

Reconstructing land use change using historical data

Lucy Ridding



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VALUING
NATURE
PROGRAMME



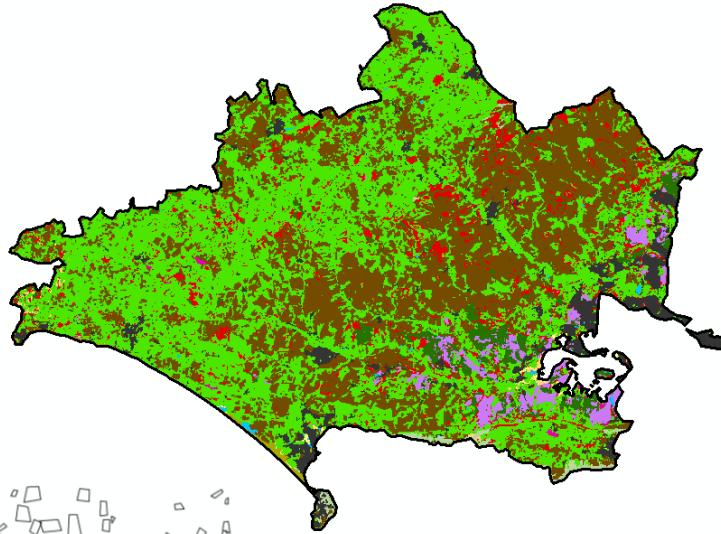
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Bournemouth
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NERC SCIENCE OF THE
ENVIRONMENT

Dorset, southern England



- Water
- Arable
- Neutral Grassland
- Calcareous Grassland
- Acid Grassland
- Fen, Marsh, Swamp
- Improved Grassland
- Heathland
- Coastal
- Urban
- Broadleaved Woodland
- Coniferous Woodland

Good (1930s)
Horsfall (1980s)



*Dorset Environmental
Records Centre*



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Biological Conservation

Changes in hedgerow floral diversity over 70 years in an English landscape, and the impacts of management

James T. Staley¹, James M. Bullock¹, Katherine C.B. Ballock¹, John W. J. Nick Barrow¹, Richard F. Pywell^{1,2}

Journal of Ecology

Taxonomic homogenization of woodland plant communities over 70 years

Sally A. Keen¹, Adrian C. Newton¹, Michael D. Morecroft¹, Clive F. Welton¹ and James M. Bullock¹

Journal of Ecology

Structure, composition and dynamics of a calcareous grassland metacommunity over a 70-year interval

Adrian C. Newton¹, Robin M. Watts¹, Duncan Gollister^{1,2}, Sally A. Keen¹, Anita Diaz¹

Summary

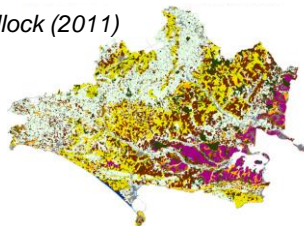
1. Calcareous grasslands are associations of high conservation value, often characterized by high rare species richness. These grasslands have experienced a major decline in area throughout

Changes in habitat overtime

Table 1
General statistics of habitat loss, fragment size and connectivity of seven semi-natural Broad Habitat Types in Dorset between the 1930s and 2000.

Broad habitat type	Woodlands		Mesotrophic grasslands				Calcareous grasslands				Acid grasslands		Heathlands	
	1930s	2000	Rough		Managed		Rough		Managed		1930s ^a	2000	1930s	2000
			1930s	2000	1930s	2000	1930s	2000	1930s	2000				
Period	1930s	2000	1930s	2000	1930s	2000	1930s	2000	1930s	2000	1930s ^a	2000	1930s	2000
<i>Habitat statistics</i>														
Total area (ha) ^b	20,872	25,358 ^d	9969	3012	90,192	0	3630	41,738	4552	4334	1705	5722	6004	
Area Loss (%) ^b	+25%		-67%		-100%		-43%		-89%		-61%		-50%	
Mean fragment size (ha) ^b	7.5	5.1	10.1	2.4	64.5		14.0	2.6	40.4	2.5	9.1	2.6	6.3	
Mean fragment size reduction (%) ^b			-75%				-83%		-94%		-77%		-76%	
Coefficient of Variation of fragment size ^b	4.4	4.1	2.7	1.1	7.1		2.6	1.2	3.4	1.6	2.7	1.7	3.1	
Connectivity – mean values														
Distance to 5 ha habitat (m) ^b	216	200	587	459	83		372	477	82	465	153	329	128	
Area within 1 km (ha) ^b	98	110	41	10	2302		59	11	813	13	78	23	500	
Area within 5 km (ha) ^b	811	1019	246	114	6805		456	122	3175	160	479	208	2402	
50% connectivity-distance (m) ^{b,c}	157	121	159	66	>750		177	72.1	375	66	157	71	708	

