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A socioeconomic profile of vulnerable land to desertification in Italy

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HIGHLIGHTS

- Based on indicators, a socioeconomic profile of vulnerable land to desertification was developed for Italy.
- Four groups of indicators discriminating between vulnerable and non-vulnerable areas were identified.
- A contrasting profile was found for vulnerable lands in northern and southern Italy with policy implications.
- Results pointed out the changing geography of vulnerable land and socioeconomic contexts at the local scale.

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ABSTRACT

Climate changes, soil vulnerability, loss in biodiversity, and growing human pressure are threatening Mediterranean-type ecosystems which are increasingly considered as a desertification hotspot. In this region, land vulnerability to desertification strongly depends on the interplay between natural and anthropogenic factors. The present study proposes a multivariate exploratory analysis of the relationship between the spatial distribution of land vulnerability to desertification and the socioeconomic contexts found in three geographical divisions of Italy (north, center and south) based on statistical indicators. A total of 111 indicators describing different themes (demography, human settlements, labor market and human capital, rural development, income and wealth) were used to discriminate vulnerable from non-vulnerable areas. The resulting socioeconomic profile of vulnerable areas in northern and southern Italy diverged significantly, the importance of demographic and economic indicators being higher in southern Italy than in northern Italy. On the contrary, human settlement indicators were found more important to discriminate vulnerable and non-vulnerable areas in northern Italy, suggesting a role for peri-urbanization in shaping the future vulnerable areas. An in-depth knowledge of the socioeconomic characteristics of vulnerable land may contribute to scenarios' modeling and the development of more effective policies to combat desertification.

1. Introduction

Accelerated ecosystem transformations at the global scale have been identified as one of the major environmental problems in the last century (Millennium Ecosystem Assessment, 2005). Severe land degradation processes, possibly leading to irreversible phenomena of desertification, are impacting developed regions and emerging economies where climate aridity, poor soil quality, and restricted vegetation cover are constraints to agricultural production, natural vegetation, and human well-beings (Mouat and Hutchinson, 1996; Middleton and Thomas, 1997; Conacher and Sala, 1998; Geist, 2005) raising increasing concern at the continental and country level (Steffen, 2004). Desertification, however, cannot be convincingly explained as a phenomenon depending on changes in biophysical factors only, since it rarely occurs without human activities influenced by global, regional, and local socioeconomic drivers (Safriel and Adeel, 2008).

The concept of 'desertification' has experienced a constant evolution since the 1980s (Gisladottir and Stocking, 2005). This concept has led through a transition towards definitions centered on the interaction between human factors and the ecosystem, to achieve a focus that embraces all phenomena of "land degradation in arid, semi-arid and dry sub-humid areas, resulting from various factors, including climatic variations and human activities", as clearly stated by United Nations Convention to Combat Drought and Desertification (UNCCD).

Land vulnerability to desertification depends on the interplay between natural (e.g. climate aridity, drought, soil degradation, poor vegetation cover) and human-derived factors (e.g. overgrazing, forest fires, landscape fragmentation, soil pollution, urbanization). The role of anthropogenic factors as key drivers of land degradation has been increasingly studied depending on the natural resource endowments (Wilson and Juntti, 2005). Underdevelopment, rural poverty and increasing human pressure in ecologically fragile areas have been hypothesized to be decisive to exacerbate the environmental conditions

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Table 1
The list of socioeconomic indicators used in the present study.

