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First economic assessment of ecosystem services from Natura 2000 network in Lombardy (Northern Italy)

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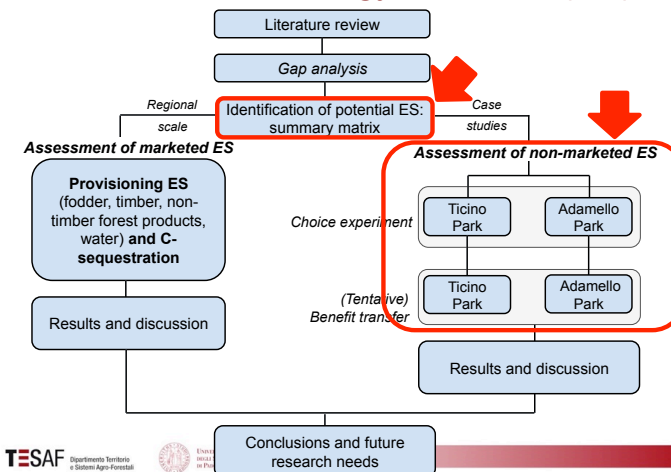
Presentation outline

- Introduction and research background
- Research methodology: overview
- Results
 - Main potential ecosystem services from Natura 2000 regional network
 - Choice experiments
 - Benefit transfer
- Conclusions

Introduction

- **Natura 2000 (N2000) and ecosystem services (ES)** → cornerstones of EU Biodiversity Strategy
- N2000 **management costs** expected to **increase** in the next years (Gantioler *et al.*, 2014)
- **Lack of quantitative and monetary data** for the potential socio-economic benefits associated to N2000 network (Harrison *et al.*, 2010; Gantioler *et al.*, 2014)
- No economic assessment of N2000 at regional scale in Italy, very few in EU countries (Gibson *et al.*, 2004; Chuan-Zhong *et al.*, 2004; Hoyos *et al.*, 2012)
- **Life+ GESTIRE Project, Action A5** → Defining and testing an approach for the assessment of the economic value of ES delivered by Natura 2000 network in Lombardy

Research methodology: overview (1/4)



Research methodology: overview (2/4)

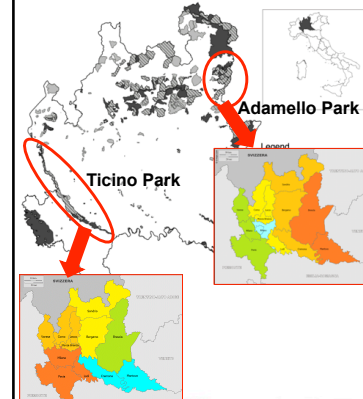
Identification of potential ES: summary matrix

Identification of the **3 main potential ES** for each N2000 site, i.e. habitat likely to deliver ES (1 low; 2 medium; 3 high), based on/adjusted through:

- habitat type(s) and extension (ha)
- previous studies and assessment exercises (Bastian *et al.* (2012), Schirpke *et al.* (2013) + Discussion with Experts)
- habitat state of conservation (from N2000 standard data forms)
- intrinsic heterogeneity and biodiversity (e.g. priority habitats)

Research methodology: overview (3/4)

Choice experiments



- **2 on-line questionnaires**, with different panels (**1,500 + 1,500**)
- preliminary **pilots** (30 + 30)
- target: residents, **18-65 years old**
- sample **stratification** according to socio-economic characteristics and distance from assessed areas (**5 zones**)
- different **interview-paths** for visitors and non-visitors
- **WTP for a 5 years new Regional Tax to improve quality of ES in the area(s)**
- **12 scenarios** x respondent (120 total choice sets)

Research methodology: overview (4/4)

