

WOODLAND OPPORTUNITY MAPPING

A CASE STUDY IN THE CAIRNGORMS NATIONAL PARK

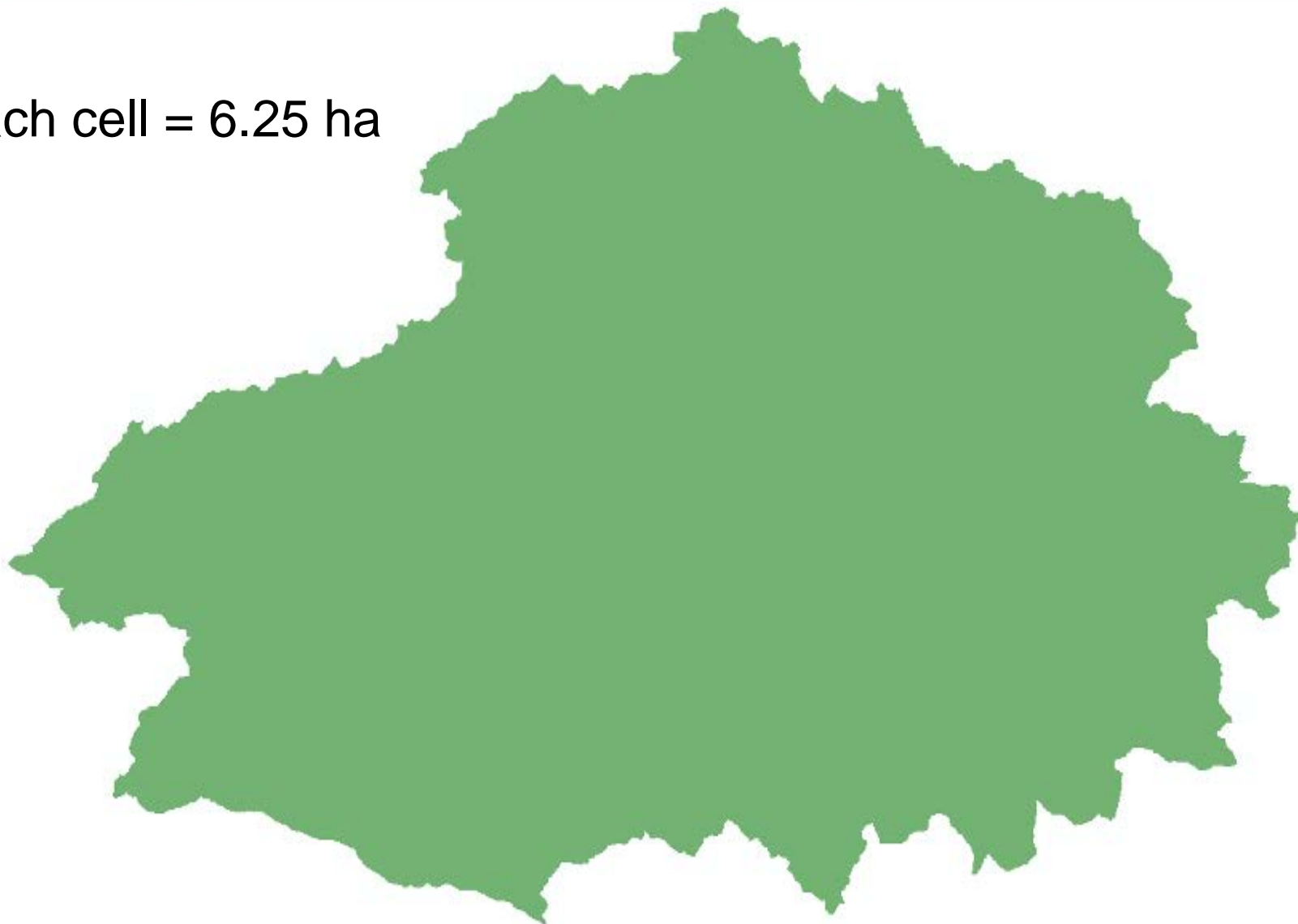


Stefania Pizzirani
Forest Research
Northern Research Station
Edinburgh



- Explored two woodland expansion scenarios: timber production focus and biodiversity focus
- Used Ecological Site Classification (ESC) model to create grid of species suitability across Cairngorms National Park (CNP)
- Attempted to stay consistent with as many CNPA objectives as possible in each scenario (e.g. native species)
- Used various spatial and site specific data to extract the most suitable areas for each scenario
- Aimed to achieve between 5-10% woodland expansion

Each cell = 6.25 ha

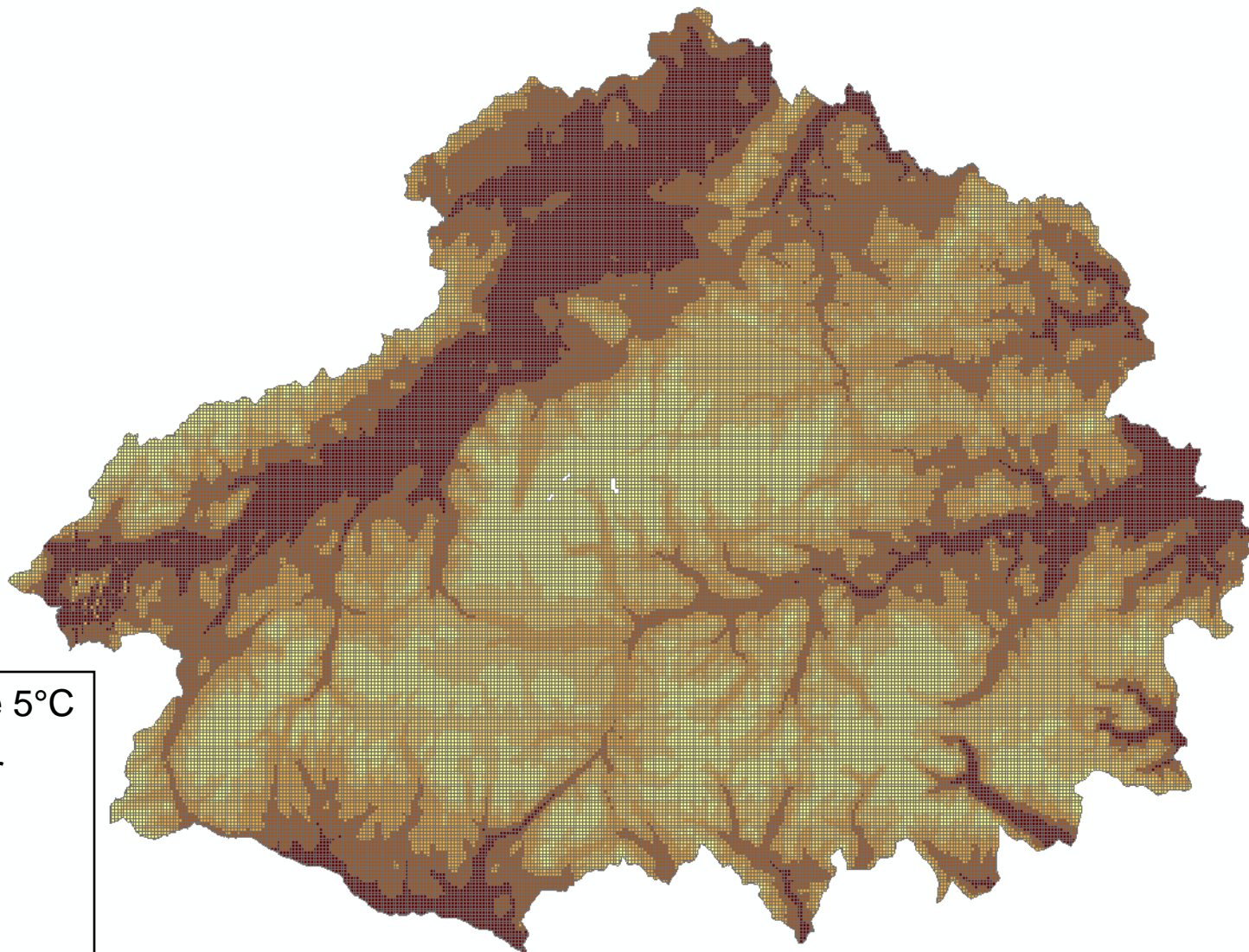


Species suitability



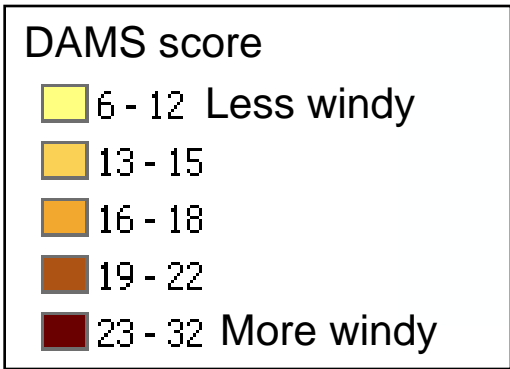
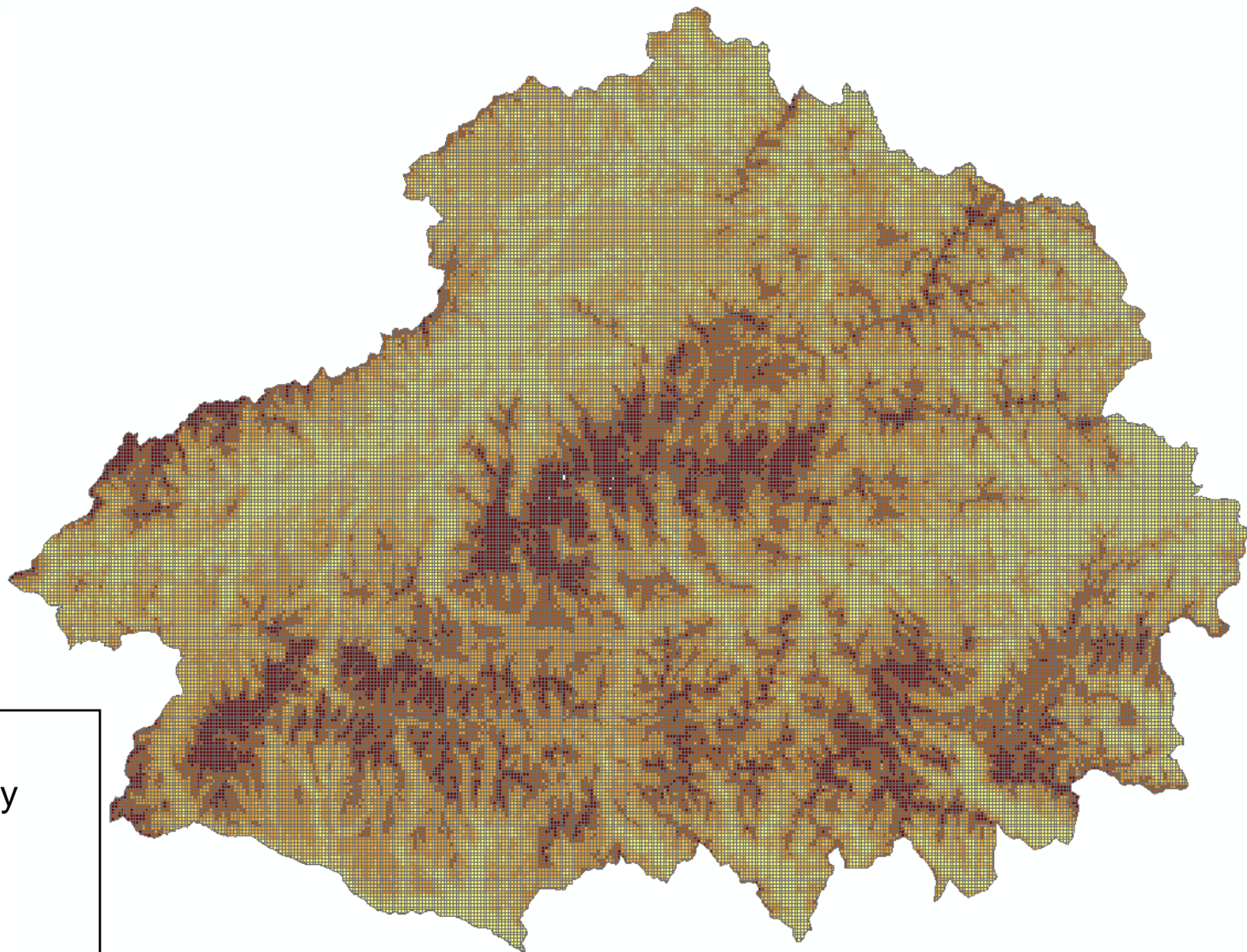
- Soil data
- Temperature data
- Moisture data
- Windiness data
- Geological data