Hoofman and Bullock (2011)



57% loss of heathland and rough grassland between 1930 and 2000



Heathland decreased by 552 ha from 7925 ha between 1987 and 1996

Biological Conservation 93 (2000) 117-125

Changes on the heathlands in Dorset, England, between 1987 and 1996

R.J. Rose, N.R. Webb^a, R.T. Clarke, C.H. Traynor

Farbridge Research Station, NERC Institute of Terrestrial Ecology, Wareham, Dorset BH20 5AS, UK

Received 22 April 1998; accepted 4 March 1999

Abstract

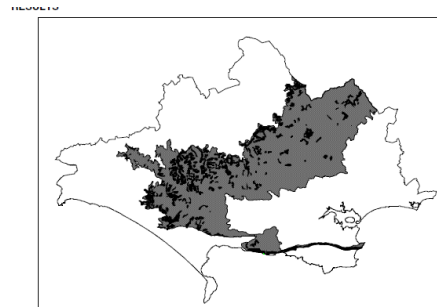
In 1996 all of the heathland in south-east Dorset, southern England, was surveyed using the same recording protocols as those used in surveys in 1978 and 1987. This approach enabled the extent of the heathlands, the degree of fragmentation, and the composition of the vegetation to be compared at a landscape scale over a period of 18 years. Between 1987 and 1996 the number of heathland patches increased from 142 to 151 and the total area of heathland decreased by 552 ha from 7925 ha in 1987. The prin-



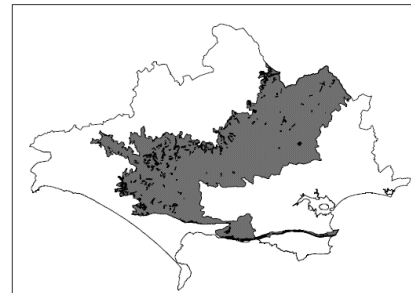
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Rose et al (2000)



