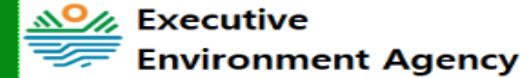
Age structure of the population

Mountain	Bear up to one year	Bear up to two years	Young female / Young Male	Mature female / Immature Male	Mature male	Adult bear
Rila	4.88	4.88	30.12	20.35	8.14	1.63
Verila	0.91	0.91	5.59	3.78	1.51	0.3
Vitosha	1.6	1.6	9.9	6.69	2.67	0.53
Pirin	2.51	2.51	15.49	10.47	4.19	0.84
Plana	0.42	0.42	2.58	1.74	0.7	0.14
Western Rhodopes	14.72	14.72	90.78	61.34	24.53	4.91
Stara Planina	5.09	5.09	31.41	21.22	8.49	1.7
Kotlenska Planina	0.63	0.63	3.87	2.62	1.05	0.21
Total	30.77	30.77	189.73	128.2	51.28	10.26
Alpine region	27.01	27.01	166.56	112.54	45.02	9
Continental region	3.64	3.64	22.45	15.17	6.07	1.21
Theoretical value in %	16%	8%	35%	24%	14%	3%
General theoretical distr...	70.56	35.28	154.35	105.84	61.74	13.23

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New feature – Calculate with threats

Estimate of brown bear population in Bulgaria on the basis of mathematical, statistical and biological analysis of monitoring data



Software interface for bear population estimation with a 'Threats' dialog box.

Threats Dialog Box:

Threats	Weight	Count	Influence
Derogation of problematic bears <input type="checkbox"/>	L	<input type="text"/>	<input type="text"/>
Conflicts with famers and local people <input type="checkbox"/>	H	<input type="text"/>	<input type="text"/>
Poaching <input type="checkbox"/>	H	<input type="text"/>	<input type="text"/>
Disturbance (human activities) <input type="checkbox"/>	M	<input type="text"/>	<input type="text"/>
Destruction of biocoridors <input type="checkbox"/>	H	<input type="text"/>	<input type="text"/>
Natural threats (survival of bears up to two years of age) <input type="checkbox"/>	L	<input type="text"/>	<input type="text"/>
Forest management for reduction (reduction of the area) of old forests <input type="checkbox"/>	H	<input type="text"/>	<input type="text"/>
Sports infrastructure and tourism infrastructure <input type="checkbox"/>	M	<input type="text"/>	<input type="text"/>
Climate change <input type="checkbox"/>	M	<input type="text"/>	<input type="text"/>

Main Interface Tables:

ETRS	visited	Mountain	Number of traces
E543N216	no	Pirin	
E543N217	yes	Pirin	
E543N219	yes	Rila	
E543N220	yes	Rila	
E543N221	yes	Rila	
E543N222	yes	Rila	
E543N223	no	Rila	
E544N215	no	Pirin	

Mountain	Estimate	Lower boundary
Stara Planina	72.99	49.64
Western Rhodopes	209.8	169.33
Rila	69.89	58.12
Pirin	35.46	31.34
Vitosha	23.06	23.06
Kotlenska Planina	8.75	7.52
Venla	13.13	12.41
Plana	6.28	6.28
Alpine region	385.43	316.4

Mountain	Estimate	Quality
Stara Planina	9.99	Favorable
Western Rhodopes	13.86	Unsatisfactory
Rila	6.28	Favorable
Pirin	454.46	Favorable

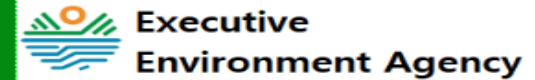
Mountain	Estimate
Stara Planina	4.3
Western Rhodopes	3.8
Rila	4.1
Pirin	4.2

Buttons: Open areas, Save areas, Load areas, Save distribution, Accuracy: 10000, All, monitoring-2017, Show age structure, Age structure by marks, **Calculate with threats**, Reference values.

Financed by PUDOOS. Developed by the Institute of Information and Communications Technologies - Bulgarian Academy of Sciences

Reference values

Estimate of brown bear population in Bulgaria on the basis of mathematical, statistical and biological analysis of monitoring data



Bears Results

Open areas Save areas Load areas

ETRS	visited	Mountain	Number of traces
E543N216	no	Pirin	not visited
E543N217	yes	Pirin	1
E543N219	yes	Rila	1
E543N220	yes	Rila	3
E543N221	yes	Rila	1
E543N222	yes	Rila	1
E543N223	no	Rila	not visited
E544N215	no	Pirin	not visited

Accuracy 10000 All monitoring-2017 Calculate Save Calculation

Mountain	Estimate	Lower boundary	Upper boundary	Threat Level
Stara Planina	72.99	49.64	96.34	Unfavorable-bad
Western Rhodopes	209.8	169.33	250.28	Favorable
Rila	69.89	58.12	81.67	Favorable
Pirin	35.46	31.34	39.58	Unsatisfactory
Vitosha	23.06	23.06	23.06	Unsatisfactory
Kotlenska Planina	8.75	7.52	9.99	Favorable
Verila	13.13	12.41	13.86	Unsatisfactory
Plana	6.28	6.28	6.28	Favorable
Alpine region	385.43	316.4	454.46	Favorable