Attributes and levels

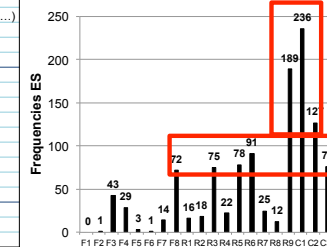
Adamello Park		Ticino Park	
Attributes (ES)	Levels	Attributes (ES)	Levels
Slope stability	10 km safe roads 20 km safe roads (+10) 35 km safe roads (+25) 45 km safe roads (+35)	Carbon sequestration	0% CO ₂ emission reduction 5% CO ₂ emission reduction (+5%) 10% CO ₂ emission reduction (+10%) 20% CO ₂ emission reduction (+20%)
Biodiversity (flora conservation)	0 ha managed meadows 200 ha managed meadows (+200) 250 ha managed meadows (+250) 300 ha managed meadows (+300)	Water quality	2 indicator species 3 indicator species (+1) 4 indicator species (+2)
Fauna	2 fauna sighting sites 5 fauna sighting sites (+3) 7 fauna sighting sites (+5) 10 fauna sighting sites (+8)	Biodiversity (flora conservation)	320 ha water meadows 400 ha water meadows (+80) 450 ha water meadows (+130)
Recreation	1 floristic trails 2 floristic trails (+1) 4 floristic trails (+3) 6 floristic trails (+5)	Aesthetic value (landscape)	0 scenic views with screened detractors 6 scenic views with screened detractors 8 scenic views with screened detractors 12 scenic views with screened detractors
Aesthetic value (landscape)	450 ha dry-stone walls in good state 453 ha dry-stone walls in good state (+3) 455 ha dry-stone walls in good state (+5)	Recreation	62 thematic trails 65 thematic trails (+3) 67 thematic trails (+5)
Regional Tax	Regional Tax (0, 2.5,10,15,20€)	Regional Tax	Regional Tax (0, 2.5,10,15,20€)

Baseline reported in italics

Results: A. Identification of potential ES

ES classification (Modified from CICES v.4.3)

F1	Crops
F2	Fodder
F3	Game/Fish
F4	Raw materials
F5	Edible non-limber (forest) products (mushrooms, fruits, herbs...)
F6	Medicinal plants
F7	Genetic resources
F8	Drinkable water
R1	Carbon sequestration
R2	Climate regulation (precipitations/temperature)/Air quality
R3	Water-cycle regulation (water table recharge)
R4	Water purification
R5	Protection against erosion
R6	Hydrogeological services (protection against floods...)
R7	Pollination
R8	Pest control
R9	Habitat for biodiversity
C1	Aesthetic value
C2	Tourism and recreation
C3	Cultural, spiritual and education value



Summary matrix (data available for all 242 N2000 regional sites):

#	Code	Site	Prov.	Type	Region	ES 1	ES 2	ES 3	ES 4	ES 5	ES 6	ES 7	ES 8	ES 9
1	IT2010018	MONTE SANGIANO	VA	pSCI	Alpine	C1	R9	C2						
2	IT2010019	MONTE DELLA VALCUVIA	VA	pSCI	Alpine	R9	R6	R5						
3	IT2010020	ITORGIERA DI CAVAGNANO	VA	pSCI	Cont.	R6	R9	C3						
4	IT2010021	SABBIE D'ORO	VA	pSCI	Cont.	F4	R3	R5	R8	C1	C3	F3	F7	F8
5	IT2010022	ALNETE DEL LAGO DI LAGO DI VA	VA	pSCI	Alpine	F4	R3	R5	R6	C1	C3	F3	F7	F8
6	IT2020010	LAGO DI SEGRINO	CO	pSCI	Alpine	C1	R7	R9						
7	IT2020011	SPINA VERDE	CO	pSCI	Cont.	R9	C1	C2						

Results: B. Choice experiments (overview)

Adamello Park:

Total respondents (n.): **1.502** (visitors: 60%, non-visitors: 40%)

Choice experiment performed by (n.): **1.461 (97%)**

Total observations (n.): **17.532** (= 1.461 x 12)

Ticino Park:

Total respondents (n.): **1.500** (visitors: 51%, non-visitors: 49%)

Choice experiment performed by (n.): **1.457 (97%)**

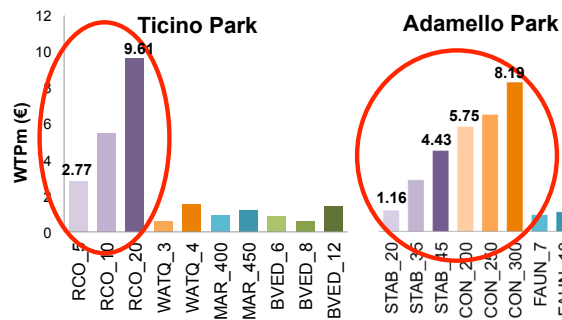
Total observations (n.): **17.484** (= 1.457 x 12)

