



Federal Ministry
of Food
and Agriculture



LITHUANIAN STATE FOREST SERVICE

Enhancing *in situ* conservation of crop wild relatives for food and agriculture in Lithuania

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1. Lithuanian crop and CWR checklist

- **The checklist** contains **2,630 taxa**:
 - 1,384 (52.6%) native taxa including archaeophytes and
 - 1,246 (47.4%) neophytes including 905 used in cultivation
- In total, 699 taxa (26.6%) attributed to food and/or forage use, of which **358 taxa** represent **native flora**, mostly species and 12 subspecies



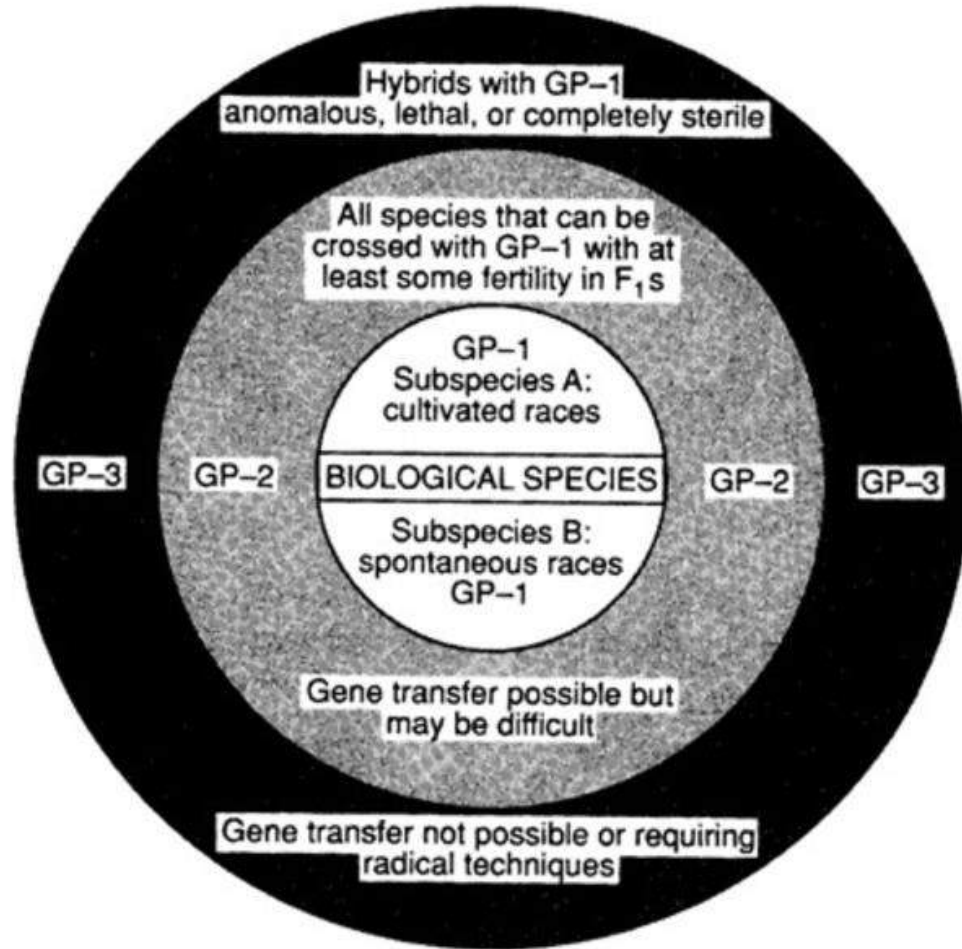
2. CWR prioritization for *in situ* conservation

In general, **native CWRs for food and agriculture** based on:

