



MULTIFUNCTIONAL LANDSCAPES AND POLICY INSTRUMENTS

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BACKGROUND

Increasing concern over environmental impact of land use led to different policy approaches:

High proportion of conservation areas

- 15.4 % of terrestrial area Natura 2000 (BfN 2015)
- 45 % of marine area Natura 2000 (BfN 2015)

High amount of public spending

CAP Pillar 1 (2014-2020)

- 5 billion € yr⁻¹ for Germany (BMEL, 2014)

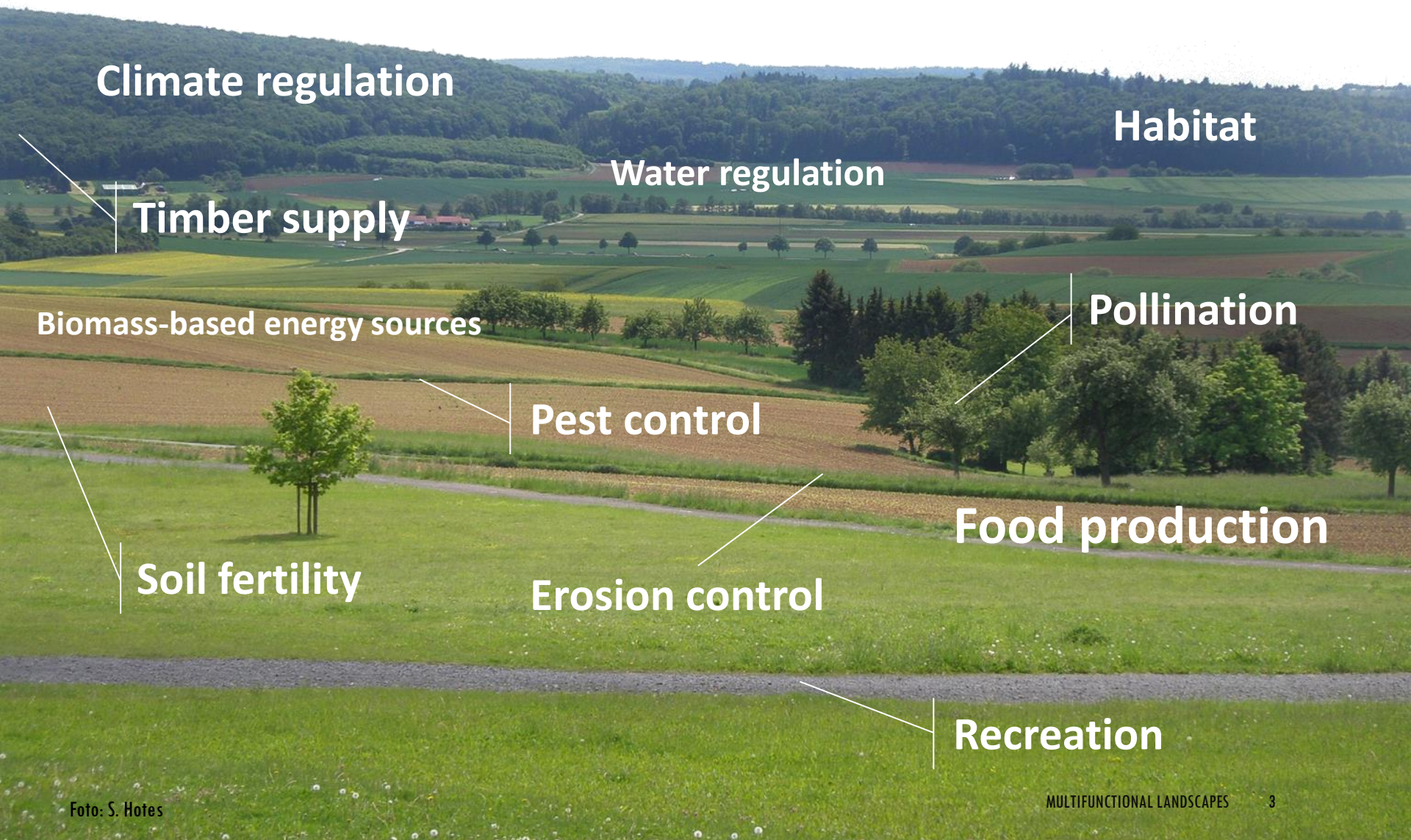
CAP Pillar 2 (2014-2020)

