FAVOURABILITY MAPS FOR PLANNING NATURE-BASED SOLUTIONS FOR AGRICULTURAL WATER MANAGEMENT IN EUROPE

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Wetpol 2023

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Objectives

1) Promote NBS in EU planning (WFD, CAP, Nutrient plans, pesticide plans…) ➔

2) Define accepted criteria for:

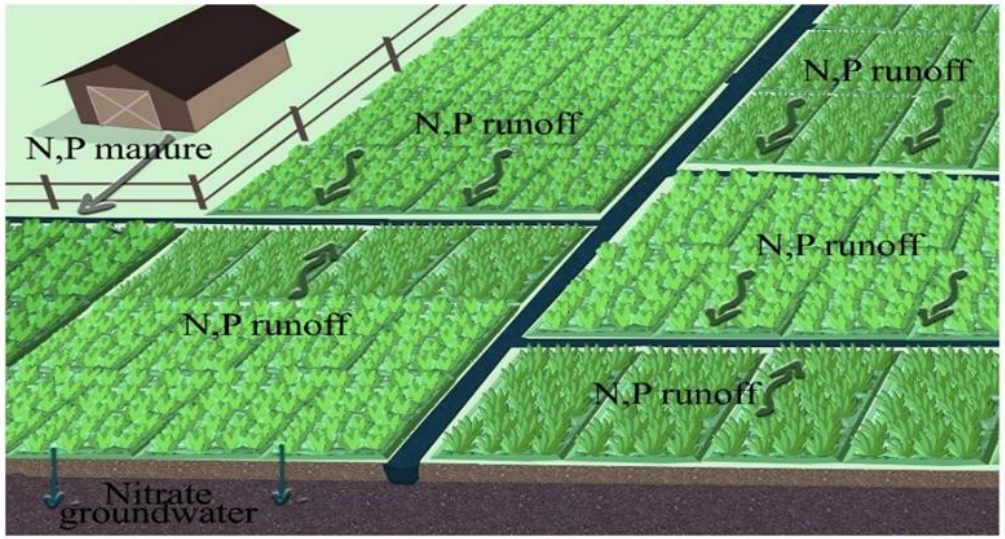
- Sizing
- Cost estimation
- Main benefits
- Side benefits

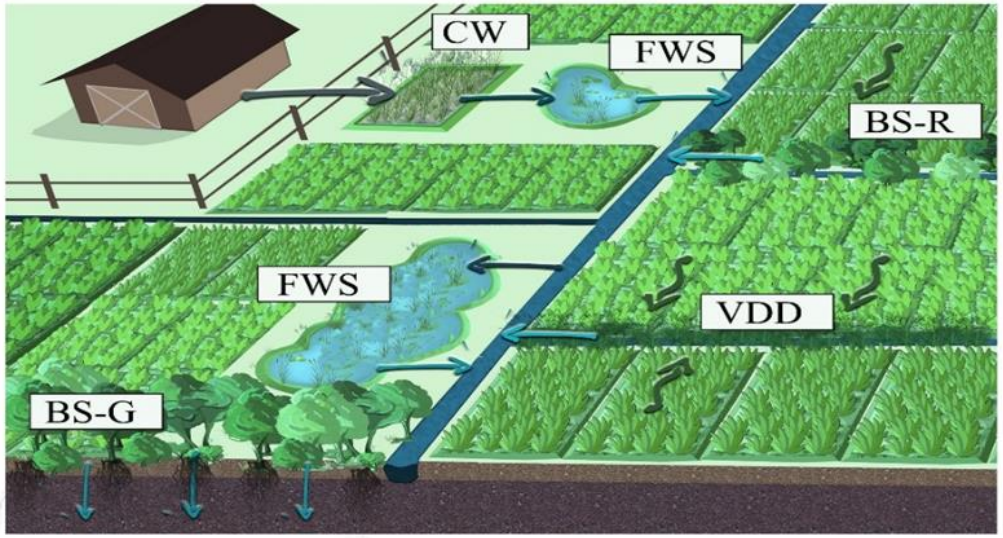
NBS types considered

1) **Treatment wetlands** for manure-derived wastewater and sludge before application as fertilizer.

2) Landscape elements addressing diffuse sources of pollution due to fertilizers (and associated contaminants) and/or pesticides (**wetlands, buffer strips,** and **vegetated ditches**).

3) Landscape elements addressing water retention to sustain water availability during dry periods, and contribute to resilience against climate change. **Ponds, managed aquifer recharge (MAR)**





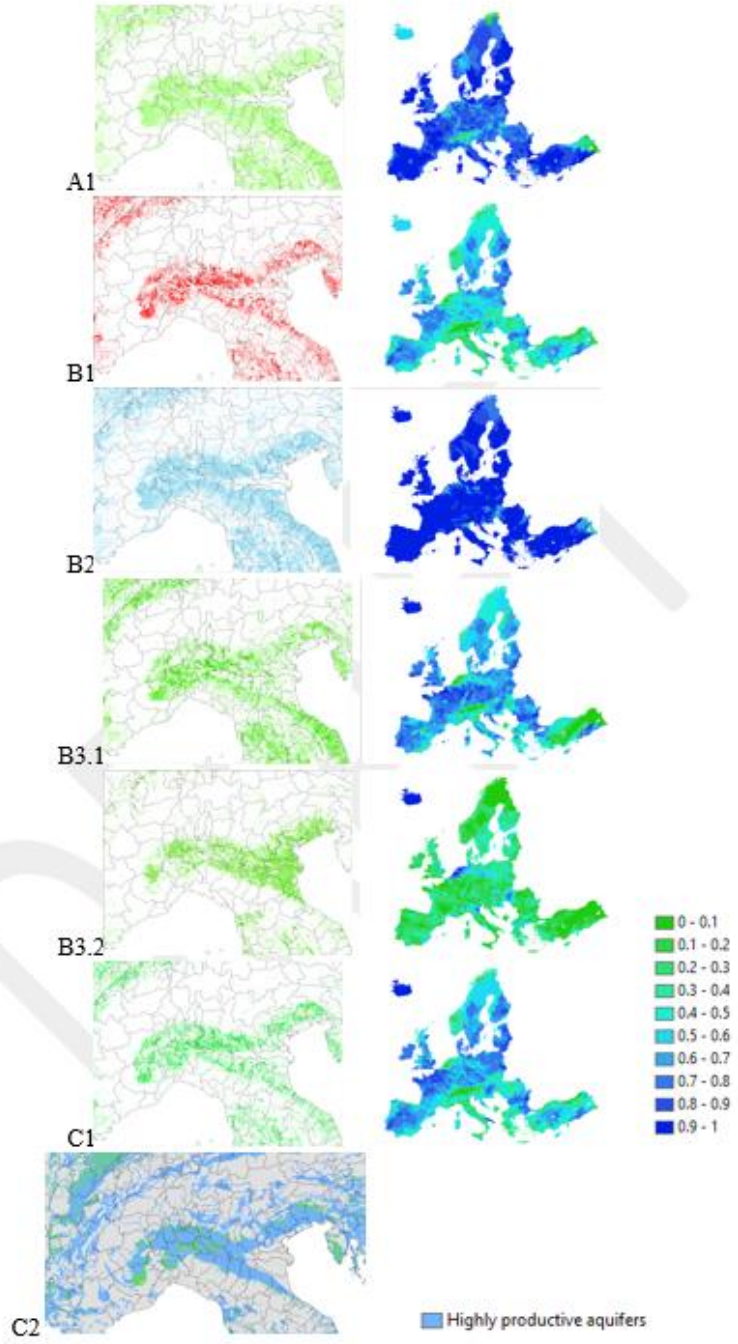
Rizzo et al., 2022

What we want to discuss…

1) Constraints in NBS implementation
   - Are we considering the key biophysical (land cover, topographic, climatic etc.) constraints to NBS?
   - Are we using appropriate indicators?
2) Removal efficiency for pollutants (particularly nutrients)
   - Are our estimates of areal removal rate of pollutants realistic and representative?
3) Costs
   - Are our estimates of unit costs of investment and operation on the various NBS realistic and représentative?
4) Overall approach to mapping