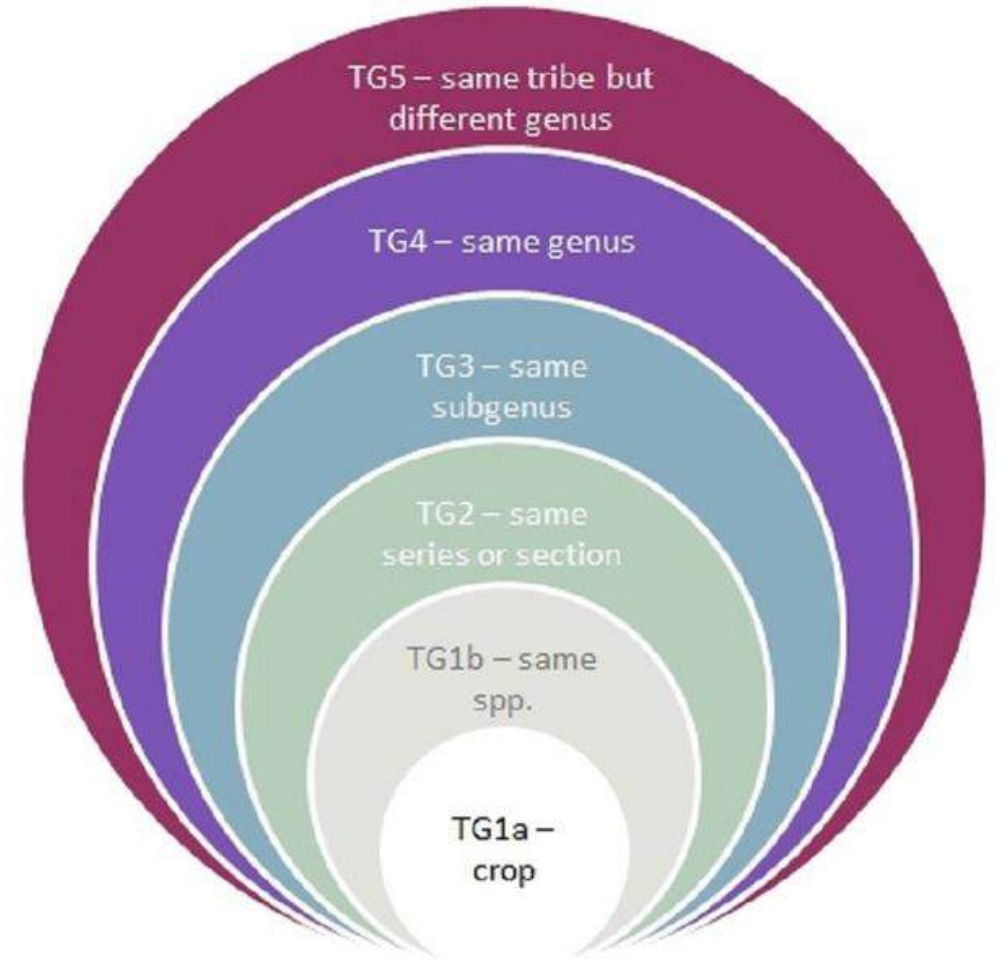
- [Annex I of the International Treaty on PGRFA](#) (FAO, 2009)
- [Lithuanian national lists of plant varieties](#)
- Socioeconomic and cultural significance of crop species
- Degree of CWR relatedness to crop species
- Threat status of CWR species



Two concepts to describe CWR/crop relatedness



Gene Pool concept (Harlan & de Wet 1971)



Taxon Group concept (Maxted et al. 2006)