MAP 1. Extent of downland and rough grazing in c. 1946



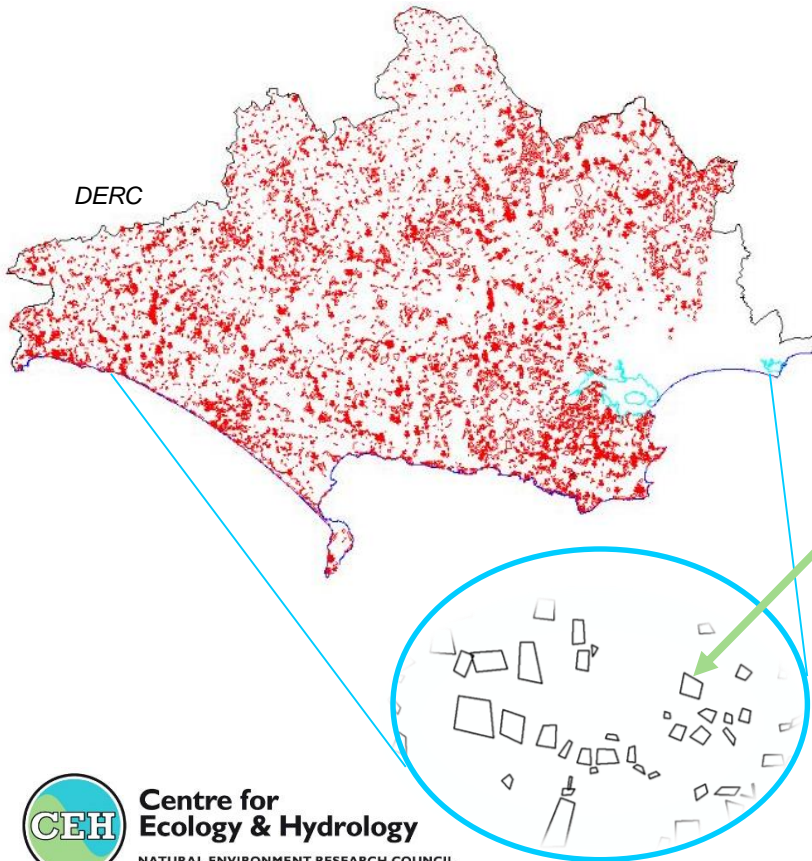
MAP 2. Extent of downland in 2005

Downland and rough pasture on Dorset Chalk 1946-2006

DERC for AONB



Trends in habitat types



Ronald Good

- Vascular plant survey 1931 to 1936
- 7575 sites
- “stand” method – distinct topographical and ecological entities
- Average of 5-6 strands per sq mile



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Creating a habitat time-series

N= 3784

1930 – Good survey

1950



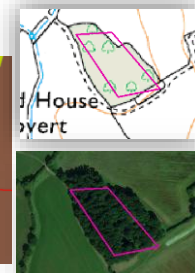
1980

Good No.	Habitat	Comments	Destroyed
G 0051	Heath		N
G 5556	Arable	Oil seed rape	Y
G 4601	Grassland	Improved cattle pasture	Y

1990



2015



Historic
Ordnance Survey
Maps
(OS Great Britain
1:25,000, 1937-1961)

Anne Horsfall's
Revisit of Good
sites

CEH Land Cover
Maps, Ordnance
Survey data, Aerial
photography



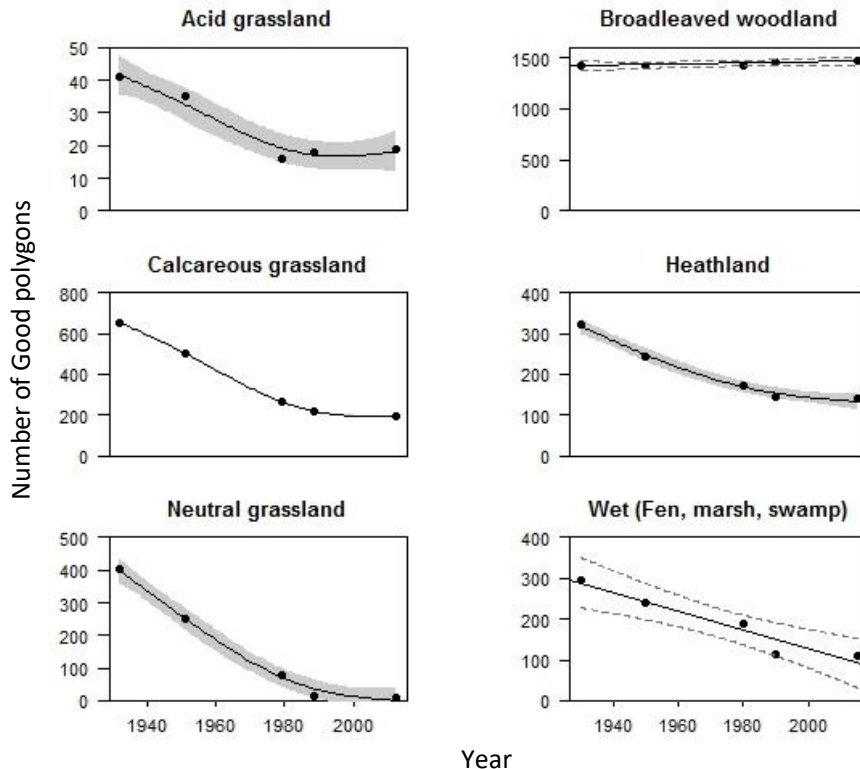
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Trends in habitat loss