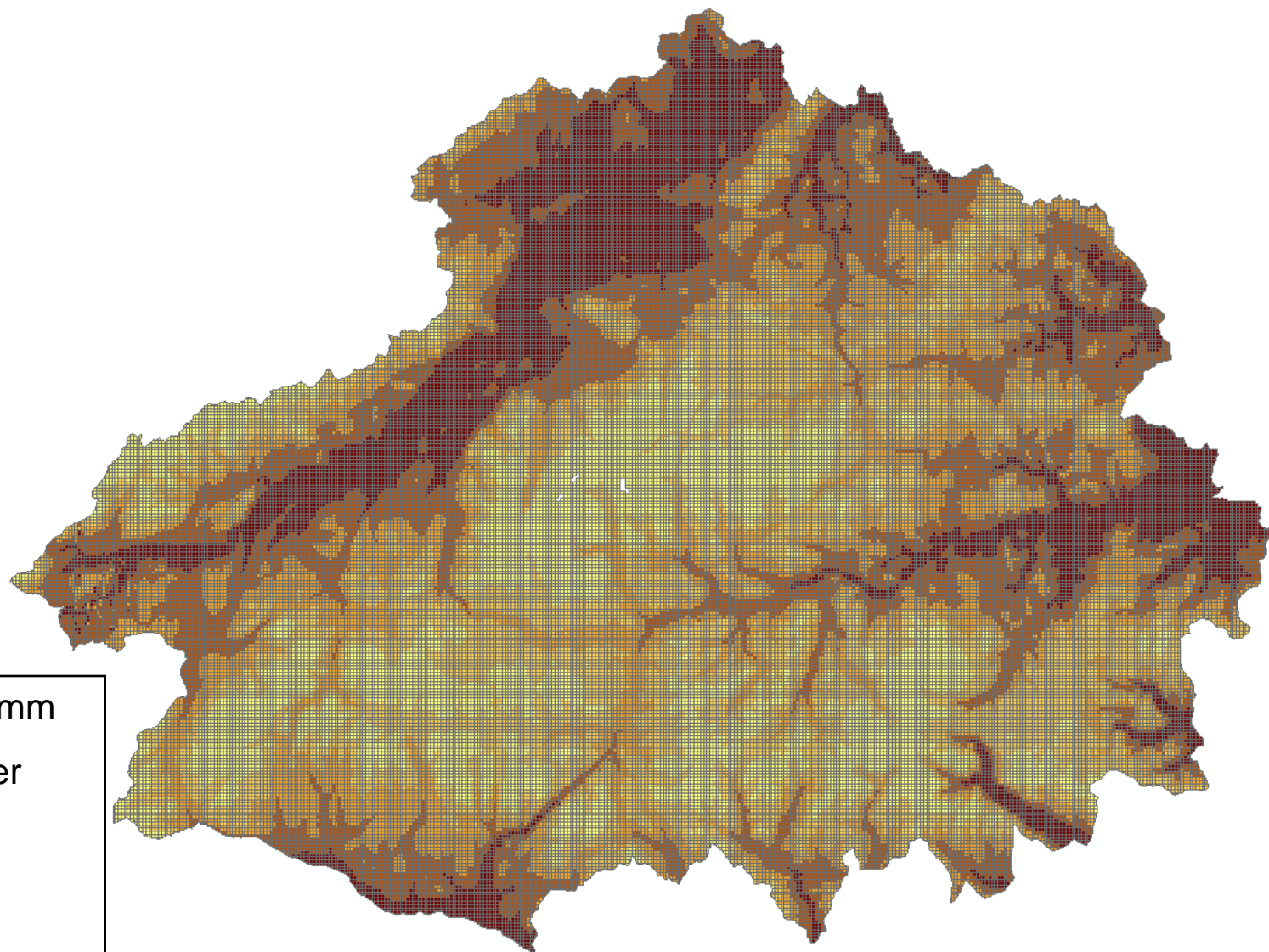
GROUP AREA	FOREST_A	CPMPT_A	SCPH_A	ENVE	STRE	SPHS	SPHS	CPHO	PLUP	SLBC	AREW	AREW_A	BETH	MLT	SMAR	STCK	SEAL	WHEL	STOP	ENCL	RESD	RESD	VOLP	MLT	BRUP
11001.0001	710	1114	C								130	11001													
60001.0000	710	1114	C								2000	10	17	44400.0											
3001.2010	710	1114	M								2000	10	130	2000.0											
2001.1000	710	1114	J								2000	10	30	11000.0											
10001.0000	710	1000	A								2000	14	130	12000.0											
3000.0000	710	1000	D								2000	14	130	10000.0											
8000.0000	710	1000	D								2000	10	30	40000.0											
2000.0000	710	1000	F								2000	10	30	11000.0											
4000.0000	710	1000	F								2000	10	30	2000.0											
1000.0000	710	1000	F								2000	10	30	11000.0											
2000.0000	710	1000	F								2000	10	30	11000.0											
3000.0000	710	1000	F								2000	10	30	11000.0											
4000.0000	710	1000	F								2000	10	30	11000.0											
5000.0000	710	1000	F								2000	10	30	11000.0											
6000.0000	710	1000	F								2000	10	30	11000.0											
7000.0000	710	1000	F								2000	10	30	11000.0											
8000.0000	710	1000	F								2000	10	30	11000.0											
9000.0000	710	1000	F								2000	10	30	11000.0											
10000.0000	710	1000	F								2000	10	30	11000.0											