Examples of CWR relatedness to crop species

CWR	Crop species	Relatedness
<i>Fragaria vesca</i> , <i>F. viridis</i>	Strawberry (<i>Fragaria</i> × <i>ananassa</i>)	GP3, TG4
<i>Malus sylvestris</i>	Apple (<i>Malus domestica</i>)	GP2, TG2
<i>Prunus spinosa</i>	Plum (<i>Prunus domestica</i>)	GP2, TG2
<i>Pyrus communis</i>	Pear (<i>Pyrus communis</i>)	GP1, TG1
<i>Ribes nigrum</i>	Black currant (<i>Ribes nigrum</i>)	GP1, TG1
	Red currant (<i>Ribes rubrum</i>)	GP3, TG3
<i>Ribes spicatum</i>	Red currant (<i>Ribes rubrum</i>)	GP2, TG2
<i>Rubus idaeus</i>	Raspberry (<i>Rubus idaeus</i>)	GP1, TG1
<i>Rubus saxatilis</i>	Raspberry (<i>Rubus idaeus</i>)	GP2, TG4
<i>Vaccinium oxycoccos</i>	Cranberry (<i>Vaccinium oxycoccos</i>)	GP1, TG1
	Large cranberry (<i>V. macrocarpon</i>)	GP2, TG2
<i>Vaccinium myrtillus</i>	Lingonberry (<i>Vaccinium vitis-idaea</i>)	GP2, TG3
	Highbush blueberry (<i>Vaccinium corymbosum</i>)	GP3, TG3
<i>Vaccinium vitis-idaea</i>	Lingonberry (<i>Vaccinium vitis-idea</i>)	GP1, TG1
<i>Vaccinium uliginosum</i>	Lingonberry (<i>Vaccinium vitis-idea</i>)	GP2, TG3

Summary of priority CWR relatedness to crop species

GP1	– 62 CWRs		57%
GP2	– 8		
<u>GP3</u>	<u>– 12</u>		
TG1	– 13		43%
TG2	– 9		
TG3	– 7		
<u>TG4</u>	<u>– 33</u>		
Total:	144		100%

GP1 + TG1 = 75 CWRs (52%)
GP2 + TG2 = 17 CWRs (12%)
GP3 + TG3 + TG4 = 52 CWRs (36%)



Priority CWR species evaluated by regional IUCN criteria

#	Species	Family	IUCN category & criteria
1	<i>Allium angulosum</i> L.*	Amaryllidaceae	EN B1ab(ii,iii)+2ab(ii,iii)
2	<i>Allium scorodoprasum</i> L.*	— // —	VU A4ac
3	<i>Allium vineale</i> L.*	— // —	EN B2ab(iii,iv,v)
4	<i>Astragalus danicus</i> Retz.	Fabaceae	NT B2b(iii); B1b(iii)
5	<i>Lathyrus laevigatus</i> (Waldst. & Kit.) Gren.	— // —	NT B2
6	<i>Lathyrus pisiformis</i> L.*	— // —	EN B1ab(iv)+2ab(iv)
7	<i>Trifolium lupinaster</i> L.*	— // —	EN B2b(iii)c(iv)
8	<i>Trifolium rubens</i> L.*	— // —	EN B2ab(i,ii,iii,iv)
9	<i>Vicia lathyroides</i> L.*	— // —	EN B2b(iii)c(ii)
10	<i>Vicia pisiformis</i> L.	— // —	NT B1+2
11	<i>Alopecurus arundinaceus</i> Poir.*	Poaceae	VU D2
12	<i>Festuca altissima</i> All.	— // —	DD
13	<i>Festuca psammophila</i> (Čelak.) R. M. Fritsch*	— // —	EN B1ab(ii,iii,v)+2ab(ii,iii,v)
14	<i>Glyceria lithuanica</i> (Gorski) Gorski*	— // —	VU B1ab(iii)+2ab(iii)
15	<i>Helictochloa pratensis</i> (L.) Romero Zarco*	— // —	VU D2
16	<i>Poa remota</i> Forselles	— // —	NT B2
17	<i>Prunus spinosa</i> L.*	Rosaceae	VU B1ab(ii,iii,v)+2ab(ii,iii,v)

* Threatened (EN & VU categories) are 12 species.