NBS Type	NBS category
NBS A1 – wetlands	NBS A1.1 – SF
	NBS A1.2 – hybrid SF + SSF
NBS B1 – free water surface wetland (FWS)	no categories
NBS B2 – vegetated drainage ditch (VDD)	no categories
NBS B3 – buffer strip (BS)	NBS B3.1 – BS - R
	NBS B3.2 – BS - G
	NBS B3.3 – BS - Integrated
NBS C1 – Storage	NBS C1.1 – Storage pond
	NBS C1.2 – Pre-treatment pond + Storage pond
	NBS C1.3 – Pre-treatment wetland + Storage pond
NBS C2 – managed aquifer recharge (MAR)	NBS C2.1 – Infiltration pond
	NBS C2.2 – Pre-treatment pond + Infiltration pond
	NBS C2.3 – Pre-treatment wetland + Infiltration pond
	NBS C2.4 – Infiltration wooded area

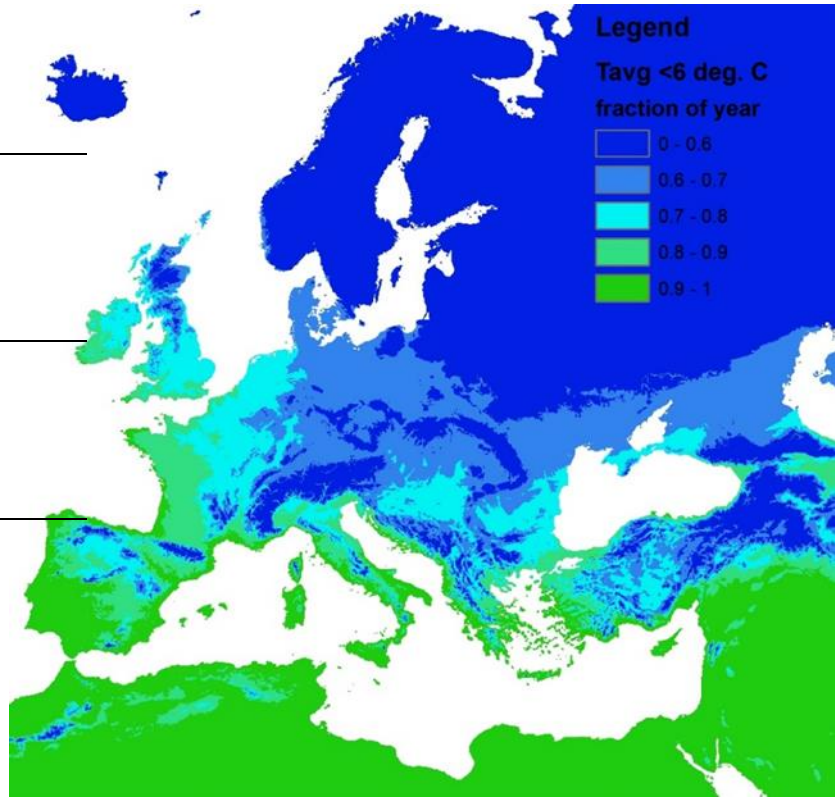
NBS type	Landscape conditions
A1: wetlands	• Slope ≤ 15% • Elevation ≤ 1700 m asl • No Flood hazard • Land cover: agriculture, mining sites • Distance from urban areas ≥ 300 m
B1: free water surface (FWS) wetlands	• Slope ≤ 5%, • Elevation ≤ 2000 m asl • No Flood hazard • Land cover: agriculture, mining sites; distance from urban areas ≥ 300 m • Water table depth (WTD) >=1m
B2: vegetated drainage ditches	• Elevation ≤ 2000 m asl • No Flood hazard • Land cover: agriculture
B3.1: buffer strips for runoff	• Slope ≤ 10%, • Elevation ≤ 1000 m asl • WTD >=2 m • Land cover: agriculture
B3.2: buffer strips for groundwater	• Slope ≤ 5% • Elevation ≤ 1000 m asl • WTD <=2 m • Land cover: agriculture
C1: ponds	• Slope ≤ 5%, • No Flood hazard • Land cover: agriculture, mining sites • WTD≥ 1m
C2: managed aquifer recharge	• Slope ≤ 5%, • No Flood hazard • Land cover: agriculture, mining



- Constraints

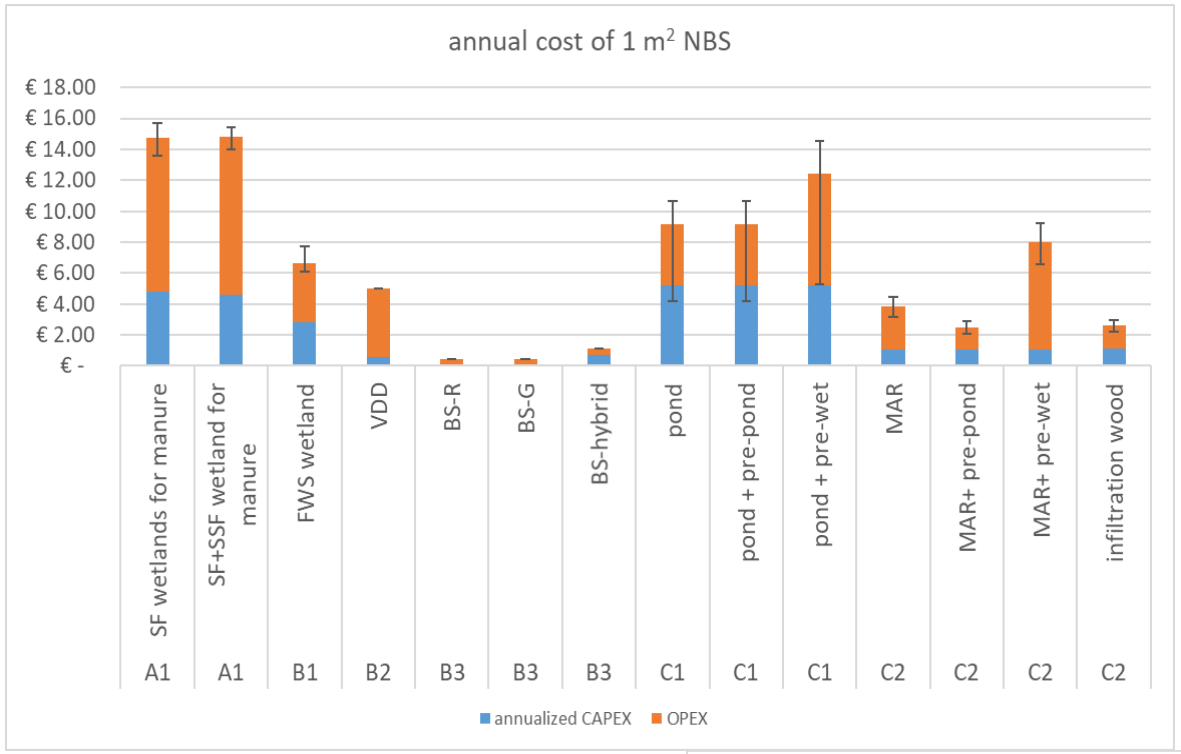
Objective	A1	A1 (Surface Flow)	A1 (Sub-Surface Flow)	B1, B2	B3.1(*)	B3.2(*)
N	450 g_N m^{-2} y^{-1} (a)	400 g_N m^{-2} y^{-1} (e)	660 g_N m^{-2} y^{-1} (i)	70 g_N m^{-2} y^{-1} (m)	Eff=70% (p) C=25 mg/L (t)	eff= 60% N-NO3 C=8 mg/
P	70 g_P m^{-2} y^{-1} (b)	60 g_P m^{-2} y^{-1} (f)	110 g_P m^{-2} y^{-1} (j)	3 g_P m^{-2} y^{-1} (n)	Eff=70% (q) C=2 mg/L (u)	-
BOD	1400 g_{BOD5} m^{-2} y^{-1} (c)	1160 g_{BOD5} m^{-2} y^{-1} (g)	4900 g_{BOD5} m^{-2} y^{-1} (k)	-	-	-
TSS	1300 g_{TSS} m^{-2} y^{-1} (d)	870 g_{TSS} m^{-2} y^{-1} (h)	7770 g_{TSS} m^{-2} y^{-1} (l)	1950 g_{TSS} m^{-2} y^{-1} (o)	Eff=90% (r) C=7000 mg/L (v)	-