- 1.3 billion € yr⁻¹ for Germany (BMEL, 2014, 2014)

Effectiveness of current policy instruments is debated

- Focus on single environmental objective (Galler et al. 2015)
- Often not spatially targeted (Batary et al. 2015)

MULTIFUNCTIONAL LANDSCAPE



Climate regulation

Habitat

Water regulation

Timber supply

Pollination

Biomass-based energy sources

Pest control

Food production

Soil fertility

Erosion control

Recreation

MULTIFUNCTIONAL LANDSCAPE

Assessment of the relationship between ecosystem services and the implementation of policy instruments

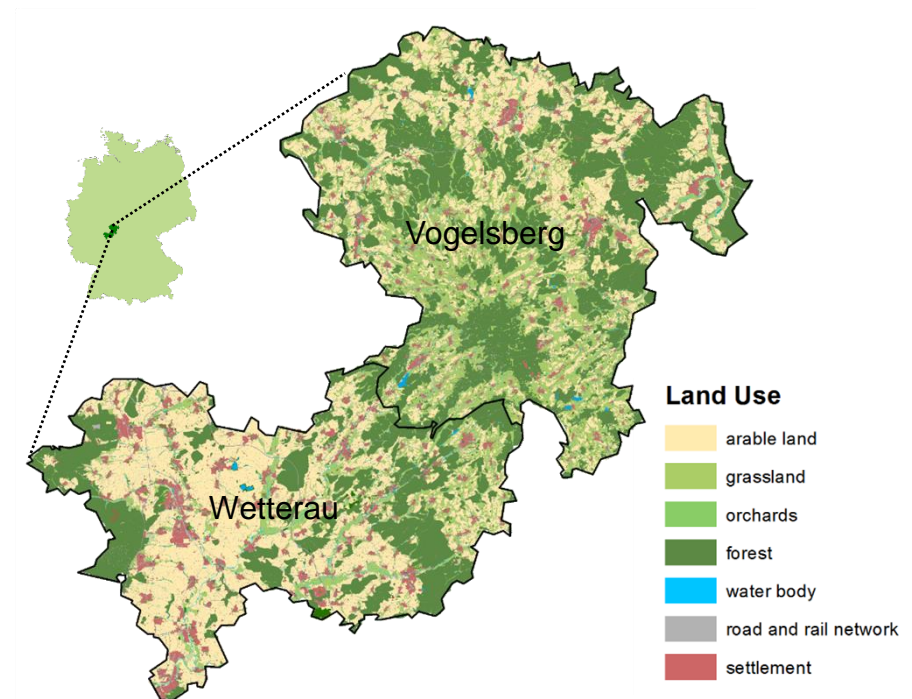
1. How are services distributed across the landscape and how do they interact?
2. Which policy instruments are aiming for sustaining ES provision and where are they implemented?



STUDY REGION

Assessment of ecosystem functioning in two typical **cultural landscapes** of Central Europe with contrasting biogeographic and socio-economic conditions:

- **Wetterau (Hesse)** – fertile soils promote intensive agriculture esp. crop production; several creeks and rivers within region;
- **Vogelsberg (Hesse)** – rural area affected by demographic changes (emigration); dominating land cover types are forests and grasslands; low population density;





1. How are services distributed across the landscape and how do they interact?
 - Spatially explicit assessment of multiple ecosystem services
 - Analysis of spatial patterns and interactions among ES