Summary of Lithuanian priority CWR inventory

Family	Genera No.	Species No.	Species %	Genera with numbers of species
Poaceae	19	47	32.6	Agrostis 5, Alopecurus 4, Anthoxanthum 3, Arrhenatherum 1, Avenula 1, Briza 1, Bromus 1, Cynosurus 1, Dactylis 1, Deschampsia 2, Elymus 1, Festuca 8, Glyceria 4, Helictochloa 1, Leymus 1, Lolium 1, Phalaris 1, Phleum 2, Poa 8
Fabaceae	11	46	31.9	Anthyllis 1, Astragalus 3, Lathyrus 7, Lotus 2, Medicago 2, Melilotus 2, Onobrychis 2, Ononis 1, Securigera 1, Trifolium 14, Vicia 11
Rosaceae	5	16	11.1	Fragaria 3, Malus 2, Prunus 3, Pyrus 2, Rubus 6
Lamiaceae	3	6	4.2	Mentha 3, Origanum 1, Thymus 2
Brassicaceae	2	5	3.5	Barbarea 2, Rorippa 3
Amaryllidaceae	1	6	4.2	Allium 6
Ericaceae	1	5	3.5	Vaccinium 5
Apiaceae	4	4	2.8	Angelica 1, Carum 1, Daucus 1, Pastinaca 1
Grossulariaceae	1	3	2.1	Ribes 3
Asparagaceae	1	1	0.7	Asparagus 1
Asteraceae	1	1	0.7	Cichorium 1
Betulaceae	1	1	0.7	Corylus 1
Cannabaceae	1	1	0.7	Humulus 1
Papaveraceae	1	1	0.7	Papaver 1
Elaeagnaceae	1	1	0.7	Hippophae 1
Σ:	15	144	100	

3. Genetic reserve selection by evaluation of the preselected sites

- As potential genetic reserves, **45 CWR sites were selected**, mostly in protected areas, including 23 ones in NATURA 2000 sites.
- By applying the **OECM** concept (**O**ther **E**ffective area-based **C**onservation **M**asures) ([IUCN, 2019](#)), 30 sites were selected in ancient hillfort sites.
- In total, **83 CWR priority species** (57.6 % of the priority list) were inventoried, and 748 occurrences identified:
 - numbers of target species: 3 to 31 with **17 species per site on average**;
 - site area: 0.22 to 23.40 ha with **3.95 ha on average**.
- The target of 5 populations of each species to be conserved (Dulloo et al. 2008) was achieved for 47 CWR species (33 % of the priority list).