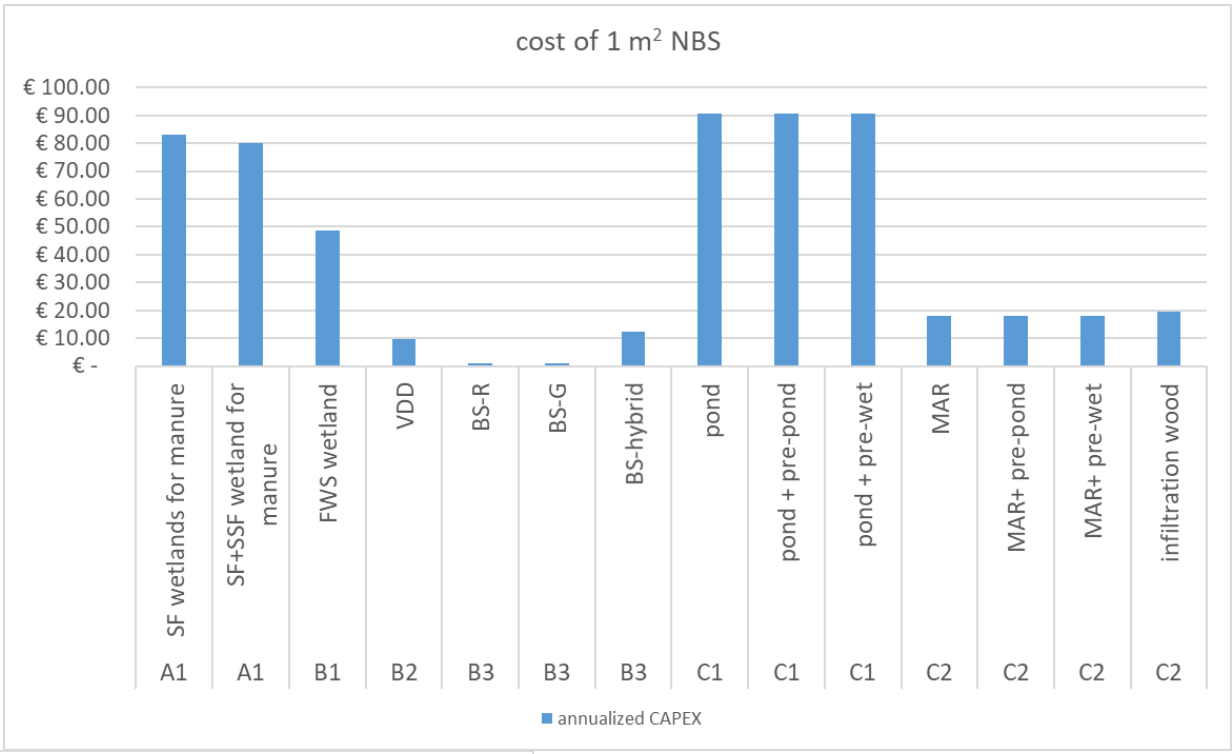
- Effectiveness



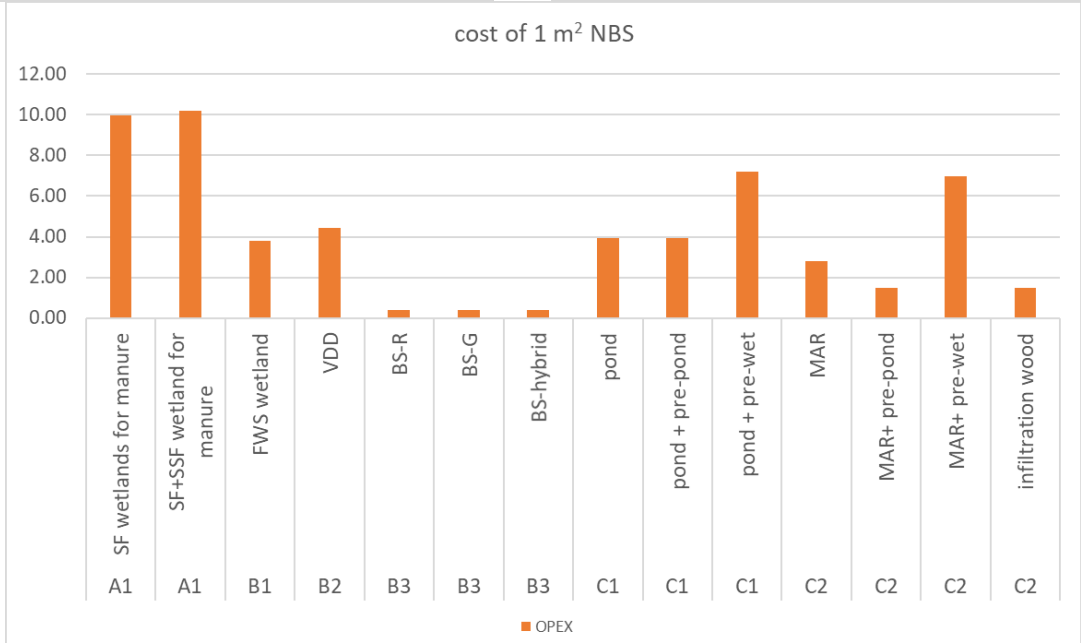
pesticides: 40% for NBS of type A and B

ponds:
volume yield for irrigation =1 to 2 times the available storage volume (type C1)
Volume yield for irrigation = all collected surplus (type C2)