Day-Degrees Above 5°C

-  -204 - 405 Cooler
-  408 - 615
-  616 - 779
-  780 - 937
-  938 - 1232 Warmer





Moisture Deficit in mm

-  -180 - -51 Wetter
-  -50 - -7
-  -6 - 26
-  27 - 58
-  59 - 112 Drier

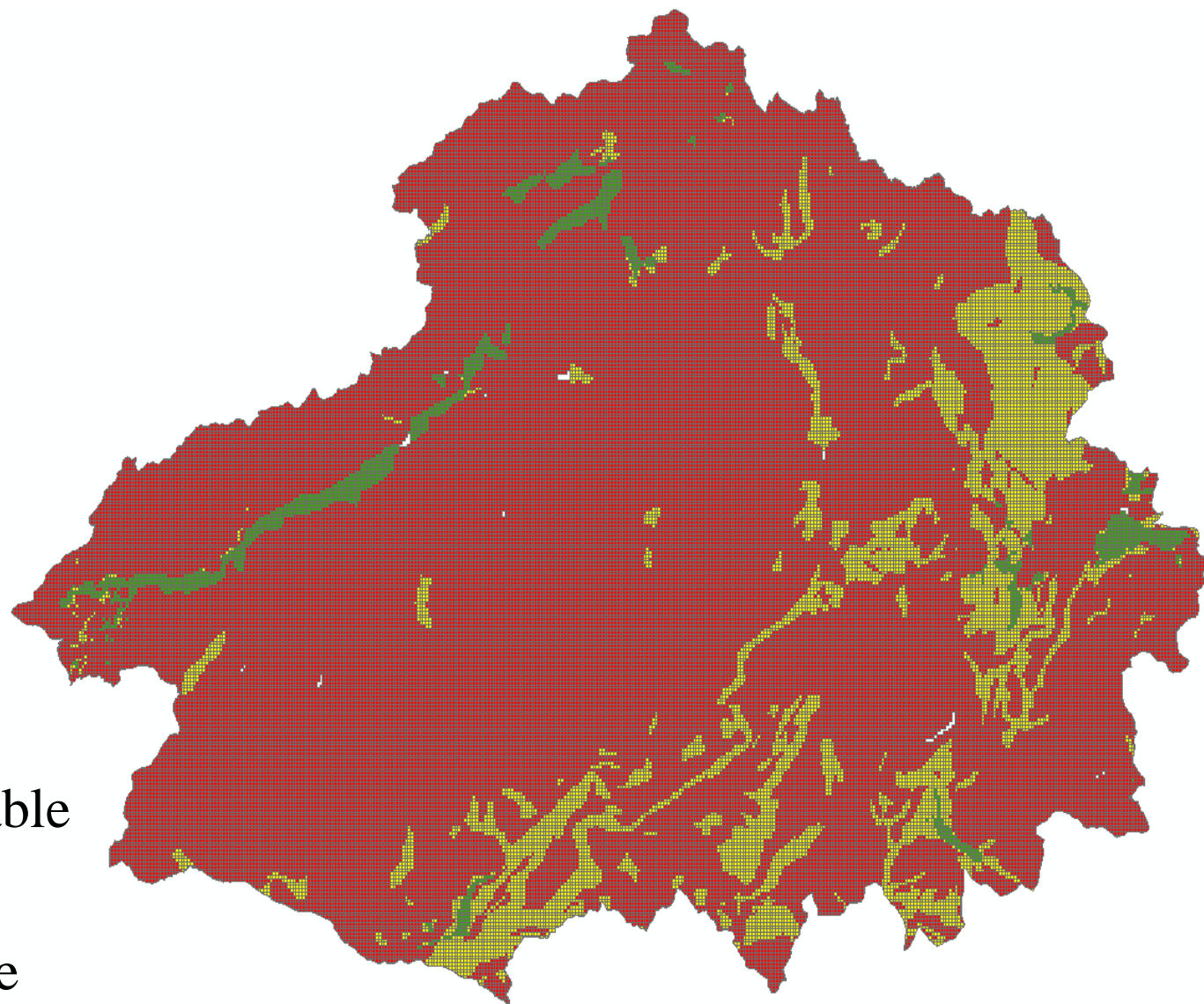





SHAPE_AREA	FOREST_1	CPMT_1	SCPT_1	LOUSE	STRY	SPS	ORBG	PROF	PLVR	YLDC	AREAP	AREA1	ROTH	MBX	SPHRM	STOCK	SRATE	MODEL	STOP	THCY	DFST	DRXT	VOLP	VOLT	DBHP	
1155.39477	715	1114	J	OPN	0	0	0	0	0	0	100	11355.4			0	0	0									
86205.52928	715	1114	C	PHF	1	SS				2009	16	87	44592.2	J		13	0	0								
3687.20161	715	1114	M	PHF	1	SS				2000	16	100	3007.2	J		12	0	0								
7388.17306	715	1114	J	PHF	1	MB				2000	8	80	5910.5	J		66	0	0								
120891.96409	715	1031	A	PHF	1	SS				2000	14	100	132089.2	J		13	0	0								
3520.66680	715	1031	D	PHF	1	AL				2000	14	100	3520.7	J		10	0	0								
6109.00991	715	1031	B	PHF	1	SS				2000	0	80	48949.9	J		13	0	0								
2279.92662	715	1032	J	PHF	1	SP				2001	8	50	11397.2	J		1	0	2001	A		7	0	0	95	50	0
6290.25429	715	1004	J	PHF	1	MB				1991	4	30	31002.2	J		63	0	1991	B		7	0	0	90	50	0
715.20789	715	1009	C	PHF	1	SS				1991	4	30	715.2	J		21	0	1991	B		7	0	0	90	50	0
4346.10991	715	1009	C	PHF	1	SS				1991	4	30	4346.1	J		21	0	1991	B		7	0	0	90	50	0
4350.26276	715	1061	J	PHF	1	MB				2000	2	100	4350.2	J		87	1600	2000			7	0	0	0	0	0
22726.48112	715	1003	C	PHF	1	SS				1981	22	100	22726.5	J		13	0	1981	A		7	0	0	100	60	0
388192.13890	715	1017	A	PHF	1	SS				1976	14	75	274844.1	J		13	0	1988	B		7	0	0	100	60	0
85853.25218	715	1008	C	PHD	0	0				0	0	100	85853.3			0	0	0			0	0	0	0	0	0
191384.02272	715	1001	A	AGK	0	0				0	0	99	149890.4			0	0	0			0	0	0	0	0	0
12001.26107	715	1002	E	OPN	0	0				0	0	100	12001.2			0	0	0			0	0	0	0	0	0
12177.14267	715	4022	A	PMN	0	0				0	0	100	12177.1			0	0	0			0	0	0	0	0	0
30313.26855	715	1031	C	OPN	0	0				0	0	100	30313.4			0	0	0			0	0	0	0	0	0
7407.29643	715	1029	D	PHF	1	MB				2003	2	100	7407.4	J		67	1600	2003			0	0	0	0	0	0
5260.93211	715	1011	E	PHF	1	SP				2006	6	67	3524.0	J		1	0	0			0	0	0	0	50	0
7650.3247	715	1003	D	PHD	0	0				0	0	100	7650.3			0	0	0			0	0	0	0	0	0
140075.44270	715	1002	A	PHF	1	NC				1940	10	58	86463.8	J		14	0	1998	A		7	0	0	100	50	0
35667.86775	715	1002	D	PHF	1	SS				1980	16	100	35667.9	J		13	0	1998	A		7	0	0	100	50	0
220100.95089	715	1000	A	PHF	1	SS				2003	12	67	147468.1	J		13	2758	2003			0	0	0	0	0	0
8908.80304	715	1033	F	PHF	1	SP				2001	8	67	8781.2	J		1	0	2001	A		7	0	0	95	50	0
55642.91953	715	1025	A	PHF	1	SS				1972	20	100	55642.9	J		13	0	1998	B		0	0	0	115	50	0
38308.46544	715	1002	C	PHC	0	0				0	0	94	38010.9			0	0	0			0	0	0	0	0	0
5387.23843	715	1029	E	PHF	1	ML				2003	8	100	5387.2	J		19	2758	2003			0	0	0	0	0	0
8941.46289	715	1017	B	OPN	0	0				0	0	100	8941.5			0	0	0			0	0	0	0	0	0
43121.51076	715	1029	B	PHF	1	SS				1972	20	70	30204.0	J		13	0	1998			0	0	0	0	0	0
1729.90762	715	1022	J	PHF	1	MB				2001	0	100	1740.2	J		67	0	2001	B		0	0	0	95	50	0
14419.59690	715	1020	F	OPN	0	0				0	0	100	14419.6			0	0	0			0	0	0	0	0	0
9567.15723	715	1001	C	OPN	0	0				0	0	100	9567.2			0	0	0			0	0	0	0	0	0
12042.45114	715	1002	H	PHF	1	SS				1994	20	100	12042.5	J		13	0	1990	A		7	0	0	100	50	0
4125.06603	715	1003	E	PHF	1	SS				1979	16	80	33001.2	J		7	0	1990	A		7	0	0	0	0	0
25532.62634	715	1004	C	PHF	1	SS				1979	20	100	25532.6	J		13	0	1998	A		7	0	0	100	50	0
33815.15261	715	1001	B	PHC	0	0				0	0	100	33815.2			0	0	0			0	0	0	0	0	0
25267.87712	715	1029	C	PHF	1	SS				2003	12	60	20214.3	J		13	2758	2003			0	0	0	0	0	0
6494.03645	715	1033	G	PHF	1	SS				1940	20	100	6494.1	J		13	0	1998	A		7	0	0	0	0	0
3432.60988	715	1006	F	PHF	1	SS				2002	16	80	2748.1	J		15	2820	2002			0	0	0	0	0	0
8643.68686	715	1036	E	PHF	1	SS				1984	24	50	4321.8	J		13	0	1988	B		0	0	0	100	50	0
9339.68187	715	1035	D	PHF	0	0				0	0	80	7471.7			0	0	0			0	0	0	0	0	0
11842.50638	715	1035	C	PHF	0	0				0	0	100	11842.5			0	0	0			0	0	0	0	0	0
8807.89057	715	1035	F	PHF	1	DF				1949	14	63	4351.8	J		20	0	1988	F		0	0	0	95	50	0
30459.04410	715	1035	B	PHF	1	SS				1991	20	71	21625.9	J		13	0	1990	A		0	0	0	100	50	0
103684.77780	715	1035	A	PHF	1	NS				1949	14	80	82347.8	J		14	0	1990			0	0	0	0	0	0
38401.10323	715	1077	D	PHF	1	NS				1959	2	47	14285.5	M		14	0	1990	F		0	0	0	95	50	0
9560.42122	715	1077	F	OPN	0	0				0	0	100	9560.4			0	0	0			0	0	0	0	0	0
4833.5792	715	1077	G	PHF	1	SS				1959	12	100	4833.6	J		13	0	1990			0	0	0	0	0	0
90562.87321	715	1077	A	PHF	1	LP				1070	10	51	46187.1	J		3	0	1998	B		0	0	0	90	50	0
21532.99790	715	1077	E	OPN	0	0				0	0	100	21532.9			0	0	0			0	0	0	0	0	0
34006.74044	715	1077	C	PHF	1	NS				1969	10	100	34006.7	J		14	0	1998	A		0	0	0	100	50	0
53395.86961	715	1077	B	PHF	1	NS				1959	10	89	47496.7	J		14	0	1998	A		0	0	0	90	50	0
3675.04830	715	1077	H	PHF	1	LP				1959	8	100	3675.1	J		3	0	1998			0	0	0	0	0	0




Batch mode processing

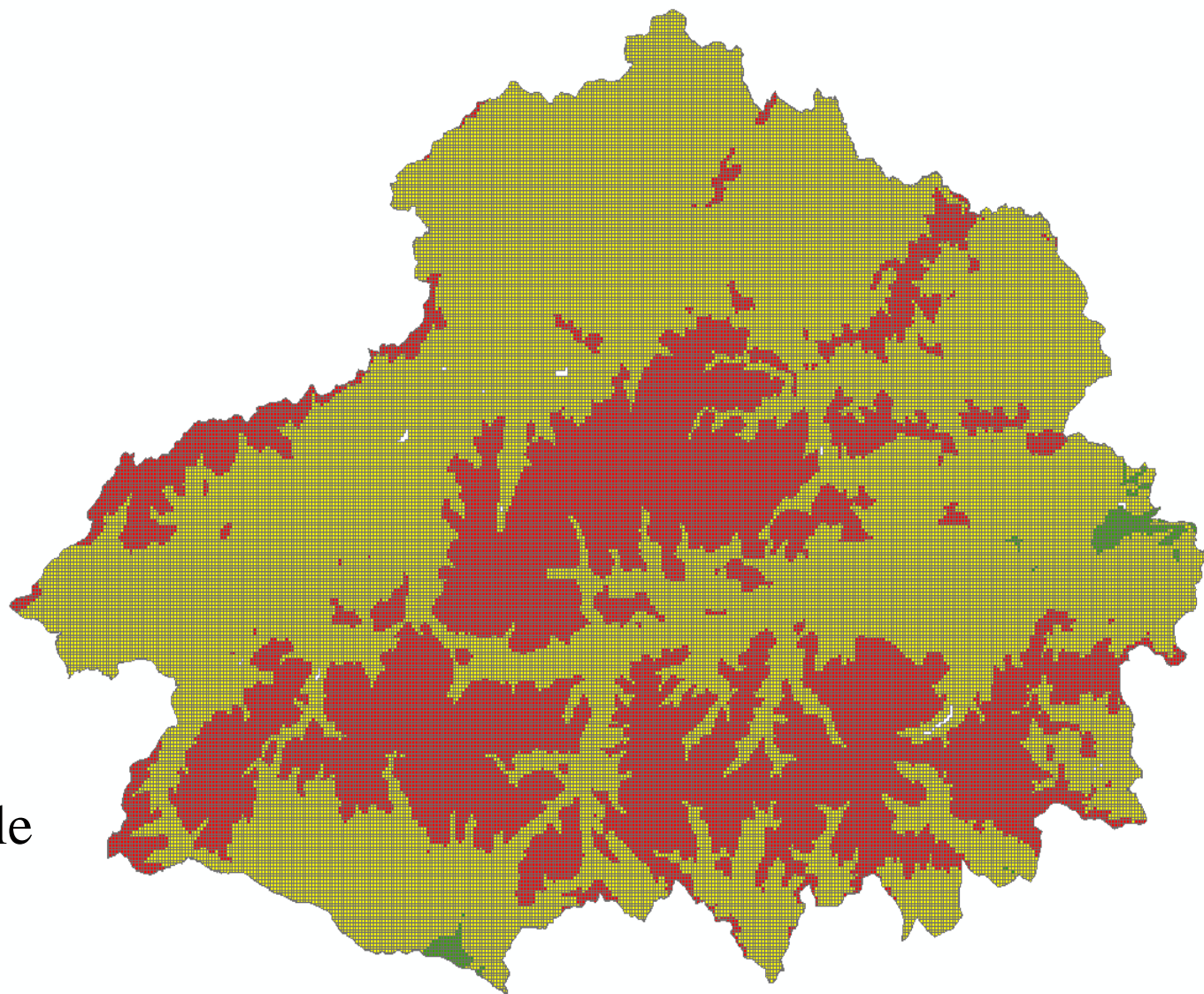





Results for each row (i.e. management unit) are recorded in the original database