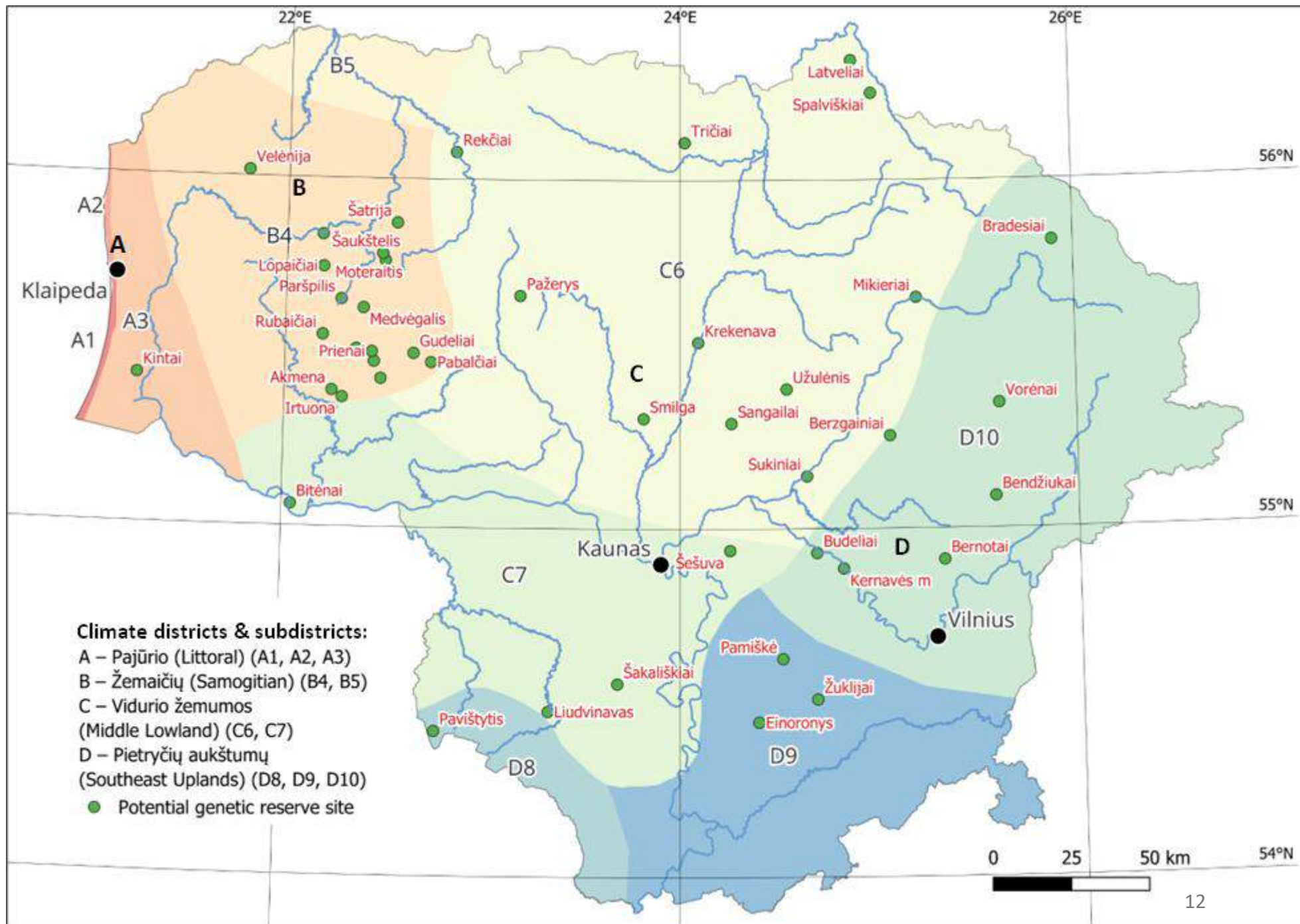


Numbers of CWR populations and species across 45 sites

Frequency group by populations	Number of populations	Number of species	Percent of priority list	Target of min. 5 populations
1	1–4	36	25.0	Achieved 20–80%
2	5–9	20	13.9	Achieved
3	10–14	3	2.1	Achieved
4	15–19	13	9.0	Achieved
5	≥20	11	7.6	Achieved
Total covered species		83	57.6	
Not covered species		61	42.4	Achieved 0%
Total priority list		144	100.0	

Still lacking: 1–4 populations for each of 36 species and 5 populations for each of 61 species.

Map of 45 CWR potential reserve sites



4. Creation of the *in situ* CWR National Inventory database

- Four major databases were used:
 - 1) Database of EU Habitat Inventory in Lithuania (BIGIS),
 - 2) Herbarium Database of the Nature Research Centre (BILAS),
 - 3) Lithuanian Vegetation Database (EU-LT-001), and
 - 4) Global Biodiversity Information Facility (GBIF).

The numbers of occurrences of CWR priority species¹ in four databases by data oldness

Data collected	BIGIS	BILAS	EU-LT-001	GBIF ²	Total ³
Before 2010	0	7,673	19	21	7,713
After 2010	284,264	9	2,155	7,187	293,615
Total	284,264	7,682	2,174	7,208	301,328

¹ The numbers refer to 140 out of 144 CWR priority species. No data on *Barbarea stricta*, *Lathyrus pisiformis*, *Onobrychis arenaria*, *Vaccinium microcarpum* is presented. A lack of distribution data of the four CWR priority species has been attributed to the species identification issues (*Barbarea stricta* vs *B. vulgaris* and *Vaccinium microcarpum* vs *V. oxycoccos*) and rarity of species (*Lathyrus pisiformis* and *Onobrychis arenaria*).