- Costs



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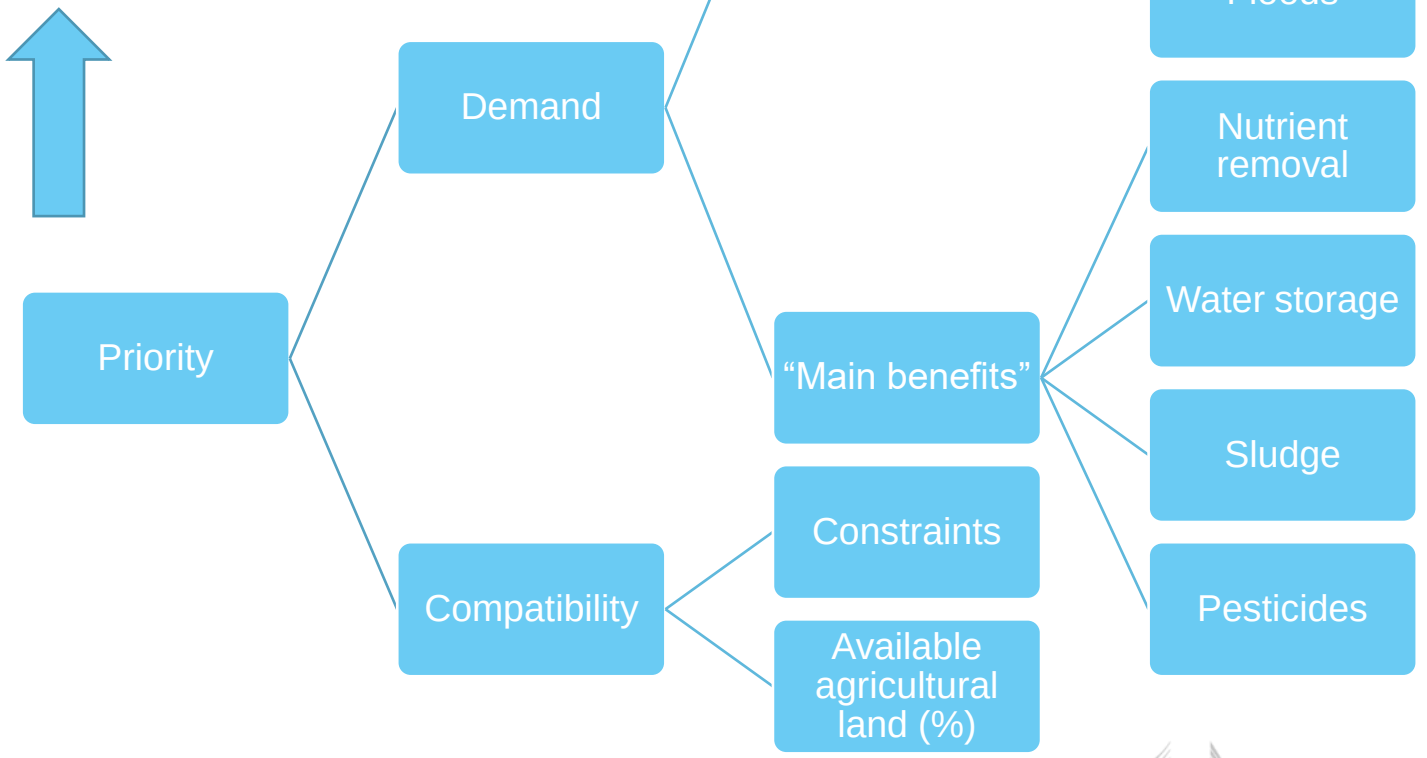
- Area = min([demand/unit benefit], [constrained area], [available agricultural land])
- Costs = unit costs x Area
- Main benefits = unit benefit x Area
- Side benefits (sediments) = unit benefit x Area
- Side benefits (floods, biodiv.) = Area weighted by indicator

- Mapping



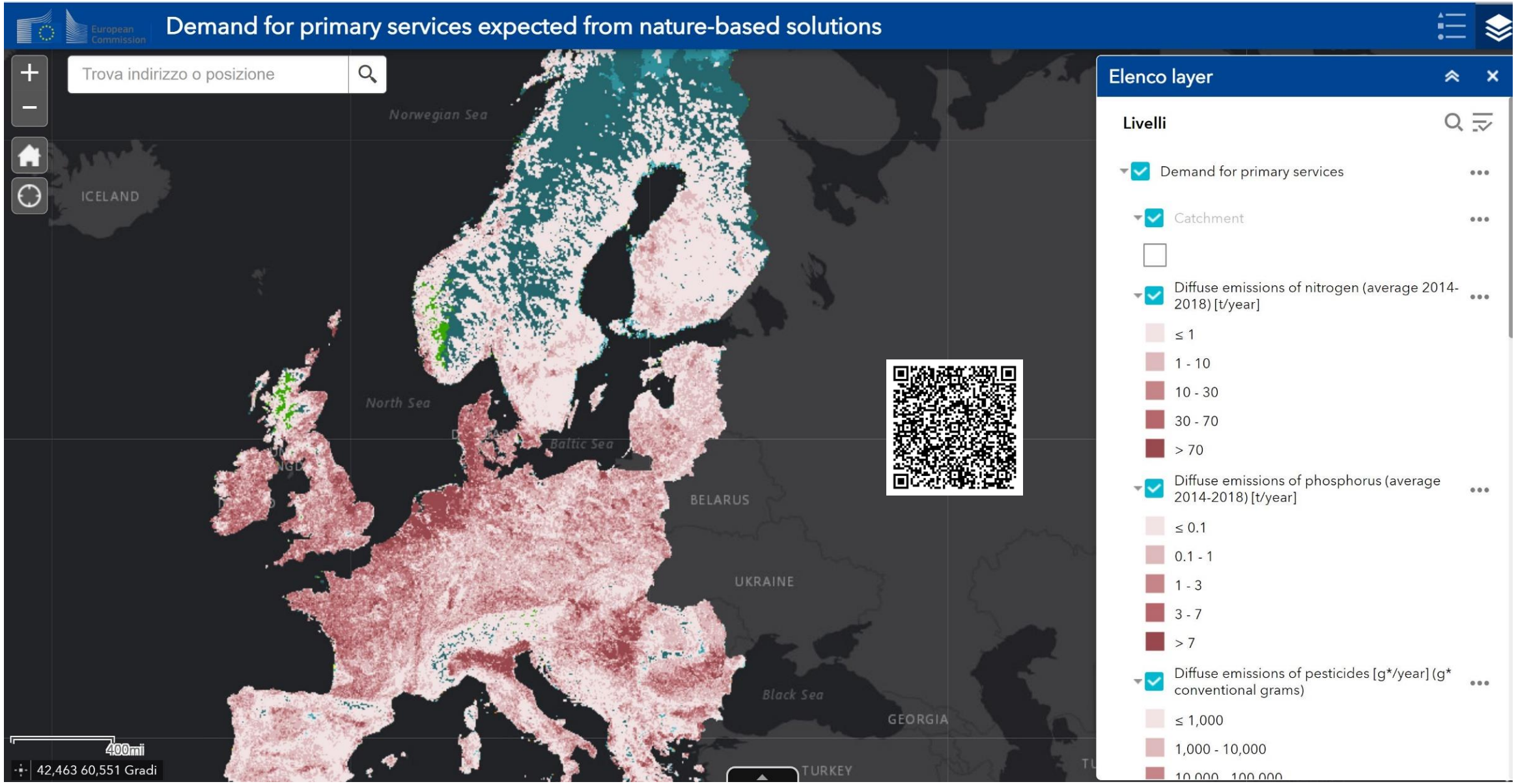
WHICH SERVICES NBS ARE ASKED TO PROVIDE?