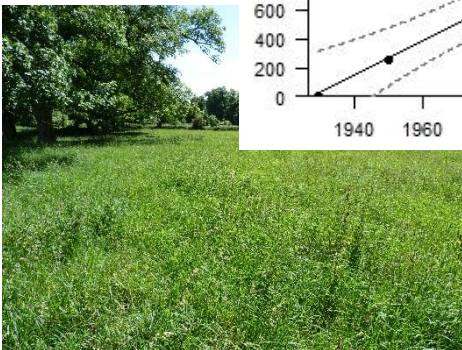
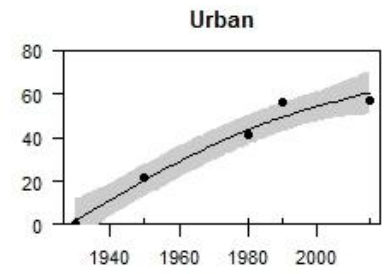
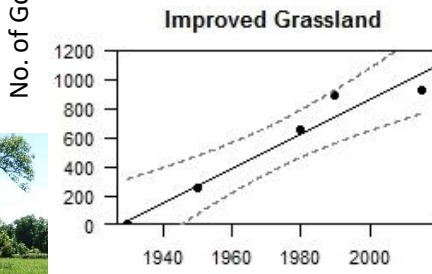
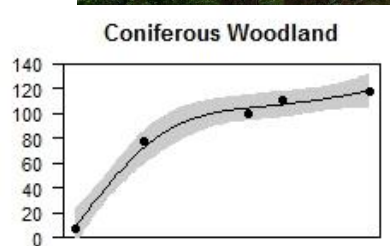
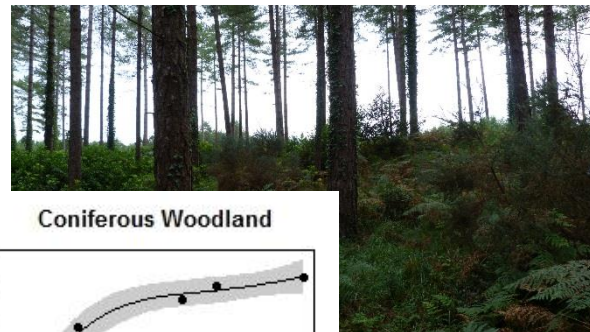
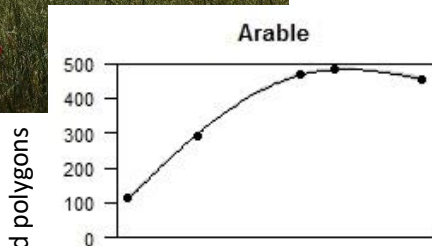


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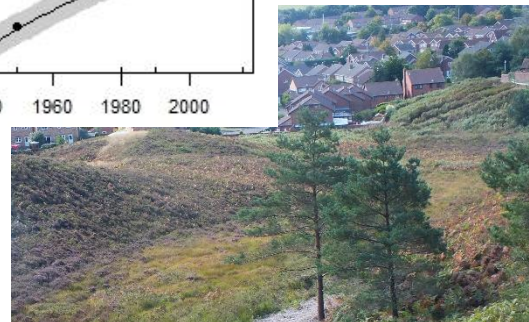
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Increases in land cover

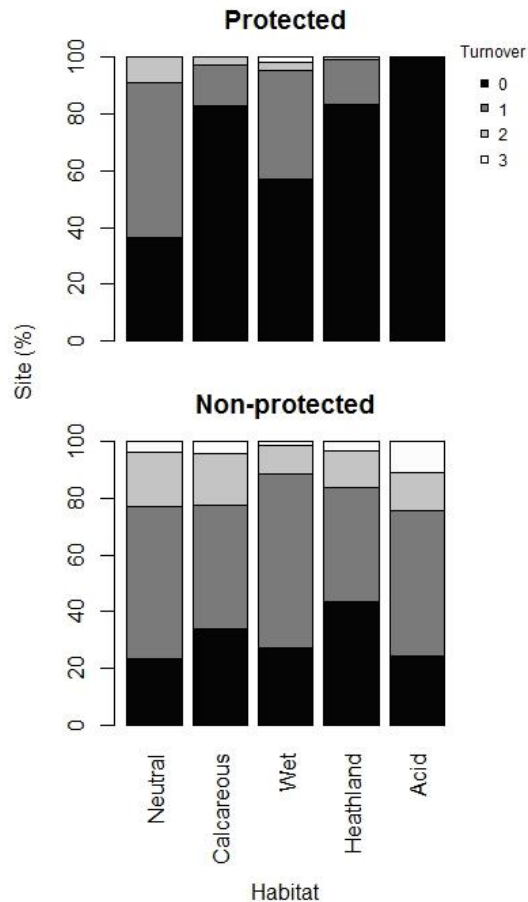


Year



Land cover change in protected sites

Sites of Special Scientific Interest (SSSI) - established in the 1950s to protect sites that are nationally important for their flora, fauna, or geological or physiographical features.