² GBIF.org (12 July 2023) GBIF Occurrence Download <https://doi.org/10.15468/dl.y43bqn>

³ The most up-to-date total is 293,615 which includes multiple occurrences of the same species per grid cell 4x4 km. If counting only distinct species records per grid cell, the total number of occurrences is 68,686.

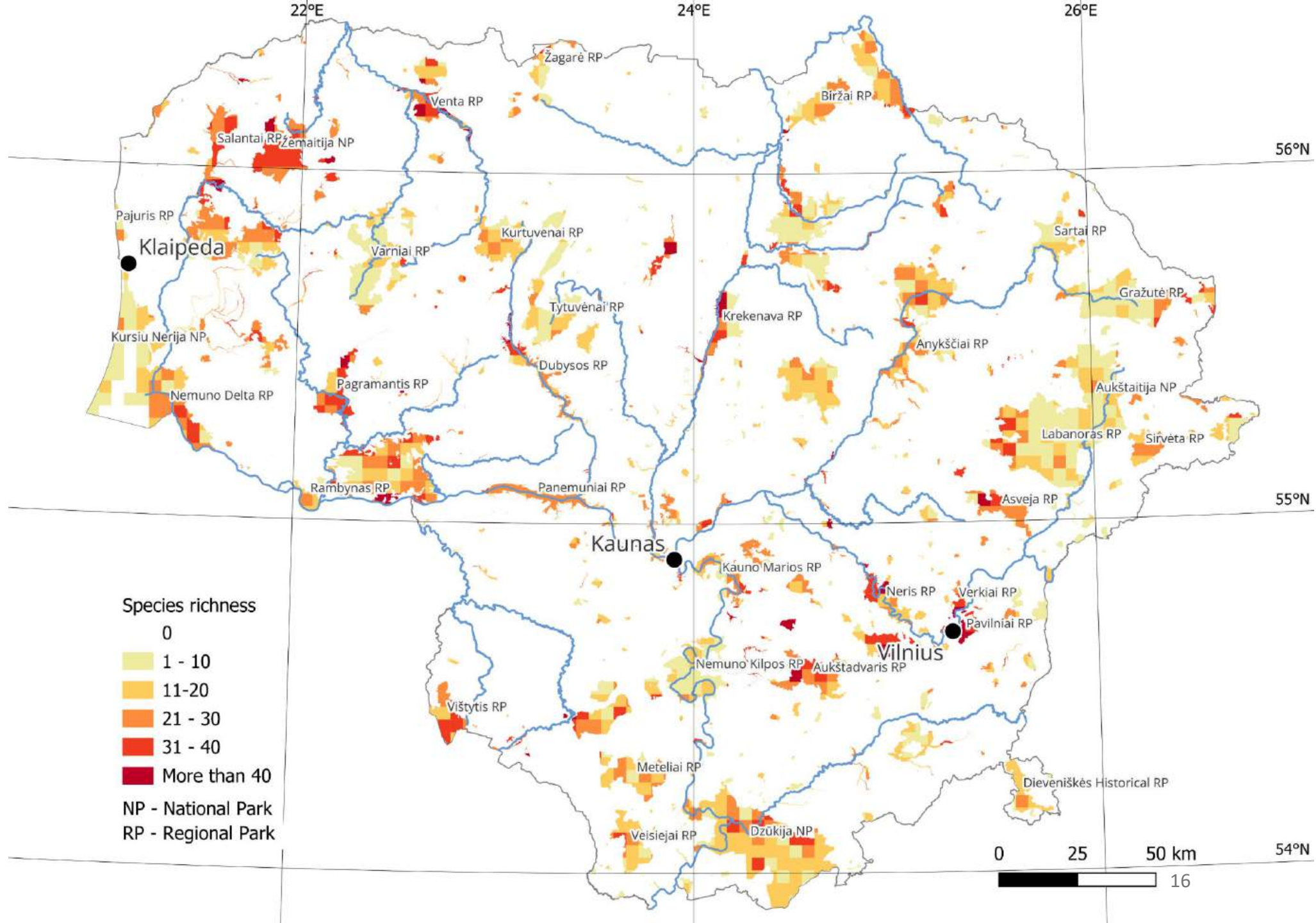
5. Hotspot analysis of the countrywide CWR distribution