Primary services

1. Diffuse Emission of Nitrogen (ton/year)
2. Diffuse Emission of Phosphorus (ton/year)
3. Diffuse Emission of Pesticides (gr/year)
4. Application of N by manure fertilizer (ton/year)
5. Application of P by manure fertilizer (ton/year)
6. Potential application rate of sludge on land (20km radius) (ton/year)
7. Water surplus to deficit ratio
8. Water annual deficit (mm/year)

Secondary services

1. Erosion of agricultural soil (t/km^2/year)
2. Average daily precipitation with return time 10 years (mm/year)
3. Fraction of wood-like habitat extent
4. Fraction of wetland-like habitat extent
5. Percentage of the year when mean T is below 6 °C (%)



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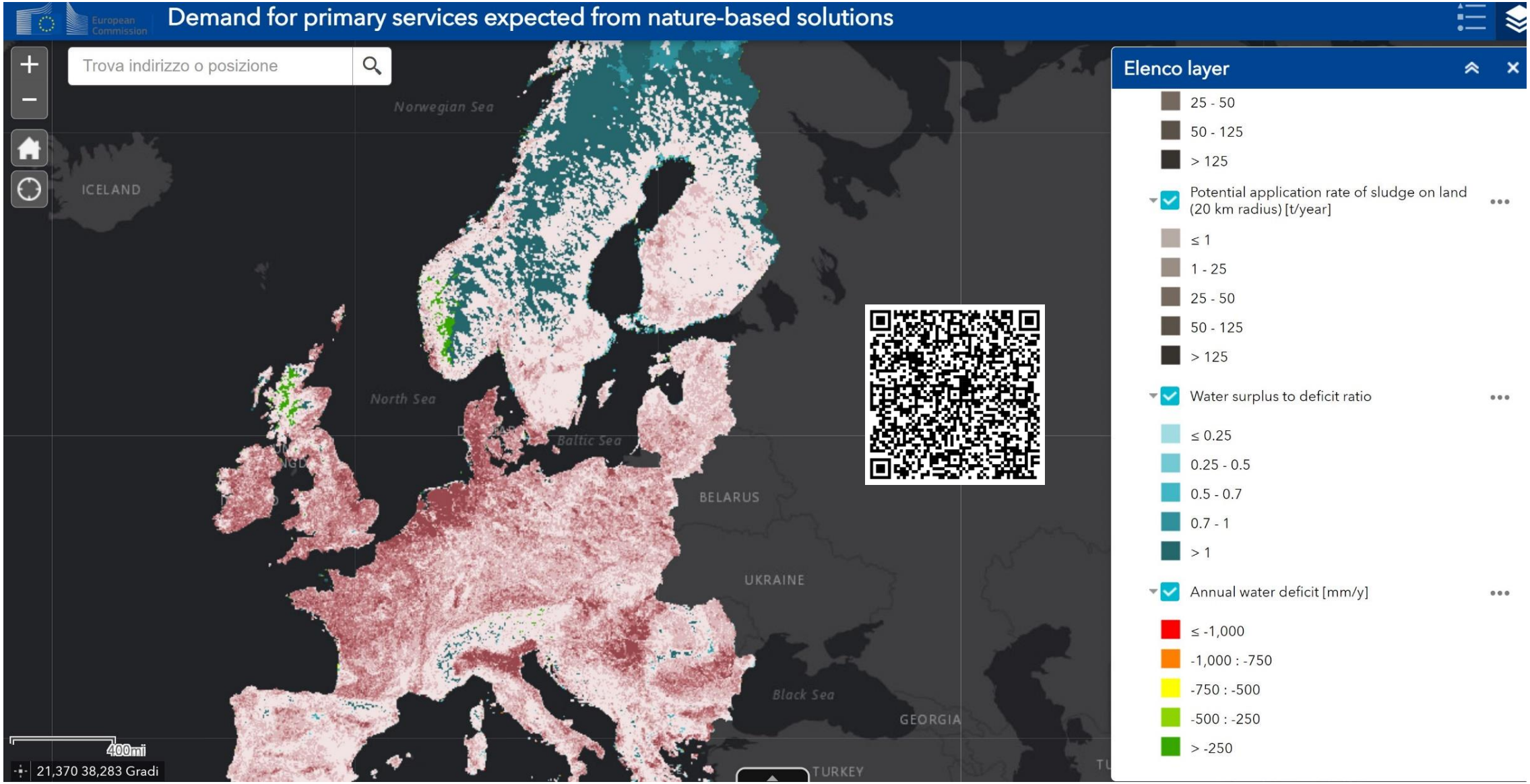

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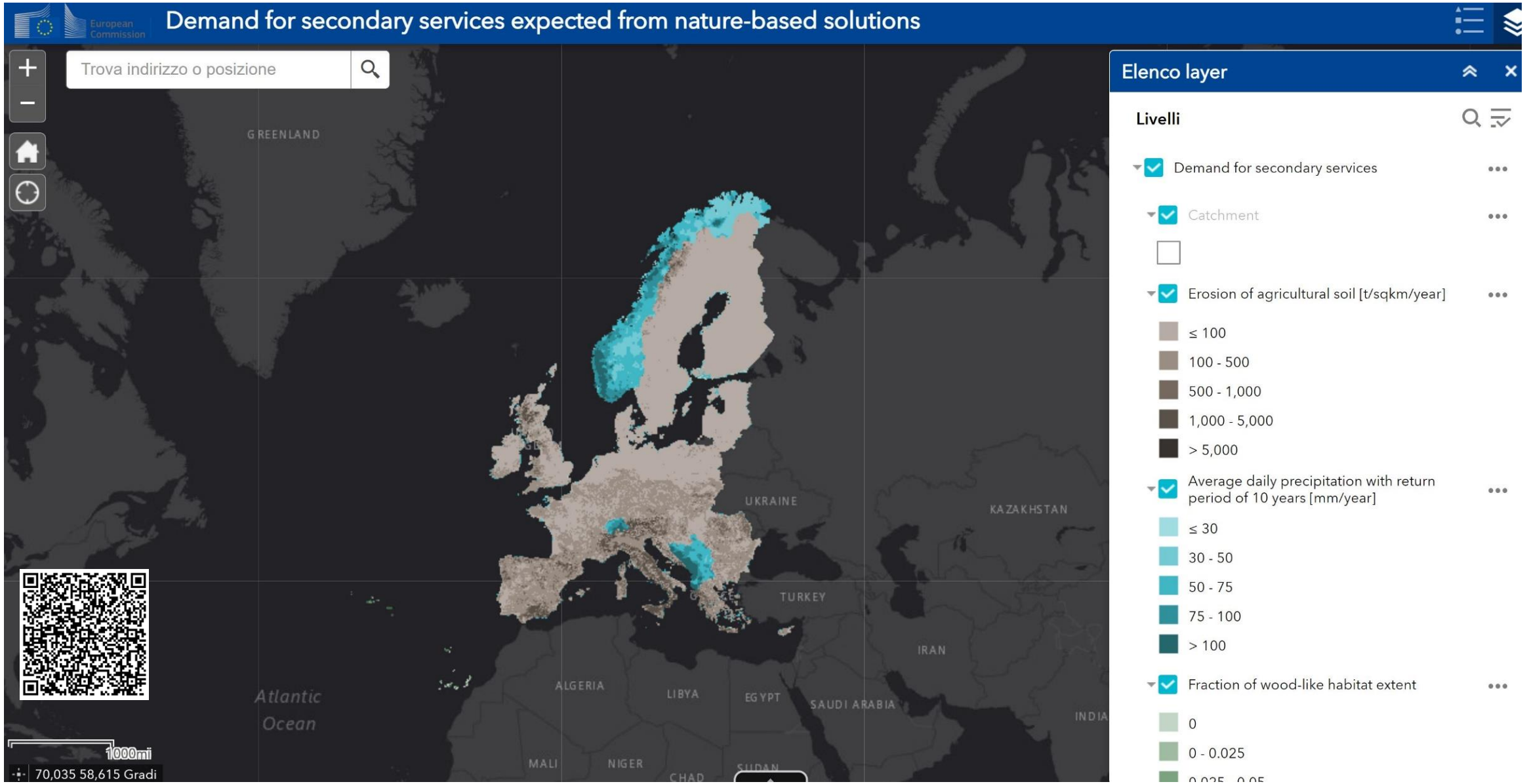