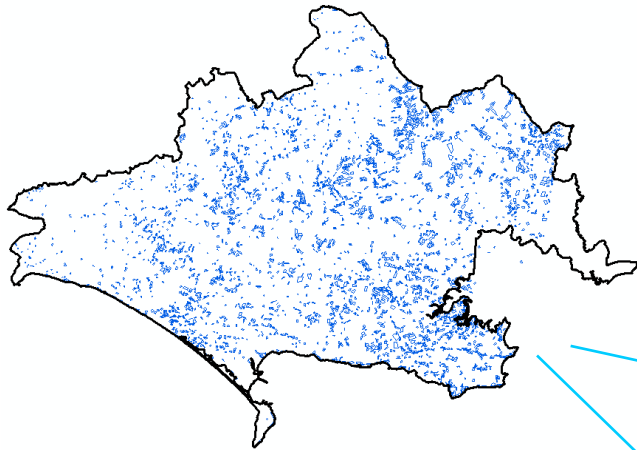


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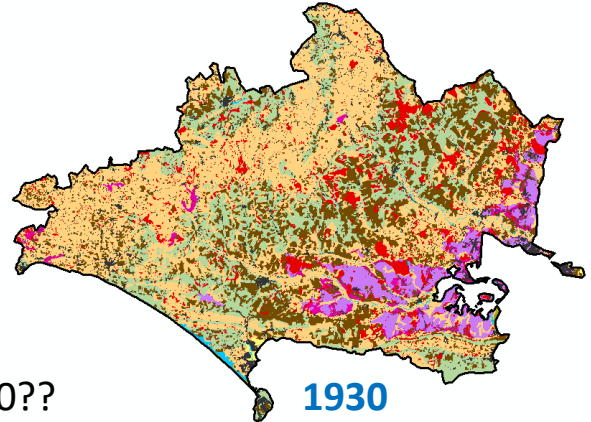
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Upscaling time-series data

Hooftman and Bullock (2011)



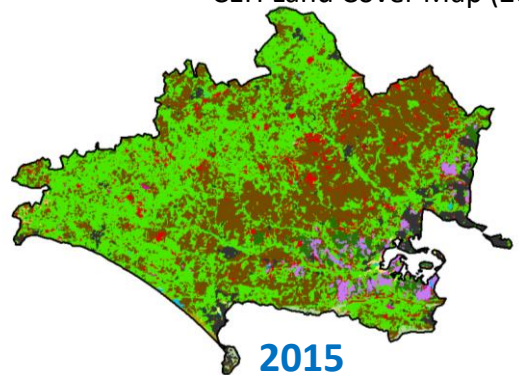
1950??



1980??



CEH Land Cover Map (2015)



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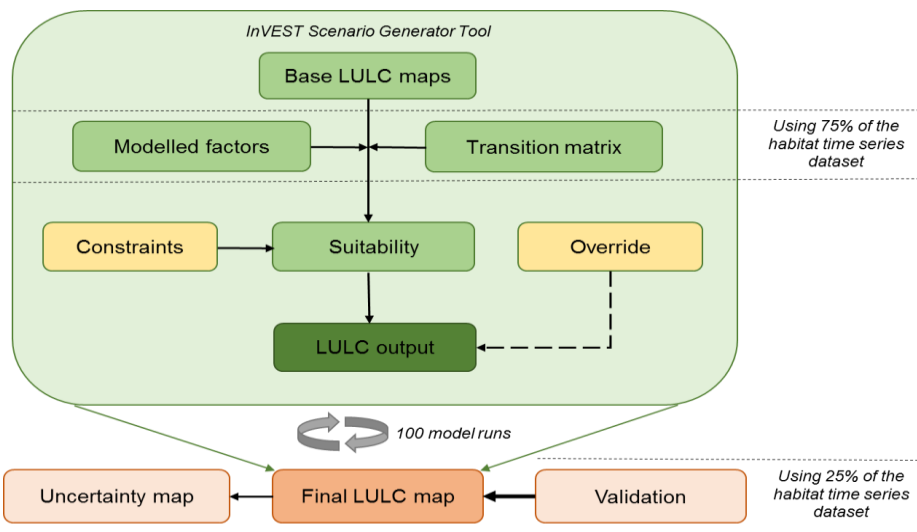
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Interpolating land cover maps