ASSESSMENT OF ES PROVISION

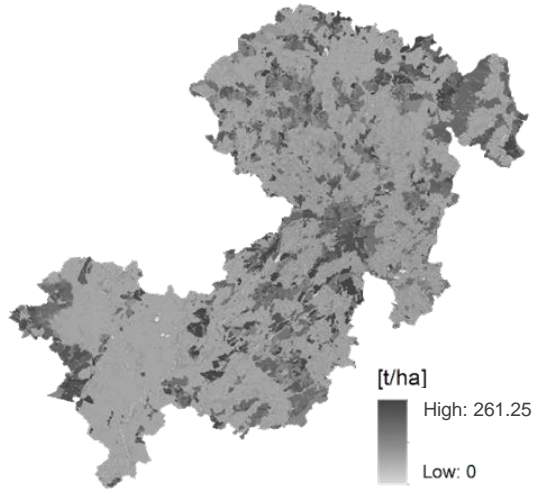


	Ecosystem service	Indicator	Description	Unit
Regulating	Global climate regulation	Carbon storage (Sharp et al., 2014)	C in aboveground biomass	[t/ha]
			C in belowground biomass	[t/ha]
			C stored in soil (30 cm below ground)	[t/ha]
	Water quality regulation	Erosion control (Sharp et al., 2014)	Sediment retained by permanent vegetation types	[kg/m ²]
Provisioning	Freshwater supply	Water yield (Sharp et al., 2014)	Surface water yield (Mean annual precipitation - mean annual evapotranspiration)	[mm]
	Provision of biomass	Timber supply (FENA, 2014)	Solid cubic meter of timber	[m ³ /ha]
	Food production	Crop production (Friedrich & Vorderbrügge, 2012)	Soil fertility of arable land	[m ²]
Cultural	Outdoor recreation	Recreational potential (Paracchini et al., 2014)	Degree of naturalness	[m ²]
			Protected areas	[m ²]
			Attractiveness of water	[m ²]