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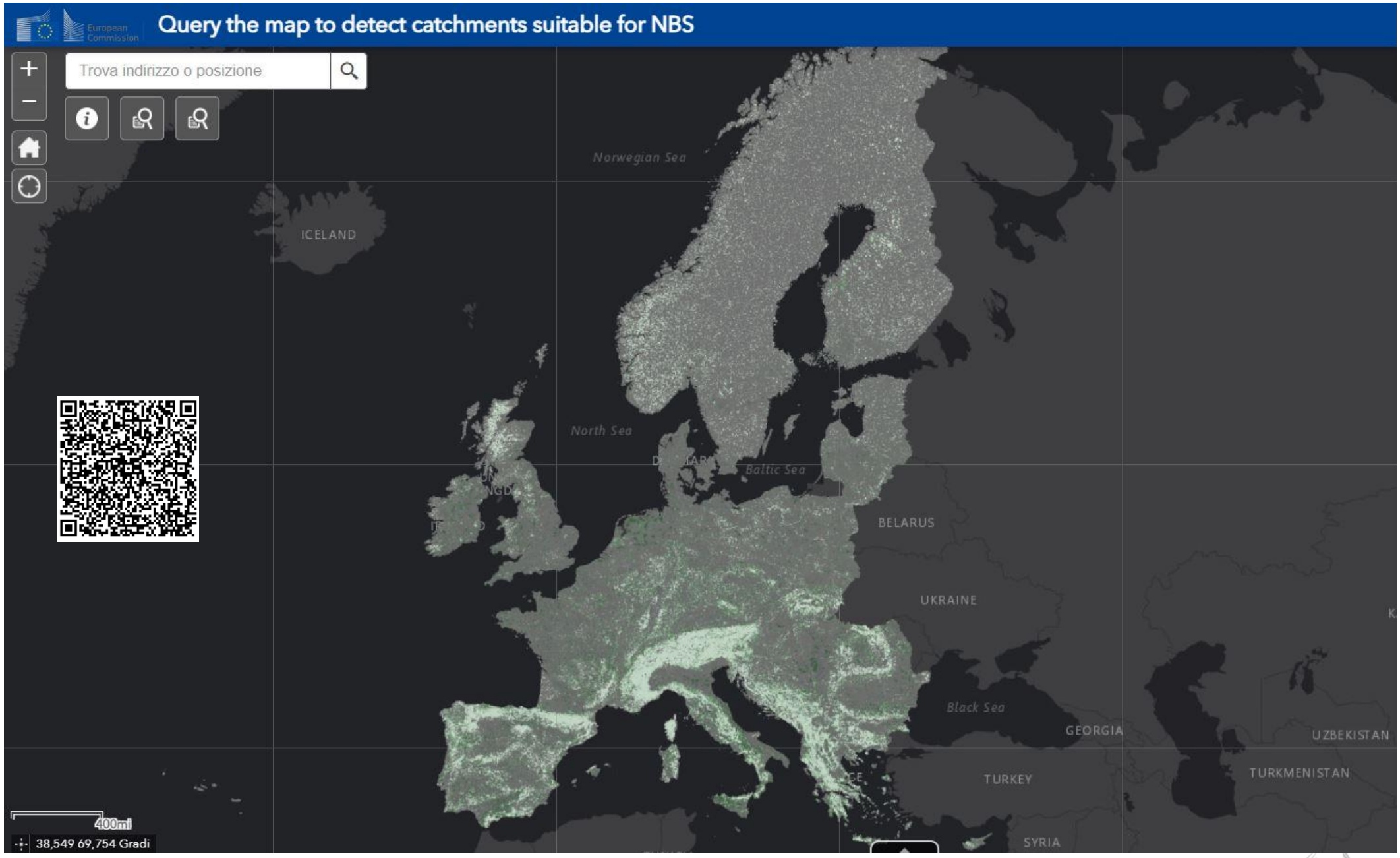

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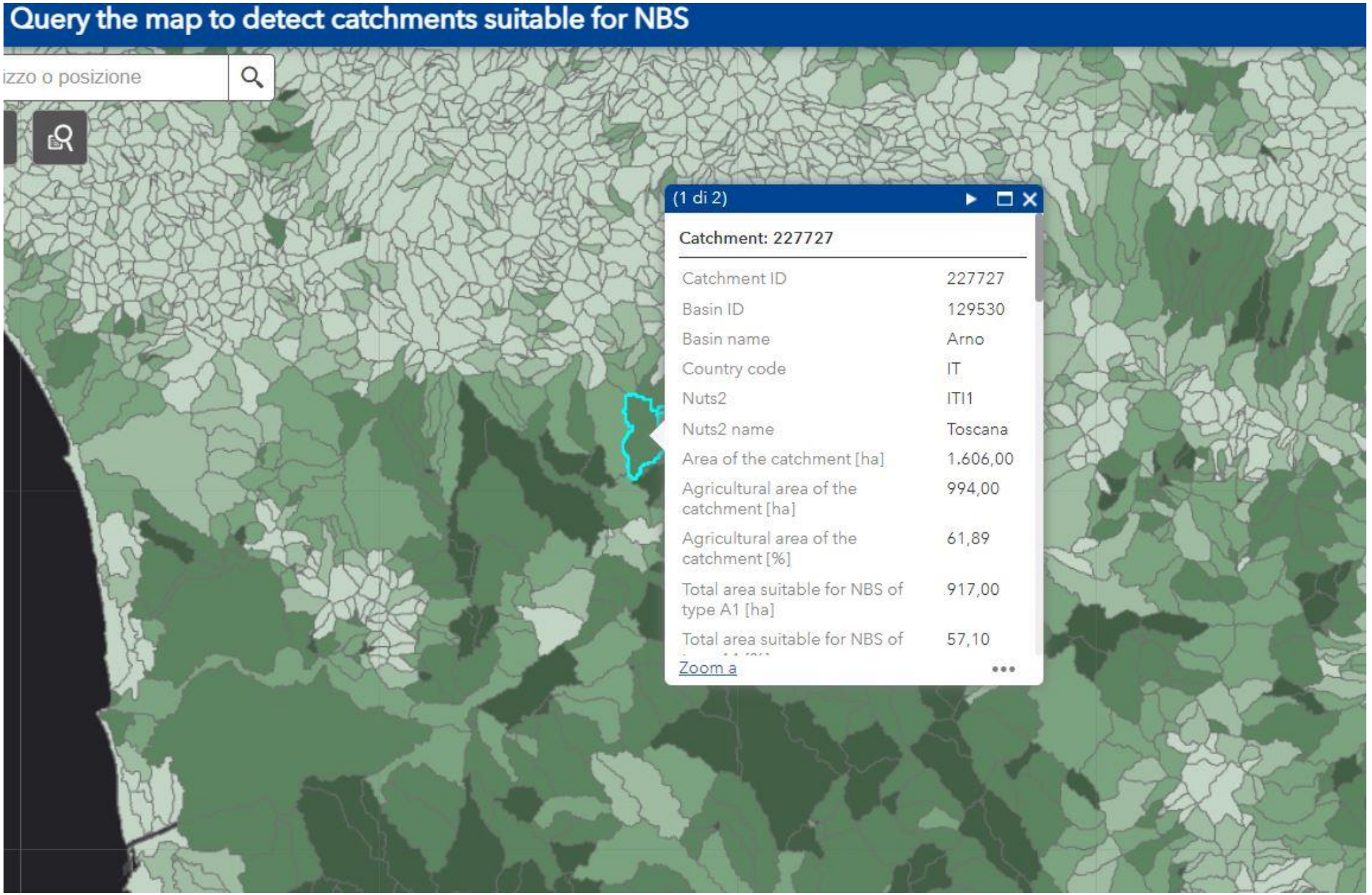
Query the map to detect catchments suitable for NBS