InVEST - a suite of free, open-source software models used to map and value the goods and services from nature



Scenario generator tool



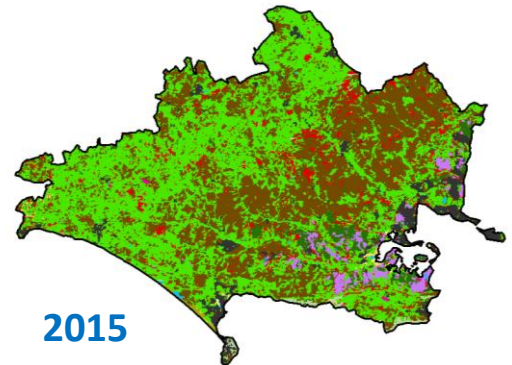
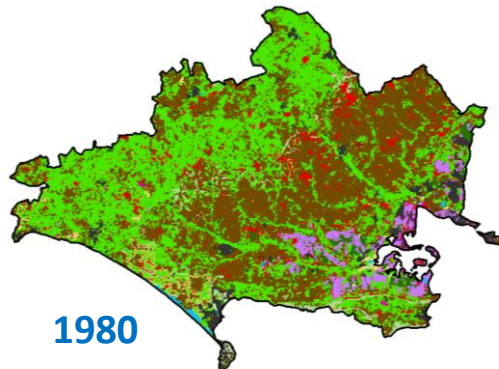
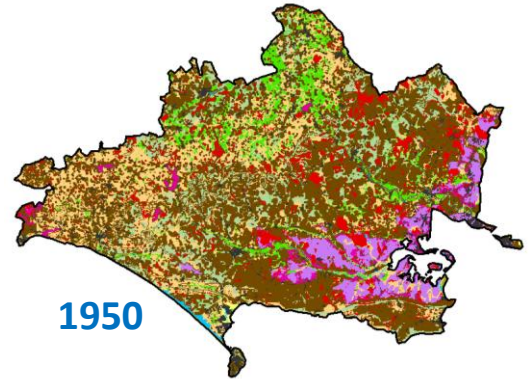
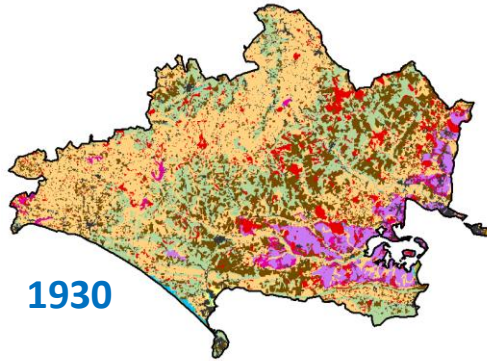
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Map time-series