Show age structure Age structure by marks Calculate with threats Reference values

Reference values for the main local populations of the brown bear

Level:	Favorable	Unfavorable - unsatisfactory	Unfavorable - bad	Large population of brown bear
Brown bear habitat				
Population of the brown bear in the sample areas on the territory of Bulgaria	420 - 690	370-419	Under 370	Over 691
Central Balkan	130 - 180	80 - 129	Under 80	Over 181
Western Rhodopes	140 - 220	120 - 139	Under 120	Over 221
Rila	70 - 125	48 - 69	Under 48	Over 126
Pirin	40 - 95	30 - 39	Under 30	Over 96
Vitosha	9 - 13	6 - 9	Under 6	Over 14
Plana	4 - 6	2 - 3	Under 2	Over 7
Verila	5 - 8	2 - 4	Under 2	Over 9
Kotlen mountain	7 - 10	3 - 6	Under 3	Over 11
Alpine biogeographical region	397-650	353-397	Under 353	Over 651
Continental biogeographical region	23 - 40	15 - 22	Under 15	Over 41

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Results from monitoring - 2017

Mountain	Evaluation	Lower boundary	Upper boundary	Level
Balkan mountains	61	44.8	76.19	Unfavorable - bad
Western Rhodopes	200	161.7	238.85	Favorable
Rila	70	56.61	83.44	Favorable
Pirin	37	31.29	42.92	Unfavorable - unsatisfactory
Kotlen mountain	6	5.35	7.72	Favorable
Plana, Verila, Vitosha	27	25.26	27.93	Favorable
Alpine area	368	305.26	426.85	Favorable
Continental area	33	31.53	33.98	Unfavorable - bad
Total	401	338.24	459.83	Unfavorable - unsatisfactory

Results from monitoring - 2018

Mountain	Evaluation	Lower boundary	Upper boundary	Level
Balkan mountains	61	47.75	74.82	Unfavorable - bad
Western Rhodopes	185	159.46	210.78	Favorable
Rila	84	68.15	100.42	Favorable
Pirin	40	28.88	50.38	Favorable
Kotlen mountain	2	1.21	2.76	Unfavorable - bad
Plana, Verila, Vitosha	2	1,71	3.15	Unfavorable - bad
Alpine area	369	320.39	416.69	Favorable
Continental area	5	2.92	6,13	Unfavorable - bad
Total	374	320.39	416.69	Unfavorable -unsatisfactory

Results from monitoring - 2019



Mountain	Evaluation	Lower boundary	Upper boundary	Level
Balkan mountains	58	47.18	67.21	Unfavorable - bad
Western Rhodopes	185	154.94	214.5	Favorable
Rila	59	48.42	69.94	Unfavorable - unsatisfactory
Pirin	41	31.36	50.86	Favorable
Kotlen mountain	8	7.33	8.72	Favorable
Plana, Verila, Vitosha	46	44.27	47.53	Favorable
Alpine area	339	287.14	388.26	Unfavorable - unsatisfactory
Continental area	58	54.57	59.73	Unfavorable - unsatisfactory
Total	397	344.71	445.83	Unfavorable - unsatisfactory

Results from monitoring - 2020



Mountain	Evaluation	Lower boundary	Upper boundary	Level
Balkan mountains	77	54.34	100.22	Unfavorable - bad
Western Rhodopes	229	171.91	286.3	Unfavorable - unsatisfactory
Rila	93	71.86	114.26	Favorable
Pirin	35	29.07	40.83	Unfavorable - unsatisfactory
Kotlen mountain	5	3.53	5.99	Unfavorable - unsatisfactory
Plana, Verila, Vitosha	18	16.99	18.90	Favorable
Alpine area	438	341.45	532.5	Favorable
Continental area	19	19.19	19.19	Unfavorable - bad
Total	457	360.64	551.69	Favorable

-	2017	2018	2019	2020
estimate bear population	401	374	397	457

ЗАКЛЮЧЕНИЕ



Тази услуга беше създадена за нуждите на **ИЗПЪЛНИТЕЛНА АГЕНЦИЯ ПО ОКОЛНА СРЕДА(ИАОС), КОЯТО Е КЪМ МИНИСТЕРСТВОТО НА ОКОЛНАТА СРЕДА И ВОДИТЕ (МОСВ) С ФИНАНСОВАТА ПОДКРЕПА НА ПРЕДПРИЯТИЕ ЗА УПРАВЛЕНИЕ НА ДЕЙНОСТИТЕ ПО ОПАЗВАНЕ НА ОКОЛНАТА СРЕДА (ПУДООС).**

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