QGIS hotspot analysis of priority CWR distribution was carried out in 4 × 4 km grid cells across the country.

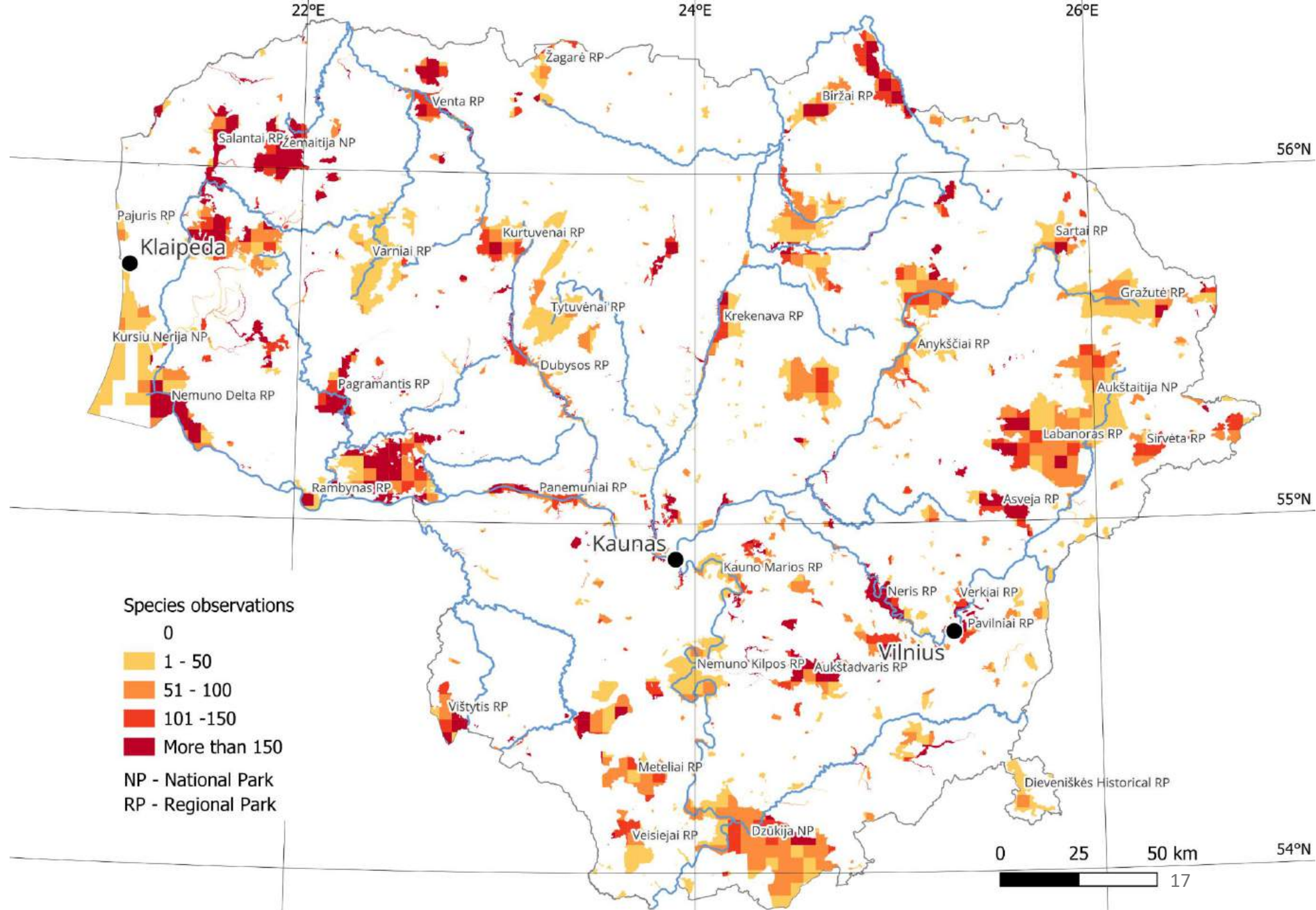
Priority given to the protected areas:

- EU protected areas (NATURA 2000)
- National protected areas (state parks, state nature reserves, etc.)
- Sub-national protected areas (municipal nature reserves)
- Other effective area-based conservation measures – OECMs (ancient hillfort sites, water protection zones)

Richness of priority CWR species in national PAs (state parks)



Occurrence of priority CWR species in national PAs (state parks)



Total and mean (per cell 4 × 4 km) numbers of CWR species, numbers of CWR species observations, and mean values of Shannon diversity and Shannon equitability indices inside and outside of protected areas
 (± SD; different letters indicate significant differences at p=0.001)

Area category	No. of unique CWR species		No. of CWR species observations		Shannon diversity index (H)	Shannon equitability index $E_H = H / \ln(S)$
	Total (S)	Mean per cell	Total	Mean per cell	Mean per cell	Mean per cell
Inside PAs	138	17.8 ± 10.6 a	190,106	82.6 ± 83.6 a	2.53 ± 0.67 a	0.513
Outside PAs	140	13.8 ± 9.5 c	111,222	50.9 ± 61.3 c	2.41 ± 0.74 b	0.488
Total country	140	16.0 ± 10.3 b	301,328	67.9 ± 75.7 b	2.48 ± 0.71 ab	0.502

6. Conclusions

- A comprehensive national CWR checklist of 2,630 taxa was created for Lithuania for the first time, containing 1,384 native taxa (incl. archaeophytes).
- A national CWR priority list of 144 species was established, comprising 10.4% of the native flora.
- Two approaches towards CWR genetic reserve selection have been employed which can complement each other:
 - (1) CWR-targeted evaluation of preselected sites – Natura 2000, national PA & OECMs – covering 83 species (57.6% of the priority list) in 45 potential genetic reserve sites, and
 - (2) analysis of the large georeferenced databases – multiple hotspots of priority CWRs were identified covering 140 species, or 97.2% of the priority list.
- The *in situ* CWR National Inventory database has been established containing data on 301,328 records of priority CWR species distributions.
- All mandatory CWR passport data fields (NICODE, INSTCODE, ACCENUMB and GENUS) are available for uploading to EURISCO.
Some additional passport descriptors could be suggested, such as SITE ID and TAXON ID to create a unique combination with NICODE to get a unique ACCENUMB.

Paper submission and data upload

- An article “**Enhancing *in situ* conservation of crop wild relatives for food and agriculture in Lithuania**” has been submitted to the journal *Genetic Resources and Crop Evolution*
- CWR mapping data uploaded to ZENODO:
<https://doi.org/10.5281/zenodo.11124923>



Acknowledgements



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Bioversity International – [BMEL](#)
funded project “Extension of EURISCO
for Crop Wild Relatives (CWR) *in situ*
data and preparation of pilot
countries’ data sets” (2022–2024).

Lithuanian State Forest Service –
project „Identification and evaluation
of potential genetic reserve sites of
medicinal and aromatic plants in
various ecosystems for long-term
conservation“ (2023).



Things to do

- Officially involve the PA managers belonging to the State Service of Protected Areas Service and invite other stakeholders like NGO's, farmers etc. towards the creation of a network of data providers.
- Filter the data and finalize preparation for EURISCO.
- Field trips to get latest data to cover priority species as much as possible