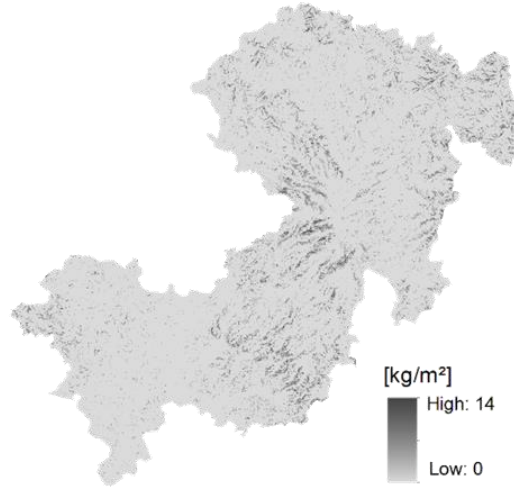
ASSESSMENT OF ES PROVISION



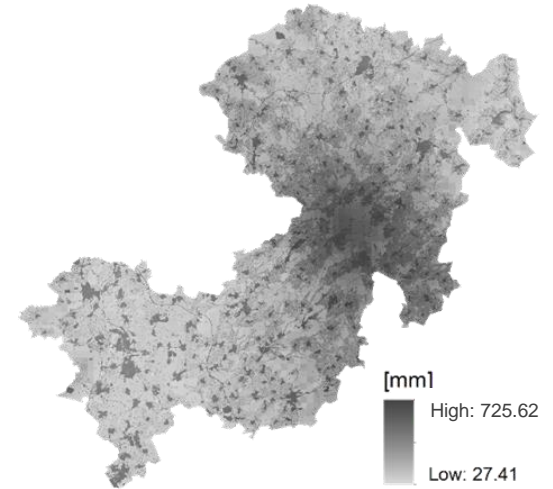
Carbon storage



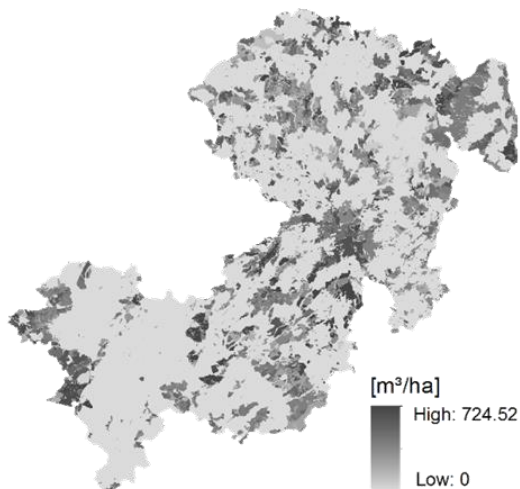
Erosion control



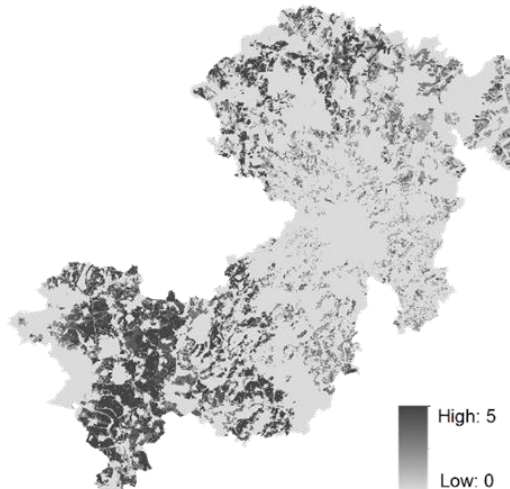
Water provision



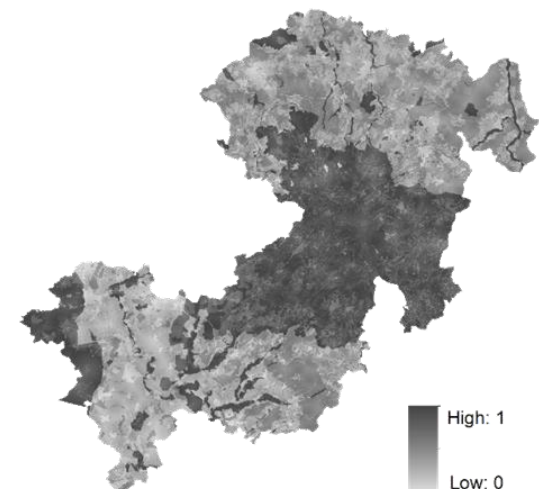
Timber production



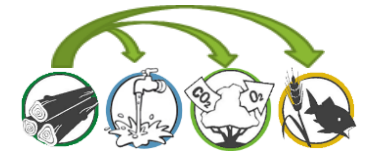
Food production



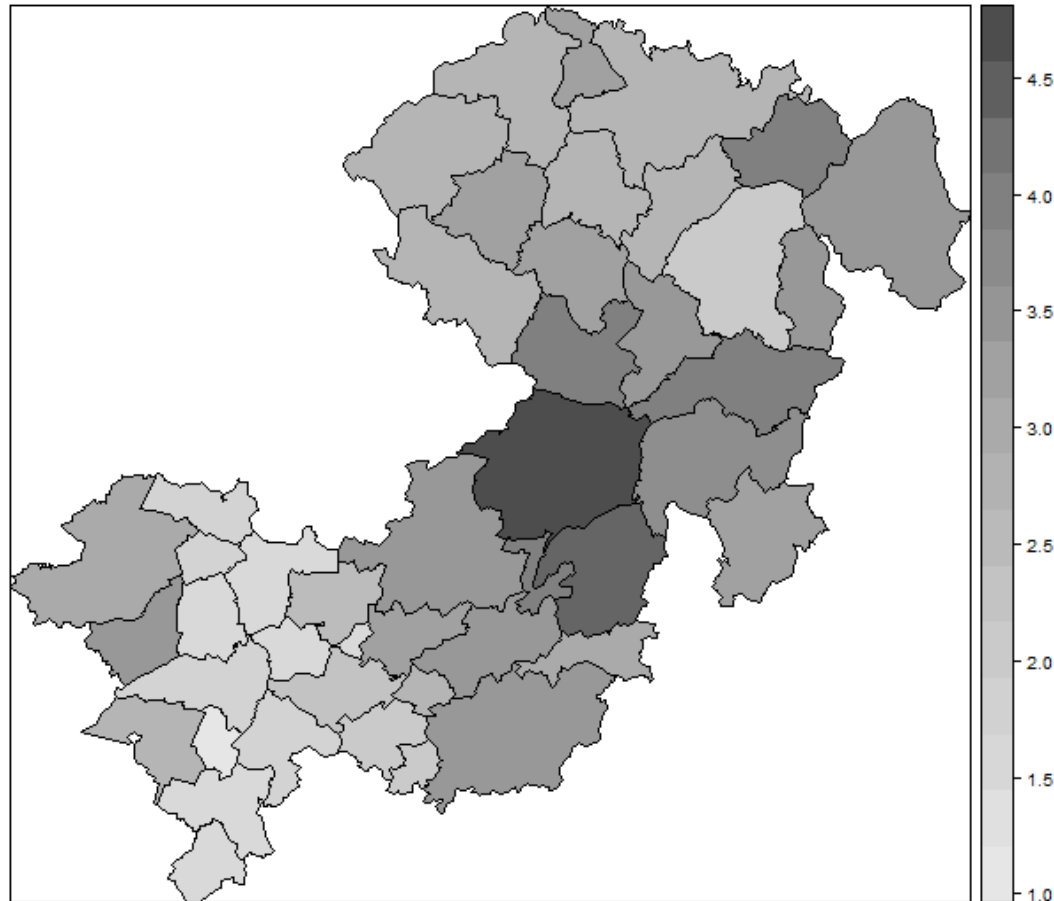
Recreational potential



TOTAL ES PROVISION



Total Ecosystem Service Value



Capacity to provide multiple services (see Maes et al., 2012)

- Regions with intensive agriculture; possible trade-off effects
- + Regions of high proportion of grassland, woodland and forest;



2. Which policy incentives are aiming for sustaining ES provision and where are they implemented?