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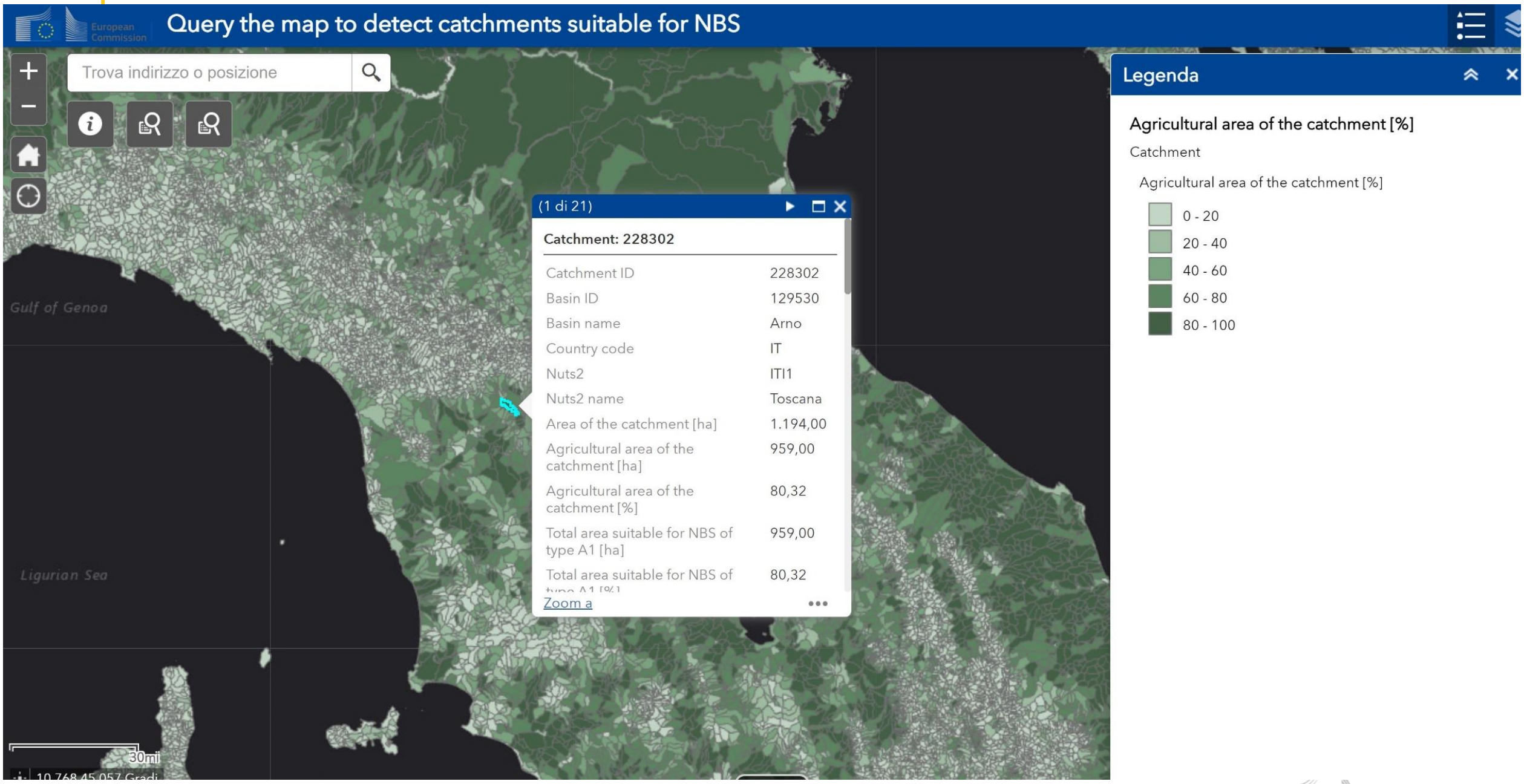

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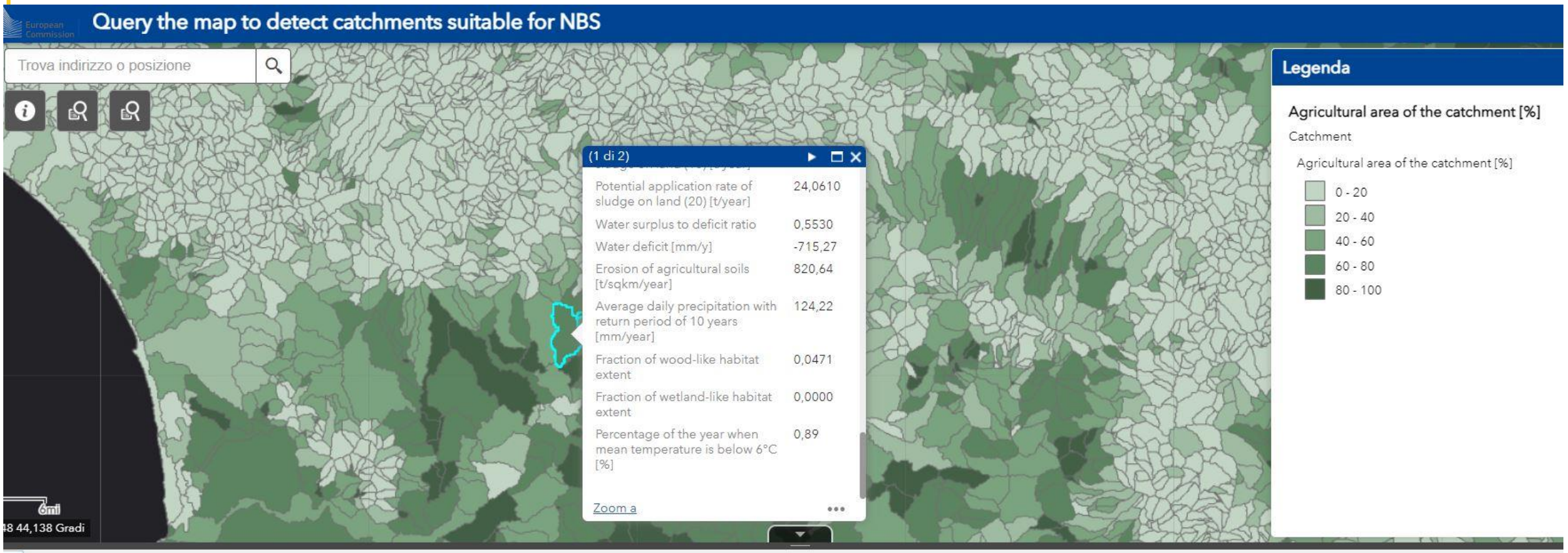

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Total area suitable for NBS of type A1 [ha]	Total area suitable for NBS of type A1 [%]	Agricultural area suitable for NBS of type A1 [%]	Total area suitable for NBS of type B1 [ha]	Total area suitable for NBS of type B1 [%]	Agricultural area suitable for NBS of type B1 [%]	Total area suitable for NBS of type B2 [ha]	Total area suitable for NBS of type B2 [%]	Agricultural area suitable for NBS of type B2 [%]	Total area suitable for NBS of type B3.1 [ha]	Total area suitable for NBS of type B3.1 [%]	Agricultural area suitable for NBS of type B3.1 [%]	Total area suitable for NBS of type B3.2 [ha]	Total area suitable for NBS of type B3.2 [%]	Agricultural area suitable for NBS of type B3.2 [%]
0	57,10	92,25	568,00	35,37	57,14	994,00	61,89	100,00	271,00	16,87	27,26	476,00	29,64	47,89