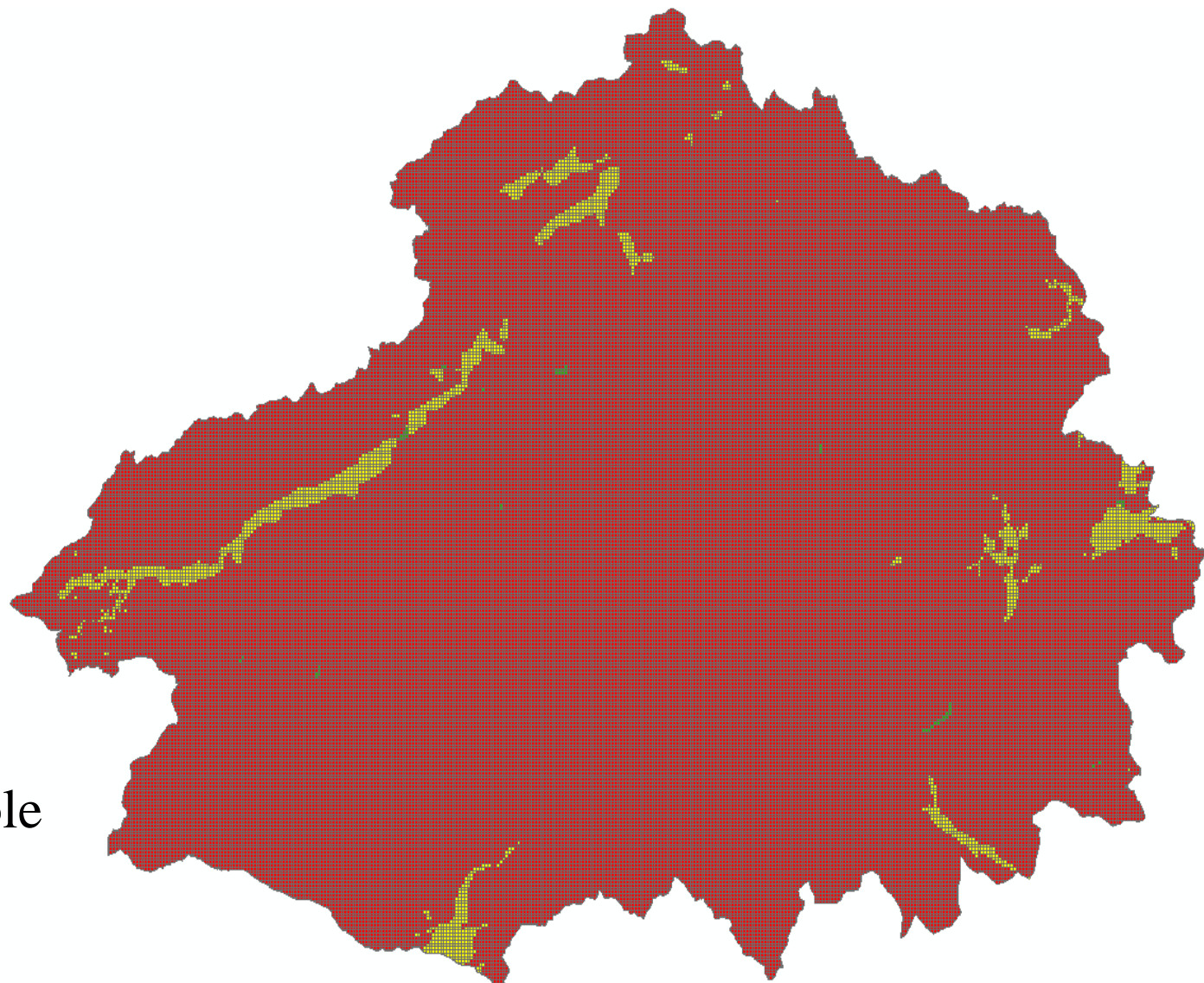


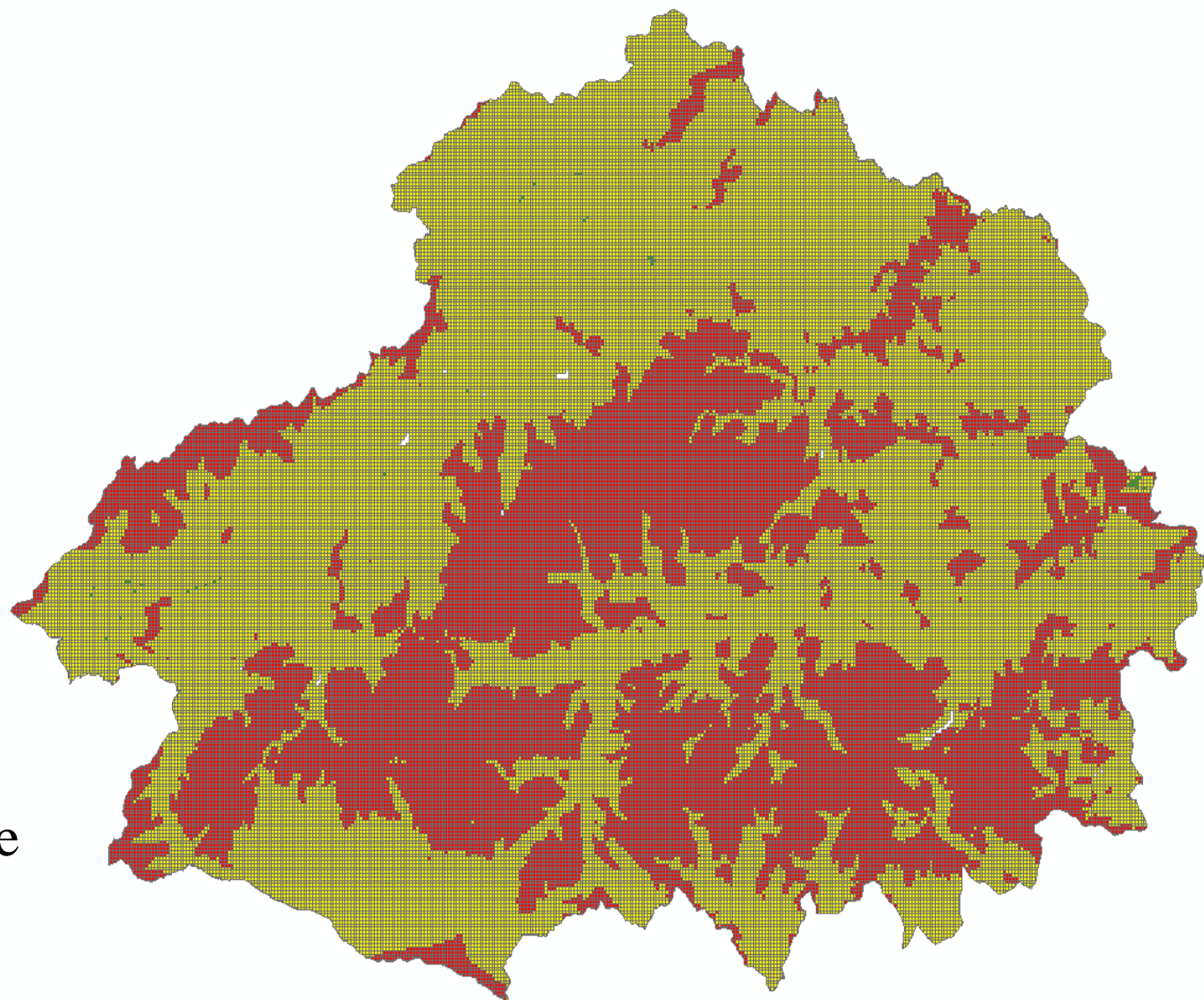
-  1 Very suitable
-  2 Suitable
-  3 Unsuitable




-  1 Very suitable
-  2 Suitable
-  3 Unsuitable



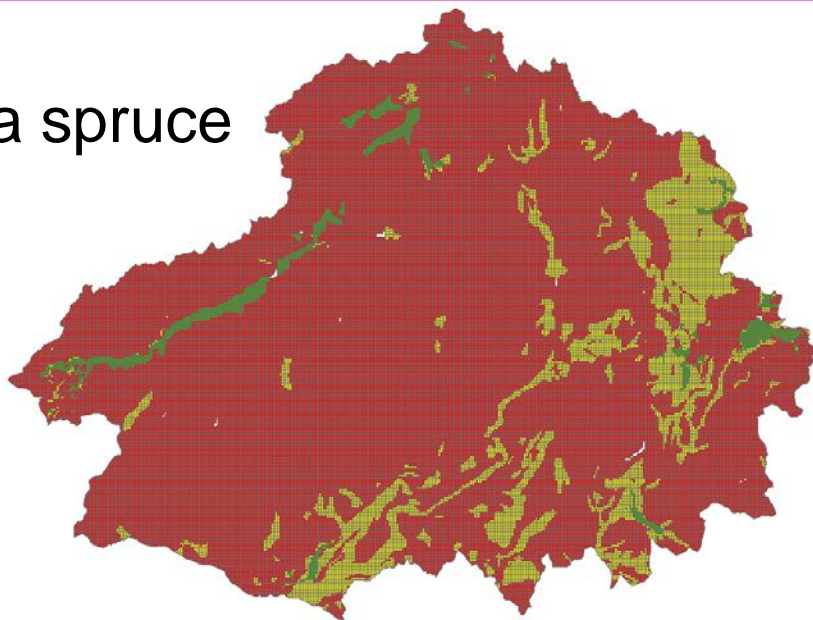
-  1 Very suitable
-  2 Suitable
-  3 Unsuitable