MNL Models (e.g. Adamello Park)

Choice (see Table 1)	Coefficient	Std. Err.	z	95% Confidence Interval		WTP _m	Significance
COST	-0.108	0.002	-71.31	-0.111	-0.105		***
STAB_20	0.125	0.027	4.67	0.072	0.177	1.156	***
STAB_35	0.305	0.027	11.32	0.252	0.358	2.828	***
STAB_45	0.478	0.026	18.54	0.428	0.529	4.433	***
CON_200	0.621	0.028	22.21	0.566	0.676	5.751	***
CON_250	0.693	0.029	24.30	0.637	0.748	6.417	***
CON_300	0.884	0.027	33.31	0.832	0.936	8.193	***
FAUN_5	0.015	0.028	0.54	-0.039	0.069	0.137	
FAUN_7	0.098	0.027	3.66	0.046	0.151	0.912	***
FAUN_10	0.116	0.026	4.48	0.065	0.166	1.071	***
FLOR_2	0.118	0.027	4.33	0.065	0.171	1.093	***
FLOR_4	0.082	0.027	3.00	0.028	0.135	0.758	***
FLOR_6	0.201	0.026	8.12	0.158	0.258	1.925	***
SEC_453	0.001	0.022	0.04	-0.042	0.044	0.009	
SEC_455	0.001	0.022	0.43	-0.033	0.052	0.087	

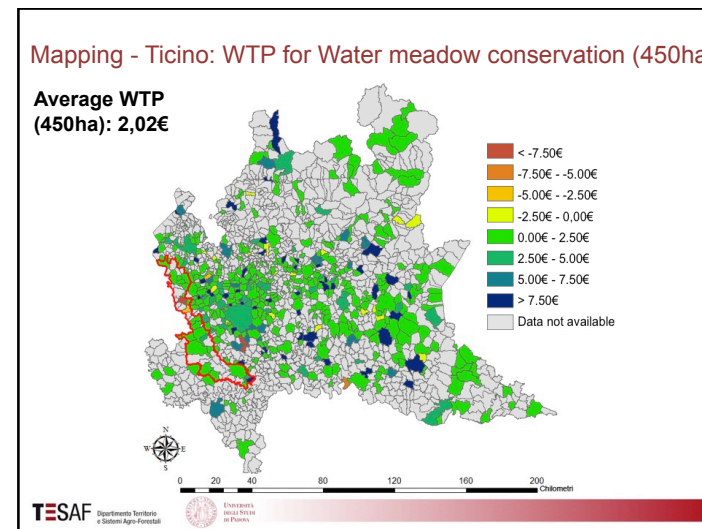
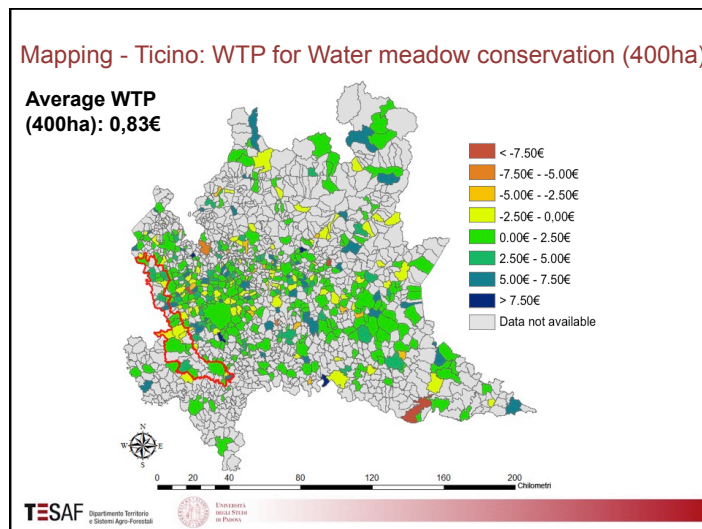
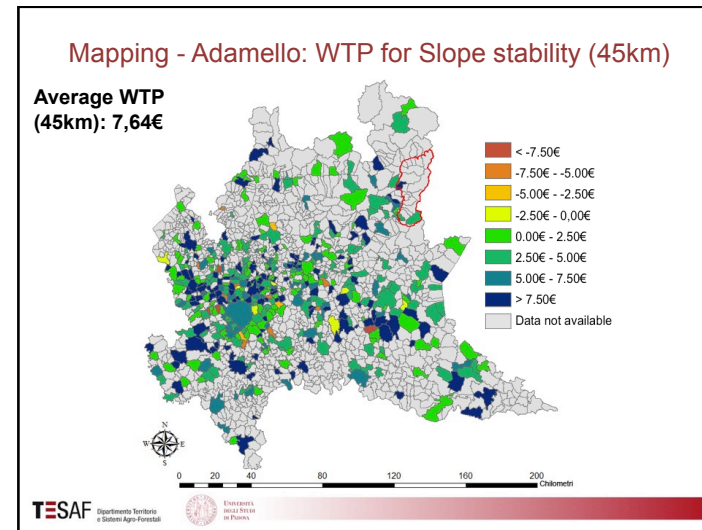
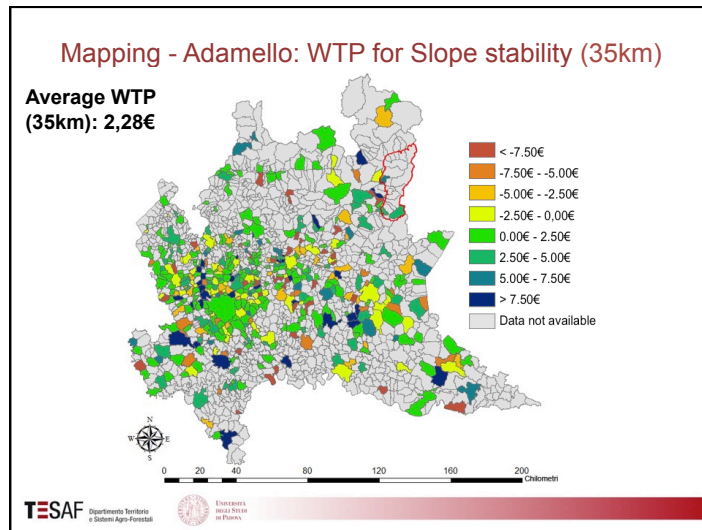
Note: ***, **, * = 99%, 95%, 90% significance