Acronym	Name	Dimension	Source	Year
Demography and territorial characteristics				
I1	% urban areas	Human settlements	Corine Land Cover	2000
I2	% dispersed urban settlements on total urban areas	Human settlements	Corine Land Cover	2000
I3	% population residing in compact urban centers	Human settlements	Census of population	2001
I4	Total municipality footprint (km^{-2})	Human settlements	Censuses of population, agriculture and industry	2001
I5	% non-occupied houses	Human settlements	Census of population	2001
I6	Average house size (m^2) per inhabitant	Human settlements	Census of population	2001
P1	Average family size	Population structure	Census of population	2001
P2	Population > 80 years/births	Population structure	Census of population, population register	2001
P3	% population > 75 years	Population structure	Census of population	2001
P4	Elderly index	Population structure	Census of population	2001
P5	Dependency ratio	Population structure	Census of population	2001
P6	Number of resident foreign people per 100 inhabitants	Population structure	Census of population	2001
P7	Masculinity ratio	Population structure	Census of population	2001
Labor and human capital				
L1	Activity rate	Job market	Census of population	2001
L2	Occupancy rate	Job market	Census of population	2001
L3	Unemployment rate	Job market	Census of population	2001
L4	Unemployment rate of young people (<35 years)	Job market	Census of population	2001
L5	Female activity rate	Job market	Census of population	2001
L6	Female occupancy rate	Job market	Census of population	2001
L7	Female unemployment rate	Job market	Census of population	2001
L8	Unemployment rate of young women (<35 years)	Job market	Census of population	2001
L9	% employees on total workers	Job market	Census of Industry and Services	2001
L10	% women workers on total workers	Job market	Census of Industry and Services	2001
L11	% consultants on total workers	Job market	Census of Industry and Services	2001
L12	% temporary workers on total workers	Job market	Census of Industry and Services	2001
L13	% voluntaries on total workers	Job market	Census of Industry and Services	2001
L14	% temporary workers on consultants	Job market	Census of Industry and Services	2001
F1	% population with tertiary education	Educational level	Census of population	2001
F2	% population graduated in high-school	Educational level	Census of population	2001
F3	% population with secondary education	Educational level	Census of population	2001
F4	% population with primary education	Educational level	Census of population	2001
F5	% literate population without formal education degree	Educational level	Census of population	2001
F6	% illiterate population	Educational level	Census of population	2001
Economic specialization and competitiveness				
S1	Average number of workers per industrial local unit	Productive structure	Census of Industry and Services	2001
S2	Density of workers per municipality surface area (km^2)	Productive structure	Census of Industry and Services	2001
S3	% workers in the agricultural and forestry sectors	Productive structure	Census of Industry and Services	2001
S4	% workers in fishing and complementary activities	Productive structure	Census of Industry and Services	2001
S5	% workers in mining industry	Productive structure	Census of Industry and Services	2001
S6	% workers in manufacturing industry	Productive structure	Census of Industry and Services	2001
S7	% workers in energy production and distribution industry	Productive structure	Census of Industry and Services	2001
S8	% workers in construction industry	Productive structure	Census of Industry and Services	2001
S9	% workers in commerce sector	Productive structure	Census of Industry and Services	2001
S10	% workers in hotel and restaurant services	Productive structure	Census of Industry and Services	2001
S11	% workers in transportation and logistics services	Productive structure	Census of Industry and Services	2001
S12	% workers in financial, insurance and banking services	Productive structure	Census of Industry and Services	2001
S13	% workers in informatic jobs, renting and real estate services	Productive structure	Census of Industry and Services	2001
S14	% workers in the public sector	Productive structure	Census of Industry and Services	2001
S15	% workers in education services	Productive structure	Census of Industry and Services	2001
S16	% workers in health sector	Productive structure	Census of Industry and Services	2001
S17	% workers in other social services	Productive structure	Census of Industry and Services	2001
T1	Number of beds in hotels and campings/resident population	Tourism specialization	Census of Industry and Services	2001
T2	Average number of beds per hotel	Tourism specialization	Census of Industry and Services	2001
T3	Hotel occupancy level (five-years average)	Tourism specialization	ISTAT (2006)	2001
T4	Camping occupancy level (five-years average)	Tourism specialization	ISTAT (2006)	2001
T5	Agri-tourism occupancy level (five-years average)	Tourism specialization	ISTAT (2006)	2001
T6	Number of beds in agri-tourism accomodation/beds in hotel	Tourism specialization	ISTAT (2006)	2001
T7	Resident population/total number of stores	Tourism specialization	ISTAT (2006)	2000
Quality of life				
Q1	% subscriptions on state radio-television channels	Living standards	Banca d'Italia and Istituto Tagliacarne	1999
Q2	Number of cars/inhabitants	Living standards	Banca d'Italia and Istituto Tagliacarne	1999
Q3	Number of deposits/banks	Living standards	Banca d'Italia and Istituto Tagliacarne	1999
Q4	Number of deposits/inhabitants	Living standards	Banca d'Italia and Istituto Tagliacarne	1999
Q5	Value of bank deposits/banks (euros)	Living standards	Banca d'Italia and Istituto Tagliacarne	1999
Q6	Average value of bank deposits (euros)	Living standards	Banca d'Italia and Istituto Tagliacarne	1999
Q7	Value of bank deposits/inhabitants (euros)	Living standards	Banca d'Italia and Istituto Tagliacarne	1999
Q8	Per capita income tax amount (euros)	Living standards	Istituto Tagliacarne	1998
Q9	Per capita real estate tax amount (euros)	Living standards	Istituto Tagliacarne	1998
Q10	Per capita municipal solid waste tax amount (euros)	Living standards	Istituto Tagliacarne	1998
Q11	Disposable income (euros)/inhabitants	Living standards	Istituto Tagliacarne	2000
Q12	Consumption (euros)/inhabitants	Living standards	Istituto Tagliacarne	2000