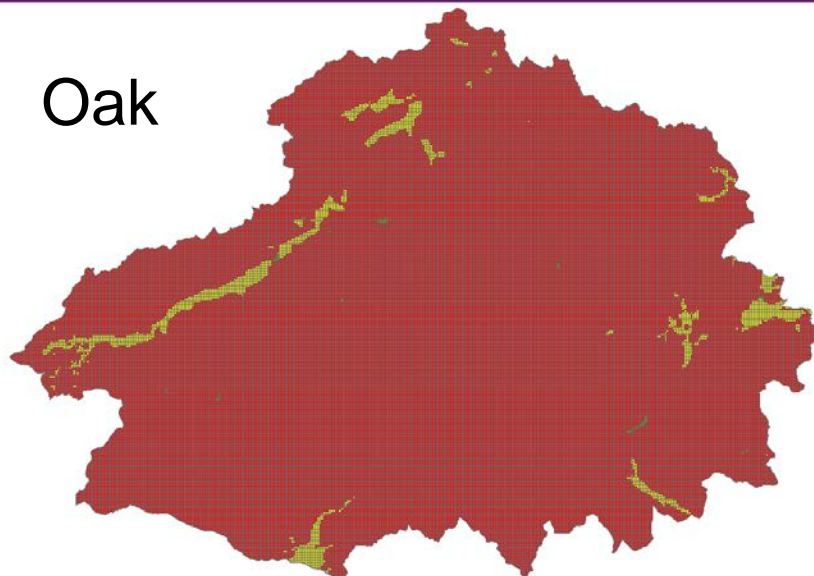


-  1 Very suitable
-  2 Suitable
-  3 Unsuitable

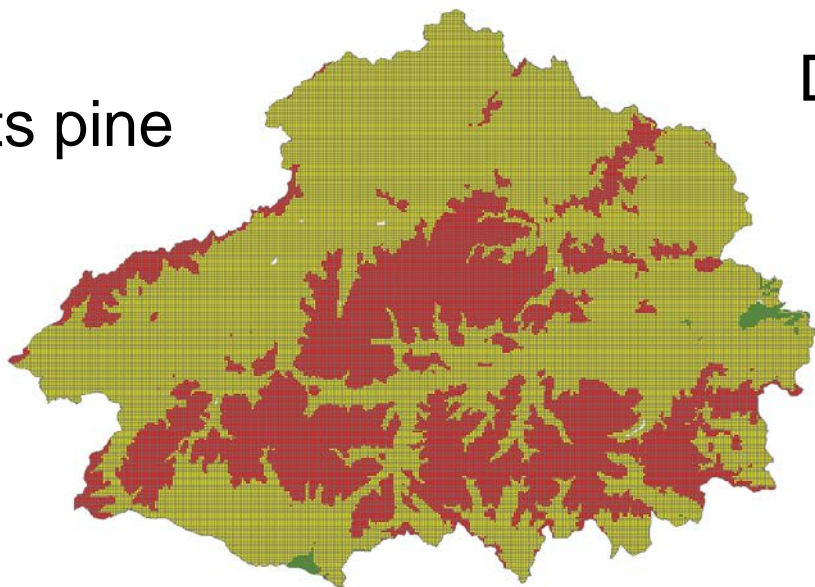
Sitka spruce



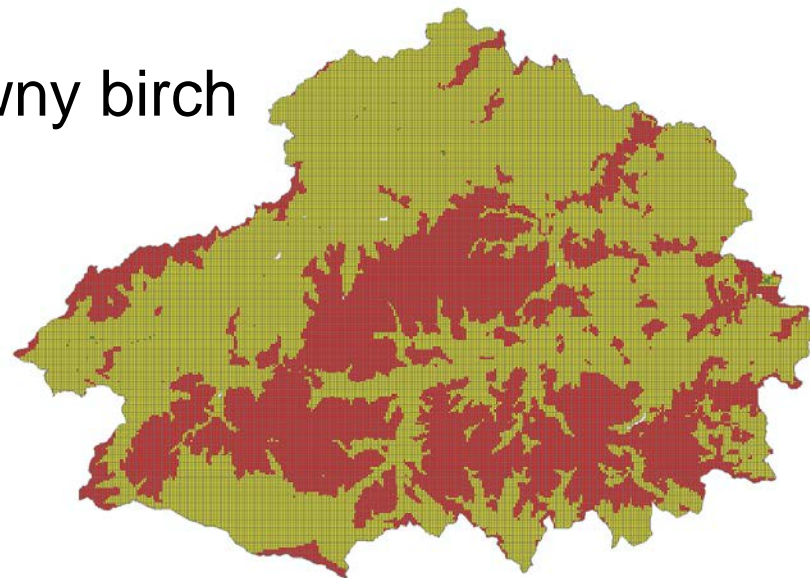
Oak



Scots pine

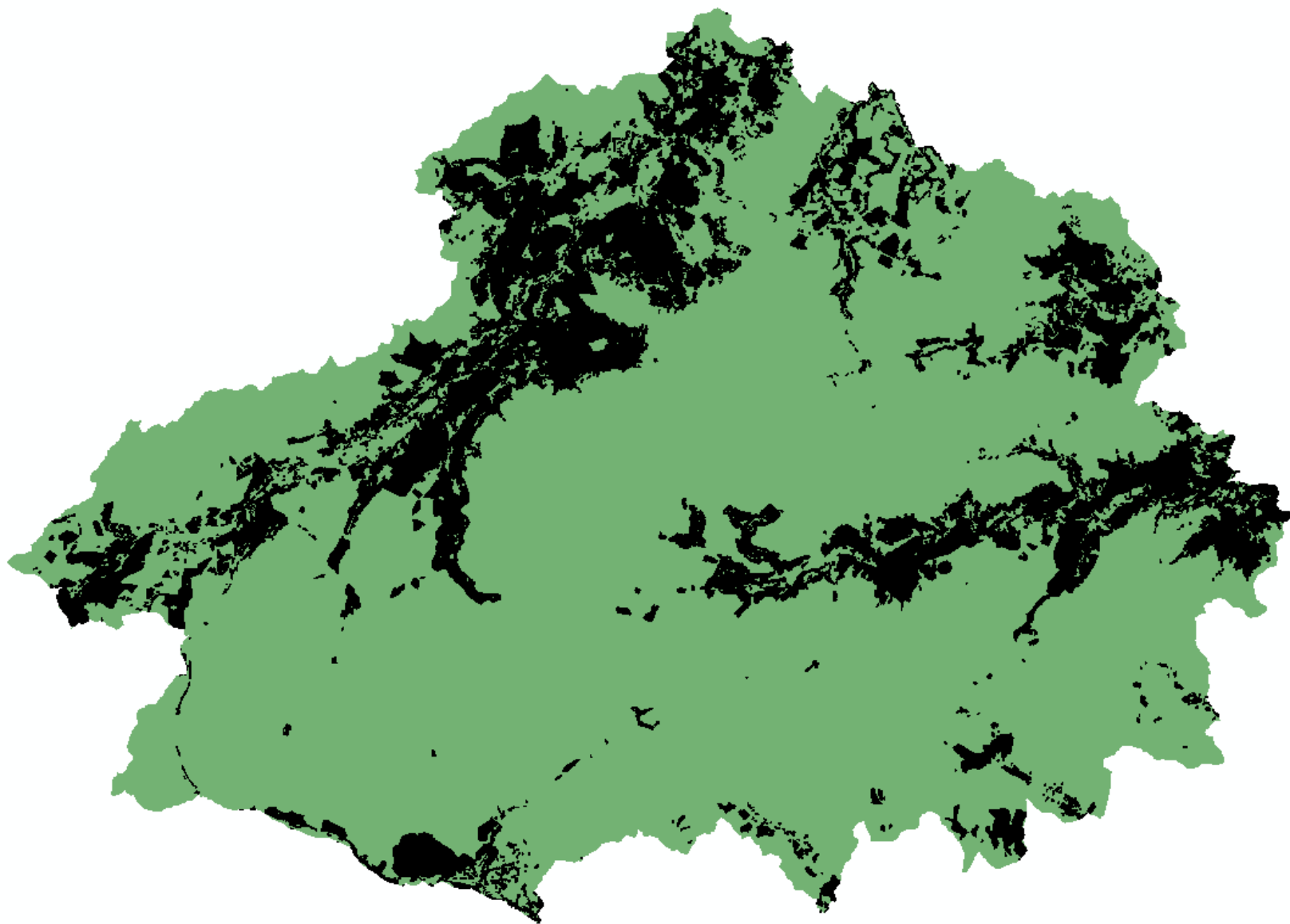


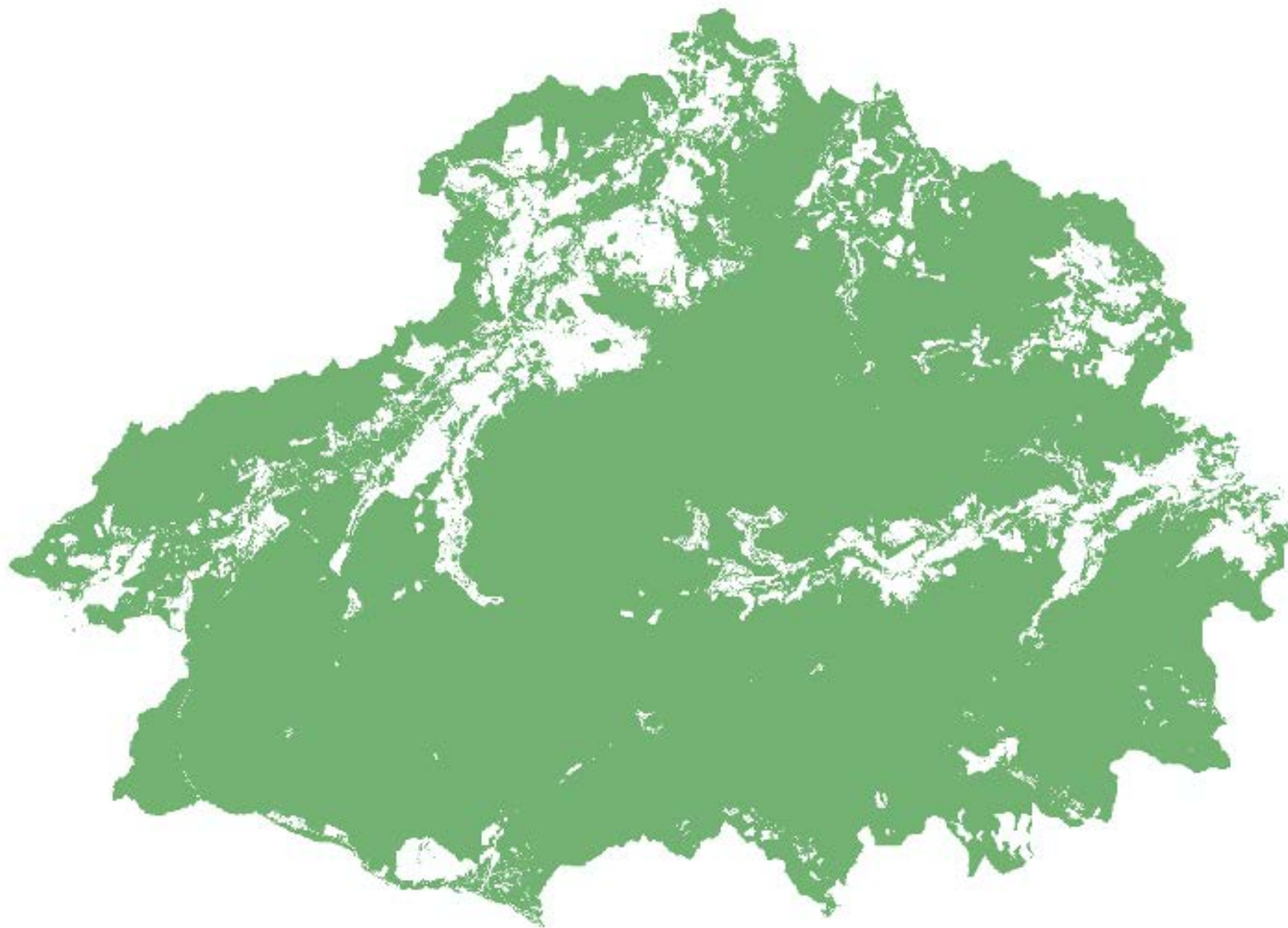
Downy birch

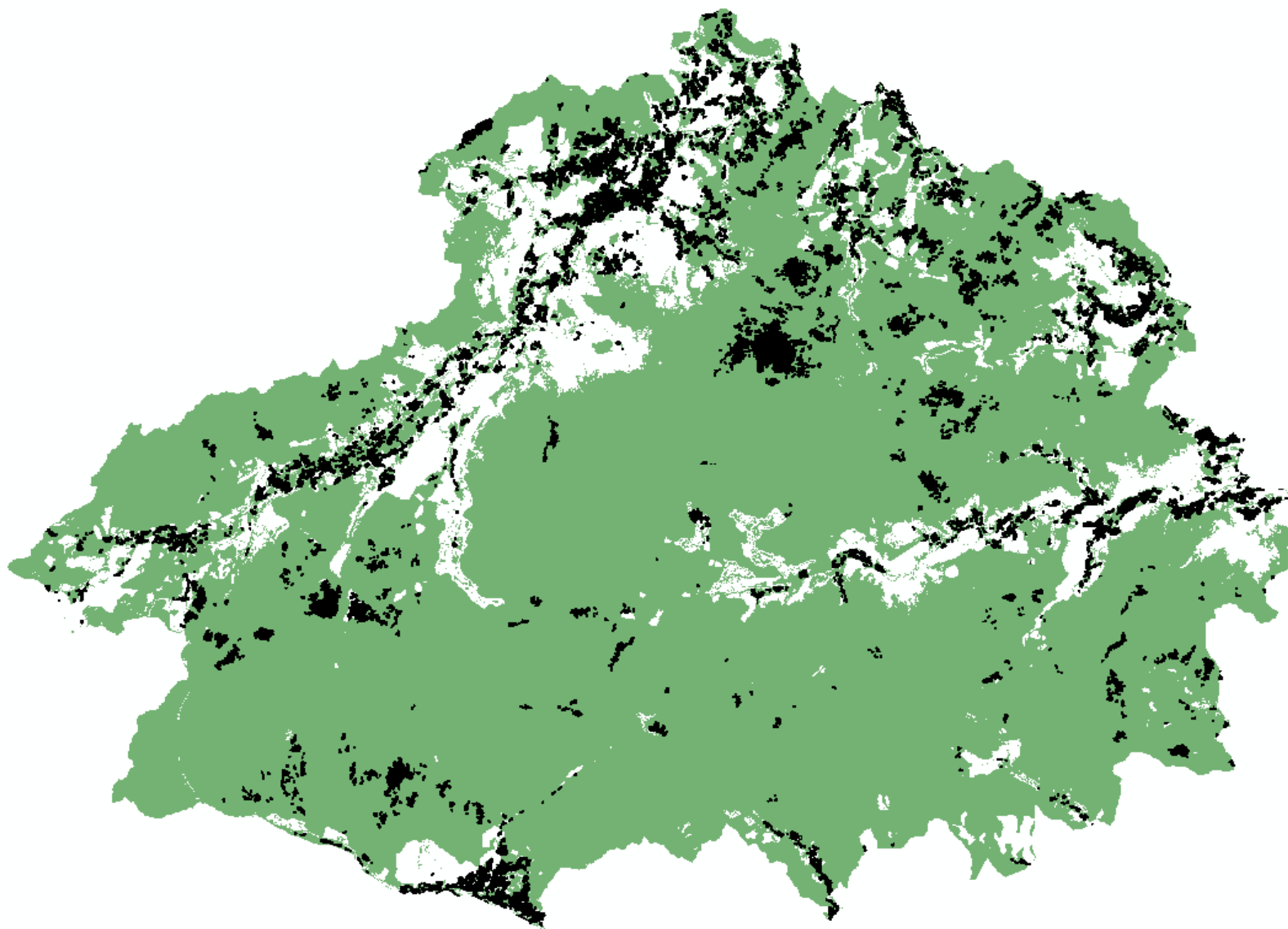


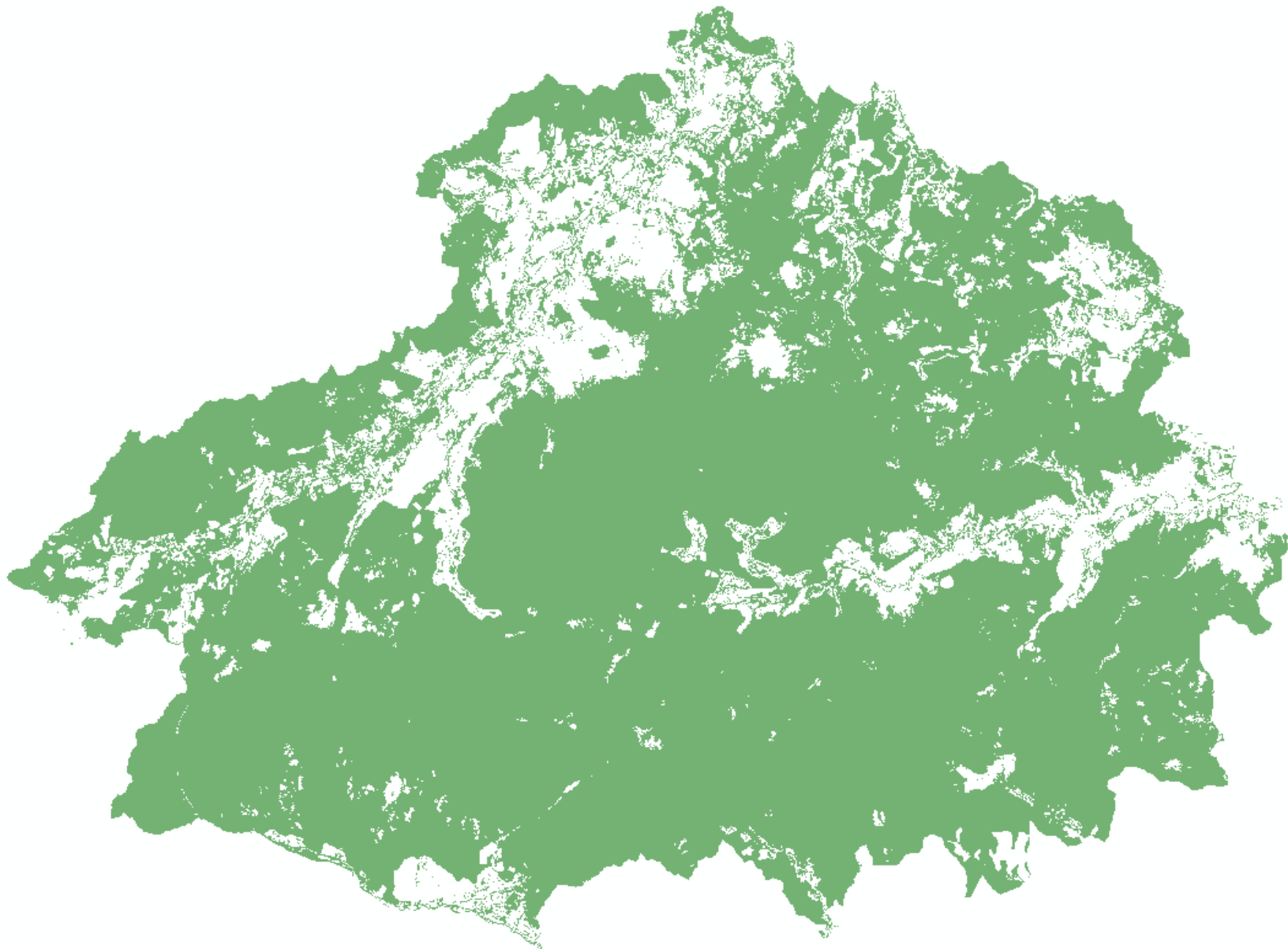
Spatial data considered in the timber production and biodiversity woodland expansion examples:

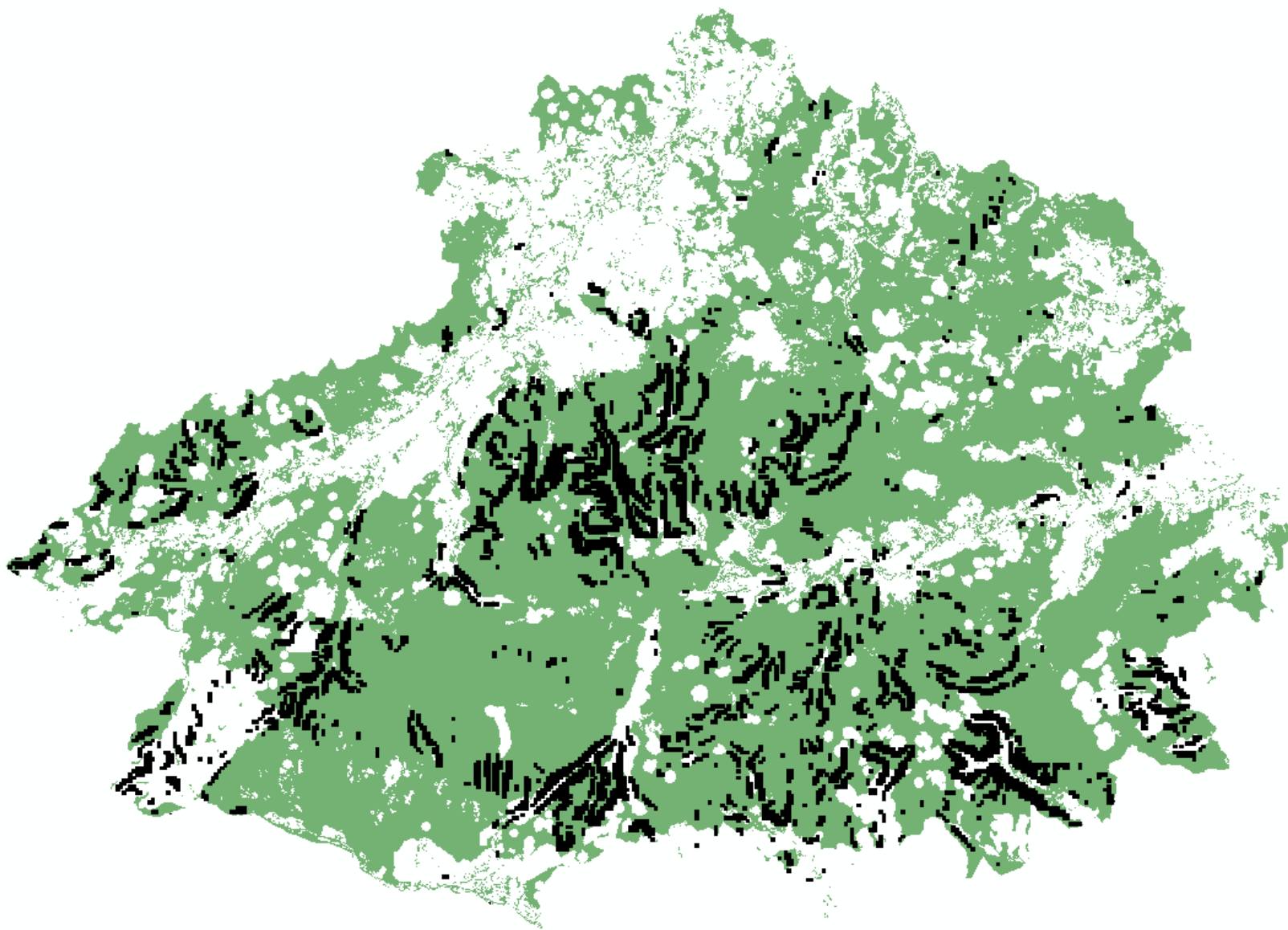
- Existing woodland
- Protected land in the National Park (e.g. arable land, improved grassland)
- Grassland networks
- Fen, marsh and swamp networks
- Sites of Special Scientific Interest (SSSIs)
- Special Protected Areas
- Special Areas of Conservation
- Slope over 30% (in the timber production scenario)
- Road network
- Tree species suitability and growth rate