100m x 100m

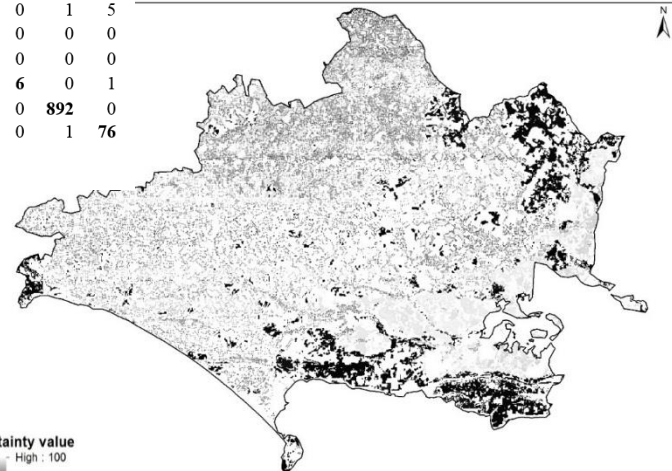


Assessing accuracy and uncertainty

1980 LULC from habitat time series

	Generated 1980 LULC map												
	Coastal	Arable	Fen, marsh, swamp	Acid grassland	Calcareous grassland	Improved grassland	Neutral grassland	Heathland	Other	Urban	Water	Broadleaved woodland	Coniferous woodland
Coastal	38	2	1	0	1	1	0	0	0	0	0	0	0
Arable	0	361	0	0	1	79	0	0	0	0	0	4	1
Fen, marsh, swamp	1	3	21	1	0	38	0	4	1	2	0	24	6
Acid grassland	0	1	0	2	0	4	0	1	0	0	0	0	0
Calcareous grassland	1	8	0	0	80	39	0	0	0	2	0	3	1
Improved grassland	0	53	0	1	4	522	1	1	0	0	0	3	0
Neutral grassland	2	8	0	0	0	42	5	1	0	0	0	4	0
Heathland	0	2	0	1	0	4	0	118	0	3	0	1	5
Other	0	0	0	0	0	0	0	0	0	0	0	0	0
Urban	0	0	0	0	0	1	0	0	0	10	0	0	0
Water	0	0	0	0	0	2	0	0	0	0	6	0	1
Broadleaved woodland	0	16	1	0	2	24	0	0	0	0	0	892	0
Coniferous woodland	0	0	0	0	1	3	0	0	0	0	0	1	76

The diagonal elements (bold) represent number of correctly classified sites



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Summary

- Considerable decline in semi-natural habitats across Dorset
- This trend was non-linear for the majority of semi-natural habitats
- Greatest losses occurred between 1950 and 1980, but still a number of sites lost in the last 25 years
- Importance of statutory protection
- Possible to create historical maps using past habitat data
- Generally good accuracy and levels of model certainty
- Number of uses – ecosystem services, fragmentation - restoration



Acknowledgements



TPAL - Mechanisms and Consequences of Tipping Points in Lowland Agricultural Landscapes



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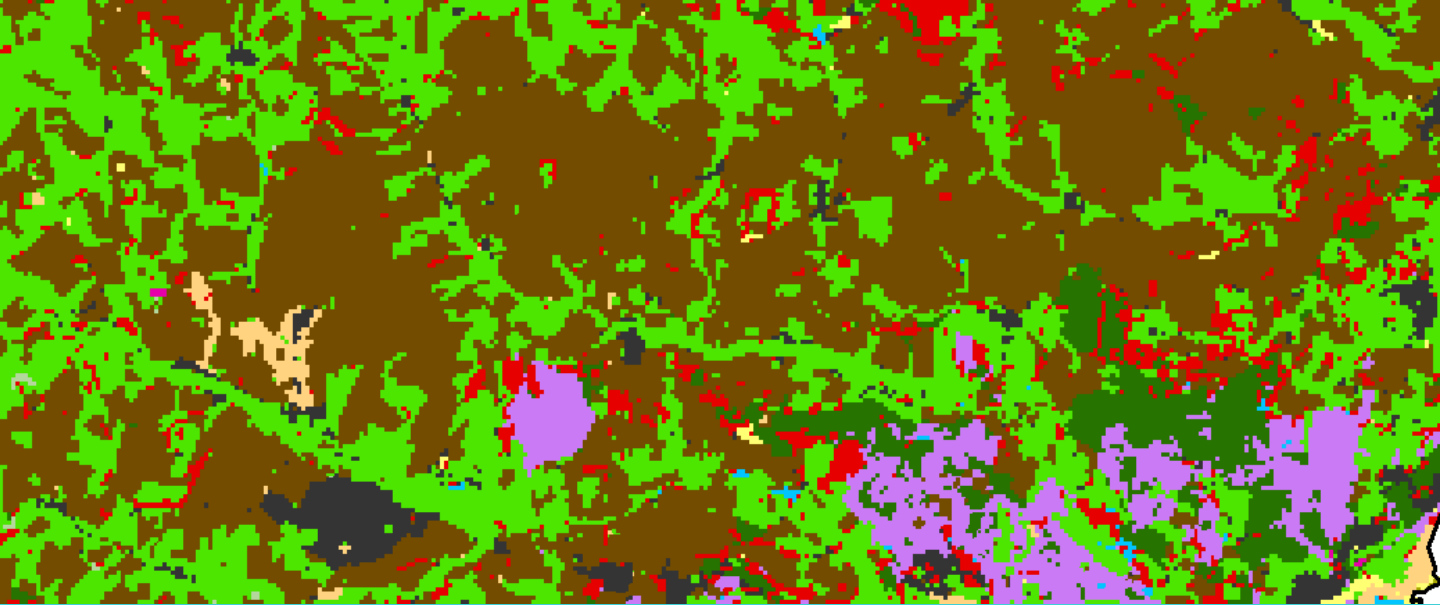
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Thank you

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