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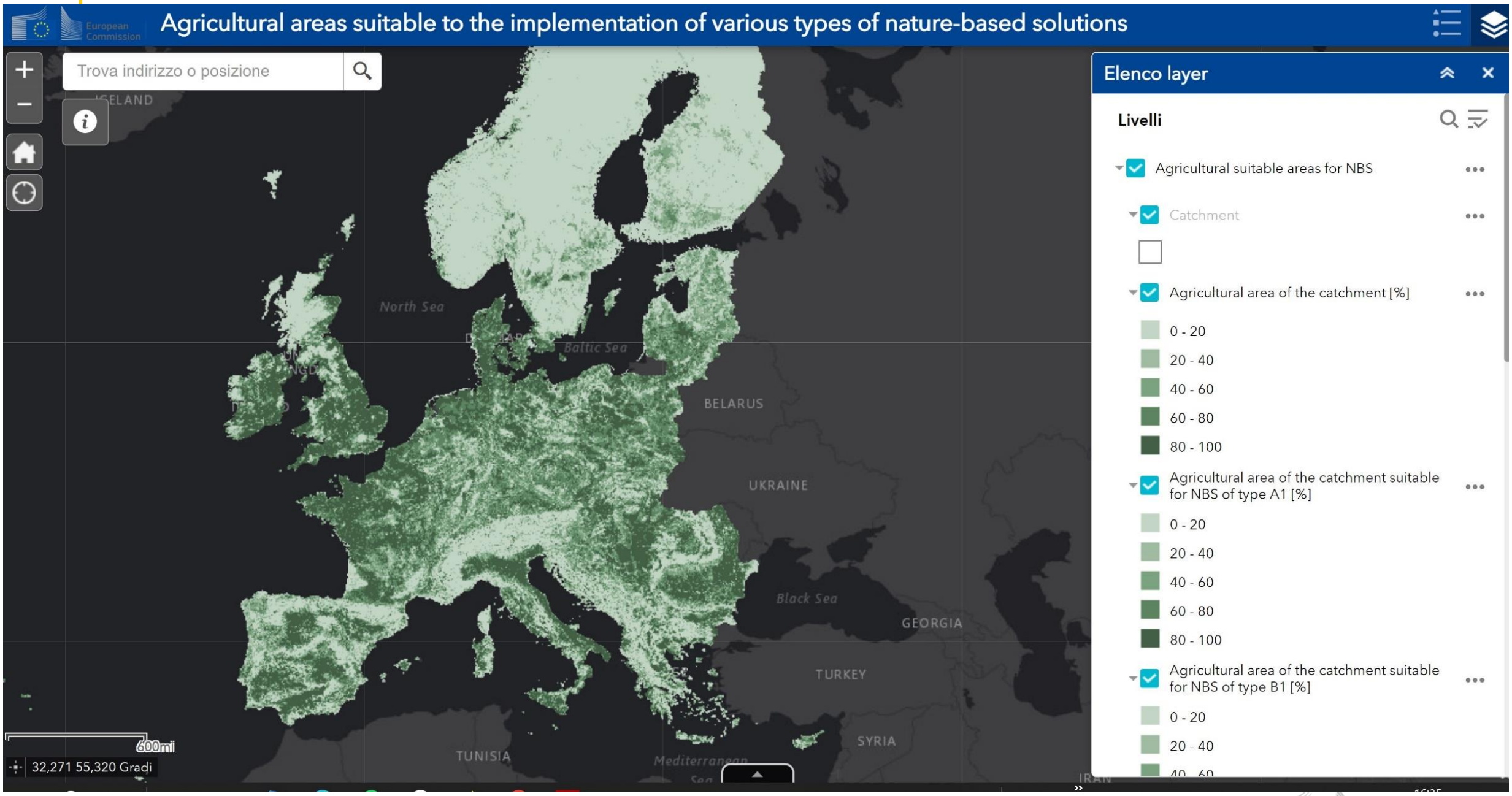

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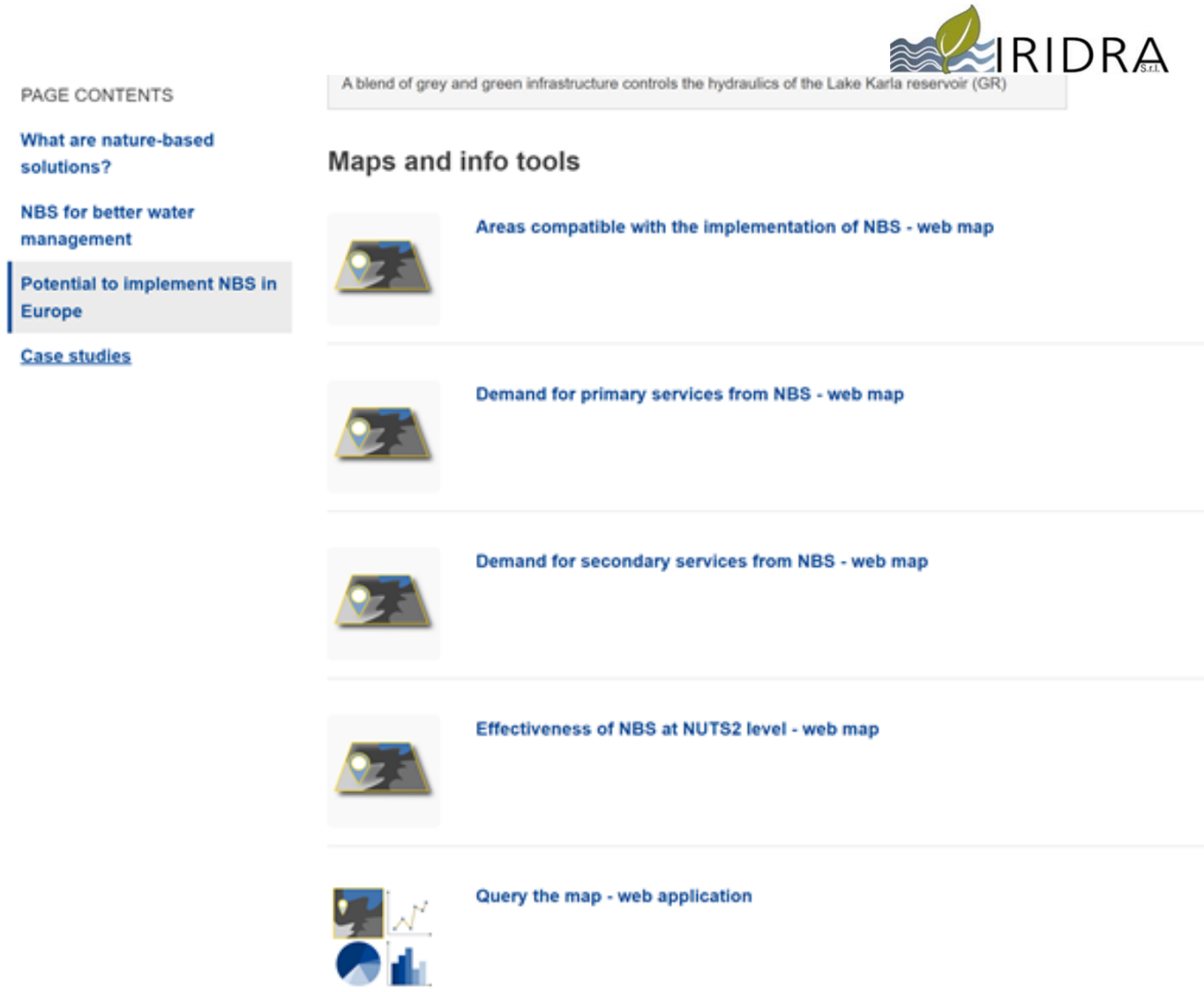

OPEN FOR QUESTIONS

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THANKS FOR THE ATTENTION

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"WITHOUT WATER IT'S JUST A ROCK IN THE OPEN SPACE"

Den Aardkloot van water ontbloot, na twee zyden aante sien.