 - Identification of policy incentives
 - Analysis of spatial concordance between multiple ES and policy incentives



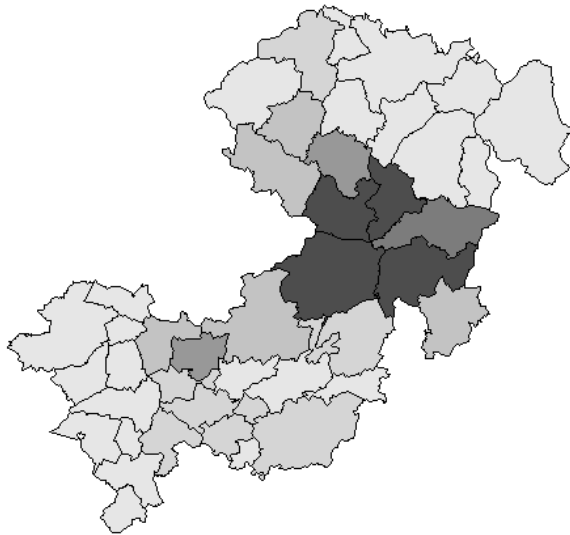
POLICY INSTRUMENTS

Type	Indicator per municipality	named objective i.a.	Reference
Biodiversity conservation	Proportion of Natura 2000 network	`sustainable management`	EEA, 2014
Organic agricultural production	Proportion of organic agricultural holdings	`environmental friendly agriculture`	Hessische Gemeindestatistik, 2015
Agri-envi. schemes	Payments for Agri-Environmental Schemes / total agricultural area	`provision of non-commodity outputs` `environmental friendly management practices`	BLE, 2015
CAP direct payments	Sum of direct payments / total agricultural area	`multifunctional agriculture`	BLE, 2015