MNL Models: marginal WTP values



Latent Class Models (e.g. Adamello Park)

Choice	Class 1		Class 2		Class 3		Class 4		Class 5		Class 6		Class 7		Class 8	
	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z	Coeff.	z
COST	-1.20	-9.45	-0.22	-15.91	-0.01	-1.80	-0.05	-5.97	-0.37	-6.35	-0.09	-8.11	0.14	7.04	-0.03	-1.91
STAB_20	-0.18	-0.82	-0.02	-0.22	0.10	1.51	0.11	1.02	0.78	2.28	-0.17	-1.39	0.15	0.77	2.25	2.91
STAB_35	0.57	3.07	0.13	1.28	-0.14	-1.78	0.30	2.52	1.45	2.67	-0.57	-3.18	0.06	0.28	3.28	4.86
STAB_45	0.96	5.29	0.65	6.76	0.08	0.95	0.88	6.47	1.48	4.05	0.47	2.64	0.76	4.02	4.68	5.98
CON_200	0.69	2.88	0.33	3.17	-0.01	-0.19	2.33	8.44	5.56	4.10	-0.27	-1.25	0.37	1.66	1.39	4.85
CON_250	0.72	4.02	0.46	4.17	0.06	0.86	2.87	0.20	6.01	4.15	-0.53	-2.91	0.44	2.19	1.10	3.15
CON_300	0.69	4.16	0.82	7.75	0.20	2.50	3.83	2.56	6.86	4.62	1.19	8.37	0.88	4.49	1.88	6.28
FAUN_5	-0.13	-0.68	0.16	1.63	0.03	0.42	0.39	3.18	0.34	0.95	-0.42	-3.06	0.10	0.56	0.30	1.11
FAUN_7	0.48	2.49	0.44	4.63	0.11	1.41	0.28	2.17	0.09	0.32	-0.21	-1.33	-0.06	-0.36	0.29	1.06
FAUN_10	0.40	2.09	0.41	4.42	0.06	0.75	0.58	4.59	0.47	1.60	0.34	1.95	0.11	0.55	0.27	1.08
FLOR_2	0.06	0.23	0.10	1.18	0.11	1.50	0.39	3.72	0.28	1.12	-0.19	-1.39	-0.11	-0.60	-0.41	-1.35
FLOR_4	0.02	0.10	0.37	4.14	0.13	1.85	0.50	4.60	0.28	1.28	-0.66	-4.50	0.05	0.24	-0.36	-0.75
FLOR_6	0.61	3.18	0.47	5.49	0.32	4.13	0.87	8.06	0.41	1.54	-0.19	-1.22	0.42	2.17	-0.22	-0.43
SEC_453	-0.04	-0.26	-0.27	-3.67	-0.10	-1.75	-0.08	-0.84	0.10	0.45	0.30	2.02	0.00	-0.01	0.07	0.24
SEC_455	-0.03	-0.16	-0.06	-0.74	0.04	0.72	-0.07	-0.80	0.32	1.53	0.58	4.14	-0.01	-0.06	-0.10	-0.44
Log-likelihood	-11.847.08															
Size	26.64		21.33		15.97		12.07		8.60		8.59		3.54		3.26	