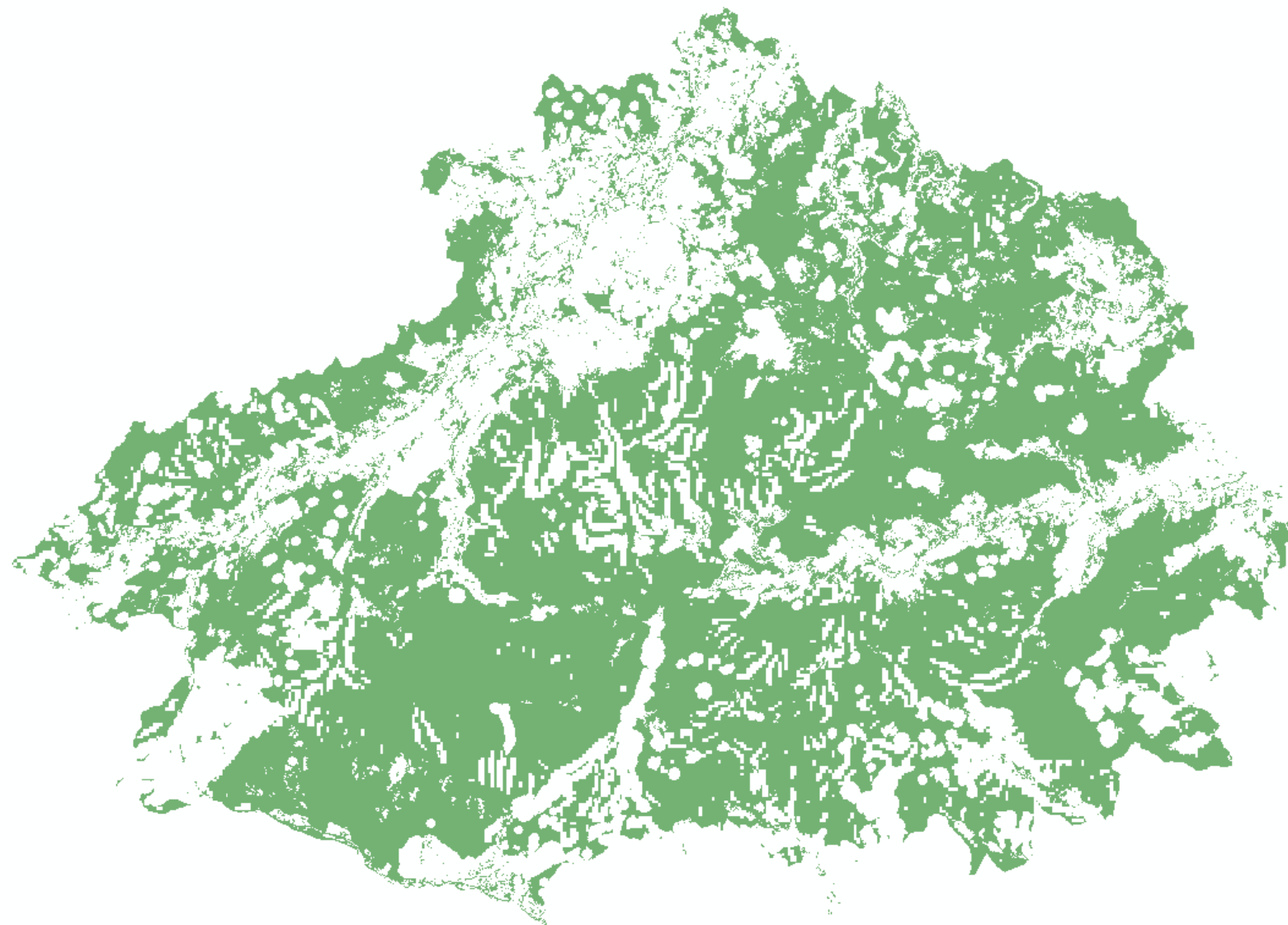


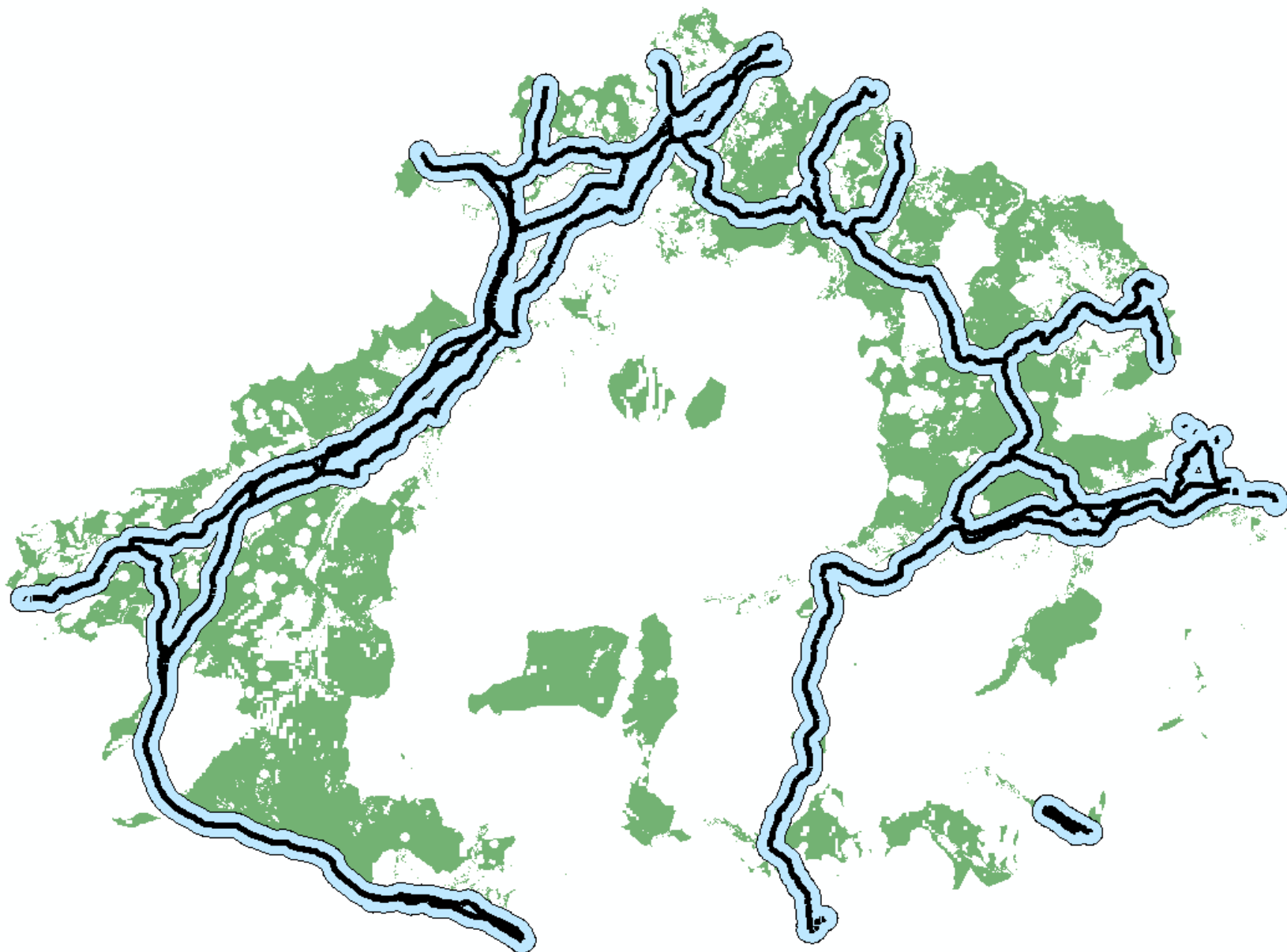


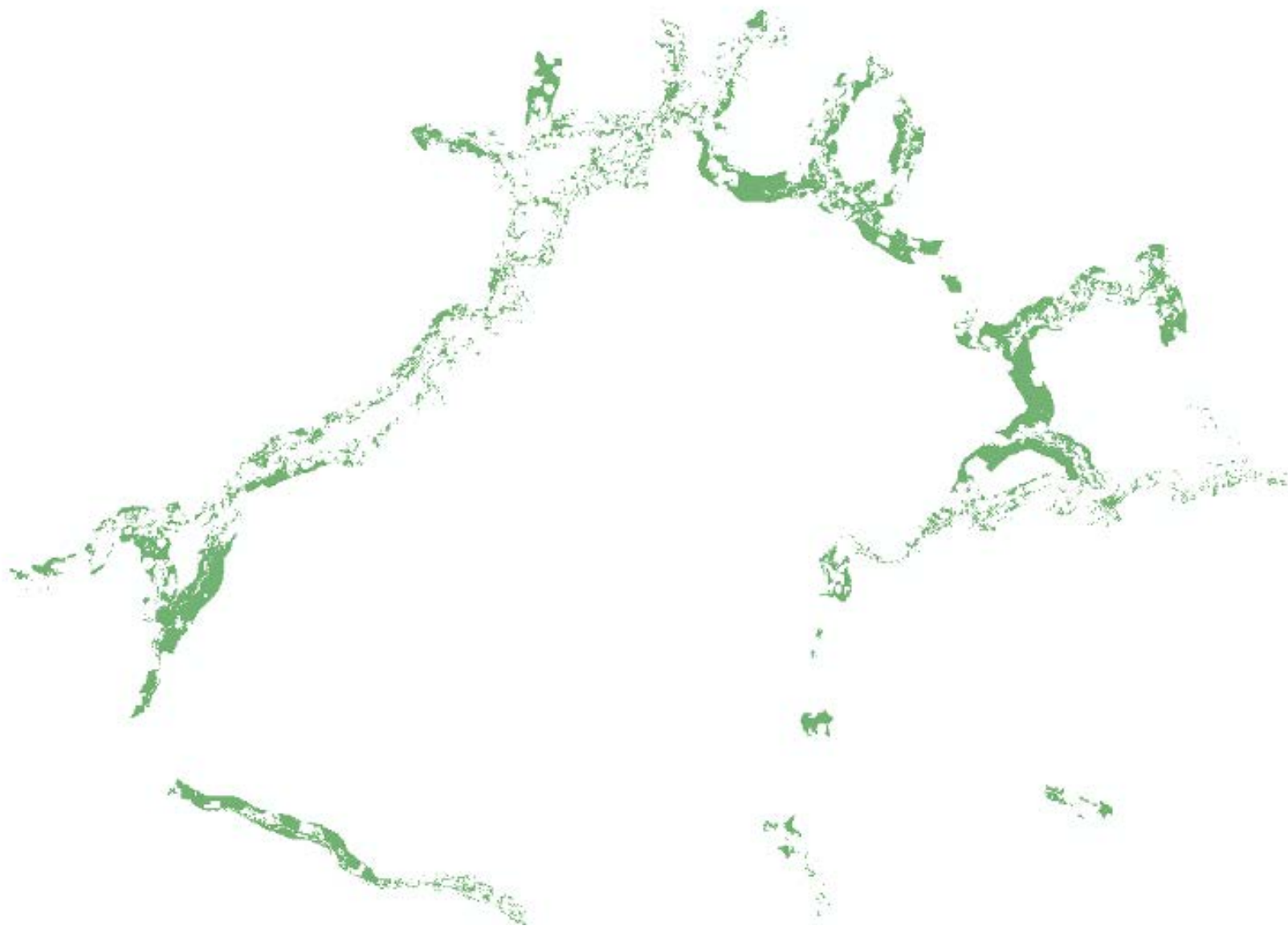


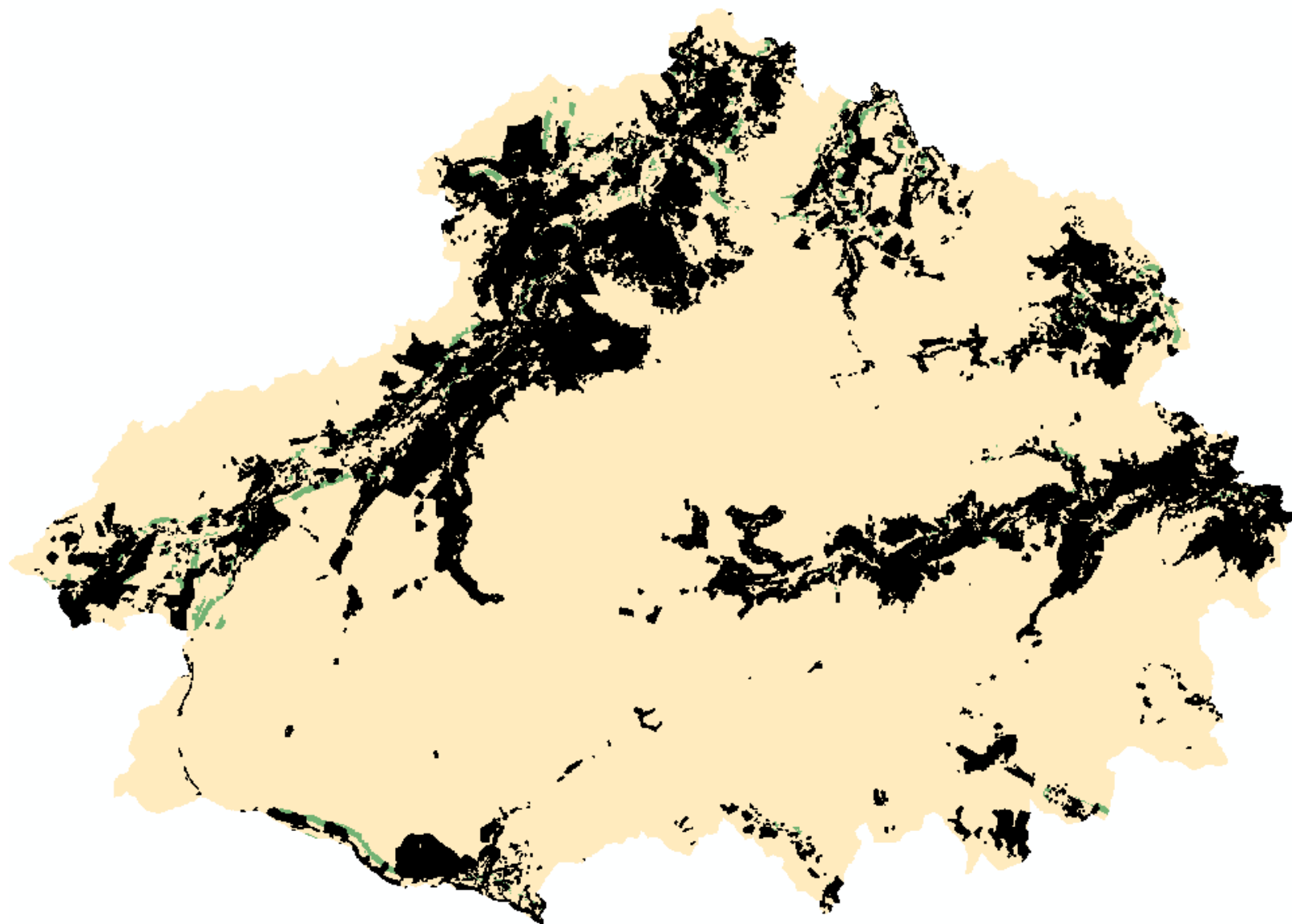


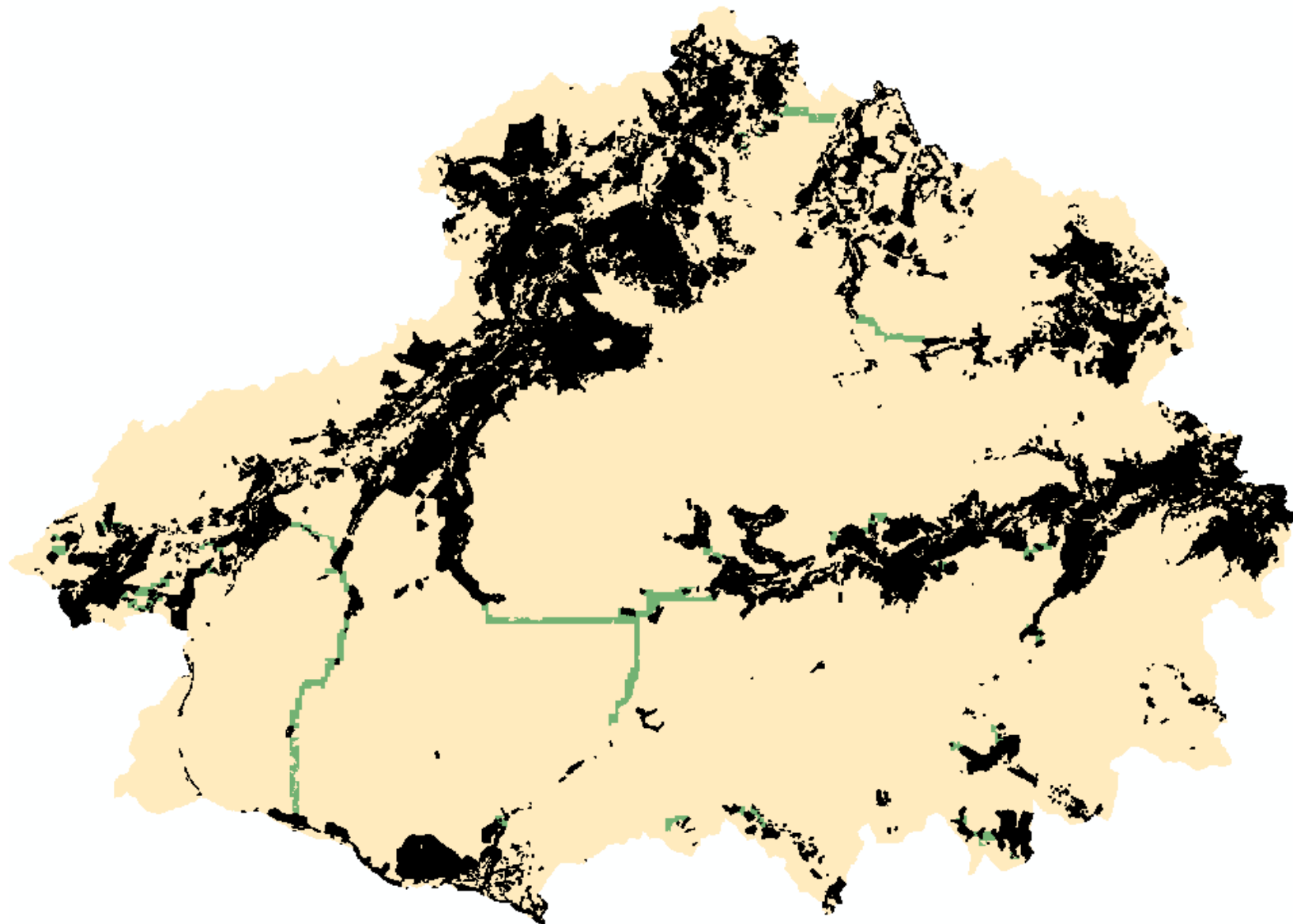












Biodiversity Woodland Expansion Scenario (managed as a 'Nature Reserve')

- Value of standing tree at end of 100-year rotation: £27.26/m³
- Total production cost: £1.10/m³ per year
- Employment: 0.001 FTE/ha per rotation
- GHG emissions (machinery): 0.96 kg CO₂ eq/ha per year
- CO₂ sequestered (total rotation): 4,442 kg CO₂ eq/ha per year

Timber production Woodland Expansion Scenario

- Value of standing tree at end of 75-year rotation: £29.74/m³
- Total production cost: £18.13/m³ per year
- Employment: 0.255 FTE/ha per rotation
- GHG emissions (machinery): 11.4 kg CO₂ eq/ ha per year
- CO₂ sequestered (total rotation): 3,053 kg CO₂ eq/ha per year

- Assume one polygon is one connected woodland
- The more polygons, the more fragmented pieces of woodland
- Original existing woodland: 2833
- Timber production scenario: 3089