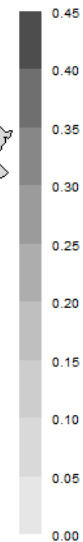
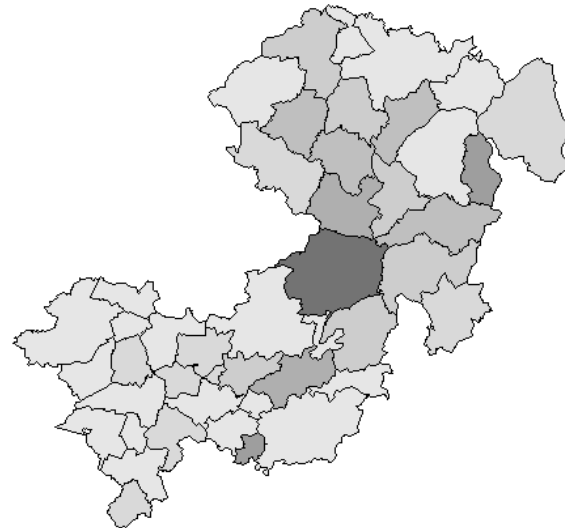
POLICY INSTRUMENTS

Proportion of Natura 2000



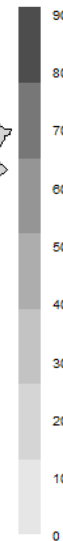
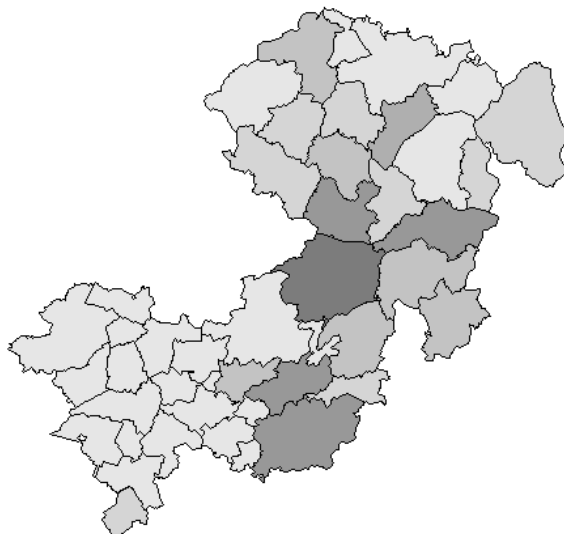
- Establishment especially in mountainous regions
- Proportions of protected areas up to 93 %

Proportion of organic farms



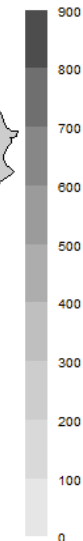
- No use of this management in some munic.
- Proportions of organic farms up to 45 %

Payments for AEM [€/ha]



- No use of this environmental market initiative in some munic.
- Payments up to 75 € ha⁻¹
- Overall sum: 2,81 Mio € (2014)

Direct payments [€/ha]



- Equal distribution across space
- Overall sum: 31.87 Mio € (2014)

POLICY INSTRUMENTS



Spatial correlation of Total Ecosystem Service Value and policy instruments Proportion of Natura 2000, Payments for AEM, Proportion of organic farming and Direct payments. All significant correlations are indicated by * (Modified t-test for spatial correlations, N = 44, $p < 0.05$).

	TESV	Proportion of Natura 2000	Payments for AEM	Proportion of organic farms	Direct payments
TESV	1				
Proportion of Natura 2000	0.44	1			
Payments for AEM	0.58 *	0.56 *	1		
Proportion of organic farms	0.43	0.45 *	0.70 *	1	
Direct payments	0.02	0.03	0.28	-0.28	1



2. Which policy incentives are aiming for sustaining ES provision and where are they implemented?

- Spatial concordance of:
 - TESS and Payments for AEM;
 - Proportion of Natura 2000, Payments for AEM & Proportion of organic farms;
- No spatial correlation of TESS and direct payments;

CONCLUSION

- Policy instruments (Natura 2000, organic farming and AEM) especially implemented in regions which provide higher levels of multiple ecosystem services
 - Current policy instruments support land sparing
 - Instruments to support economically underdeveloped region
- Need for a better targeting regime of policy instruments?
- „land sharing“ versus „land sparing“?



Thank you!

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