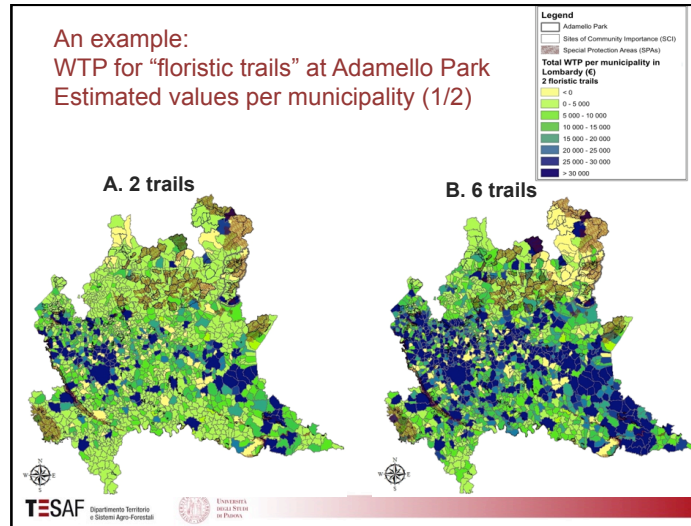
Results: C. Benefit transfer (BT)

$WTP_i = f(\text{individual socio-economic var., municipal socio-economic var., geographic and territorial variables})$

Multiple regressions based on:

- 13 individual socio-economic variables: age, gender, education, income, membership of associations, ...
- 28 municipal socio-economic variables: population, household size, employed/economic sector, ...
- 14 geographic and territorial variables: log-distance from parks and other substitute sites, ...

An example:
WTP for "floristic trails" at Adamello Park
Estimated values per municipality (1/2)



An example:
WTP for "floristic trails" at Adamello Park
Estimated values per municipality (2/2)

Total WTP (€)	2 trails		4 trails		6 trails	
	Municipalities (N)	% on Total	Municipalities (N)	% on Total	Municipalities (N)	% on Total
< 0	81	5,2	110	7,1	89	5,8
0 – 5.000	863	55,9	748	48,4	383	24,8
5.001 – 10.000	277	17,9	311	20,1	271	17,6
10.001 – 15.000	118	7,6	138	8,9	177	11,5
15.001 – 20.000	50	3,2	68	4,4	137	8,9
20.001 – 25.000	24	1,6	27	1,7	89	5,8
25.001 – 30.000	12	0,8	17	1,1	73	4,7
> 30.000	119	7,7	125	8,1	325	21,0
Total	1.544	100,0	1.544	100,0	1.544	100,0

Conclusions

- First tentative study at regional scale in Italy
- Definition of a **methodological approach** that needs to be further developed (e.g. spatial econometrics for BT, socio-economic variables for BT better refined)
- Focus on **protected areas** rather than N2000 (70-75% of respondents do not know N2000)
- **Systematic data collection:** monitoring and accounting for N2000 costs/benefits at regional scale
- Environmental norms included within the **2015 Italian Budget Law** (PES, accounting...)
- Informative basis for developing future policies as well as supporting decision-making by relevant players