- Biodiversity scenario: 2756

Species suitability

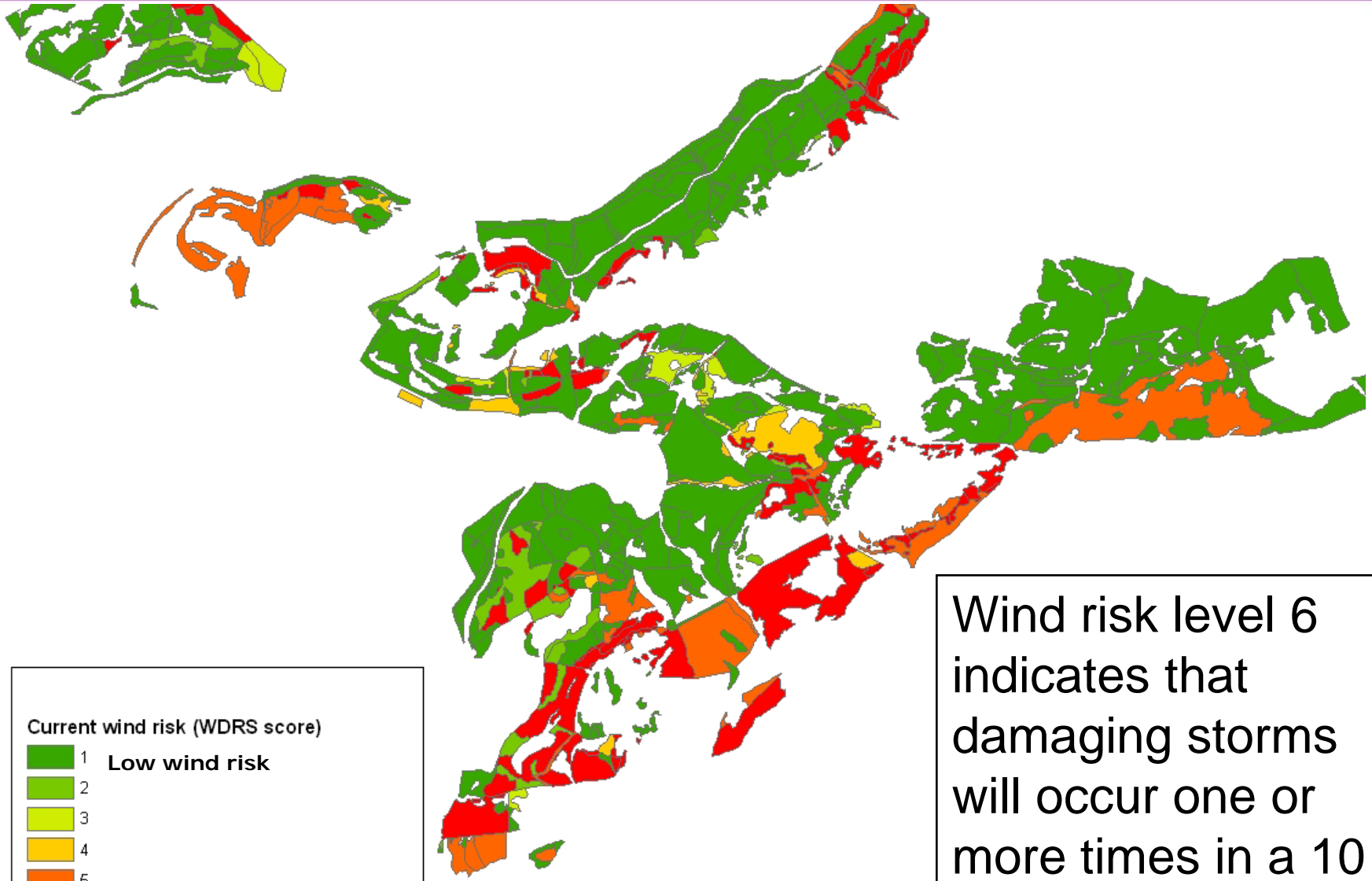


Timber quality



Wind risk





Current wind risk (WDRS score)

1	Low wind risk
2	
3	
4	
5	
6	High wind risk

Wind risk level 6 indicates that damaging storms will occur one or more times in a 10 year period

- The rules and thresholds for various spatial data can be adapted to suit any scenario or objective
- This process allows CNPA to
 - assess the impacts of woodland expansion and bioenergy scenarios
 - map the suitability of sites for expansion or conversion
 - fine-tune policy targets, and support decisions with evidence
 - develop a spatial plan that balances the multiple objectives of forest landscapes
- This process also provides a common language and framework to engage with stakeholders which
 - brings stakeholders together to contribute to Park planning
 - ensures planning is informed by local knowledge, values and expectations
- Hypothetical forests can be modelled into the future to assess the effects of climate change (wetter/drier soils), wind risk, etc.

