

# THE RECONSTITUTION:



# ENVIRONMENTAL RESTORATION ASSESSMENT BY MEANS OF LCC AND FCC

MANFREDI PAOLO<sup>1</sup>, CASSINARI CHIARA<sup>2</sup>, TREVISAN MARCO<sup>2</sup>

<sup>1</sup>M.C.M. ECOSISTEMI S.R.L., GARIGA DI PODENZANO, PIACENZA, ITALIA

<sup>2</sup>FACOLTÀ DI SCIENZE AGRARIE, ALIMENTARI E AMBIENTALI, DIPARTIMENTO DI SCIENZE E TECNOLOGIE ALIMENTARI PER UNA FILIERA AGRO-AMBIENTALE SOSTENIBILE - DISTAS, Università Cattolica del Sacro Cuore, Piacenza, Italia

RECONSTITUTION IS A PEDOTECHNIQUE PRODUCING ENVIRONMENTAL PROPER AND FERTILE TECHNOSOLS APPLYING CHEMICAL-MECHANICAL TREATMENT TO ALLUVIAL SEDIMENTS, DEGRADED SOILS AND PEDOMATERIALS INCLUDED WASTE BY DIFFERENT PRODUCTIVE **PROCESSES.** 

BY THE MEANS OF RECONSTITUTION THE ENVIRONMENTAL RESTORATION OF COVERING DEGRADED SOIL OF A CLOSED LANDFILL NEAR

PIACENZA IS MADE.



LCC IS USED TO CLASSIFY LANDS; THE LIMITATION MADE UP BY LOW PRODUCTIVITY, DUE TO SOIL CHEMICAL FERTILITY (PH, C.E.C., ORGANIC MATTER, SALINITY, DEGREE OF SATURATION) IS RELATED TO MORPHOLOGY, CLIMATE AND VEGETATION OF THE AREA WHERE SOIL IS.

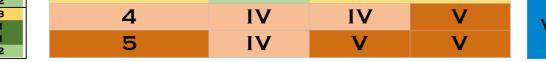
FCC IS USED TO EVALUATE SOIL FERTILITY, NOT IN RELATION TO MORPHOLOGY OR EVOLUTION, BUT ON THE BASES OF PHYSICO-CHEMICAL PROPERTIES OF THE 0-20 CM SOIL LAYER. ON THE BASIS OF PH, ORGANIC MATTER, TOTAL CACO<sub>3</sub>, EXCHANGEABLE  $K_2O$ ,  $P_2O_5$  A MODIFICATION OF FCC IS USED TO CALCULATE AN INDICATOR OF GLOBAL SOIL FERTILITY.

											СНЕМ		FERTI	LITY								
					K₂O MG KG⁻¹		<80			80-100	b		101-12	0		121-16	60		>160	<b>)</b>		
					PH.	<5	5.0-6.5		<5	5.0-6.5		<5	5.0-6.5		<5	5.0-6.5		<5	5.0-6.5		FCC CLASS	ES
						0 >8.5	0 7.9-8.5	6.6-7.8	0	1	6.6-7.8	0 >8.5		6.6-7.8		0	6.6-7.8	0	0 7.9-8.5	6.6-7.8		FE
	INTRINSEC	FERTILITY			P <sub>2</sub> O <sub>5</sub>																CHEMICAL	II
_	Ν	CLASS			MG KG <sup>-1</sup> ∖						_										FERTILITY	
	1 1	CLASS			<23 23-30	5	5 4	4	5	4	4	4	3	3	4	3	3	4	3	3	_	
	< 2	С		SAND>60 %	31-34	4	3	3	3	2	2	3	2	1	3	2	1	3	2	1	1	
- 1		B	шk		>34	3	3	3	3	2	2	3	2	2	3	2	2	2	2	2	2	
	2 - 4	B	l Bi		<30	5	5	5	5	5	5	5	4	4	4	З	3	4	З	3	2	
	> 4	Α	LEXTURI	LOAM	30-39 40-48	5	4	4	5	4	4	4	3	3	4	3	2	3	2	1	3	
					> 48		-	3		3	-	3	2		3		2		2	2	$\sim$	

LCC o	CLASSES
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I	SOILS HAVE SLIGHT LIMITATIONS THAT RESTRICT THEIR USE
П	SOILS HAVE MODERATE LIMITATIONS THAT RESTRICT THE CHOICE OF PLANTS OR THAT REQUIRE MODERATE CONSERVATION PRACTICES
ш	SOILS HAVE SEVERE LIMITATIONS THAT REDUCE THE CHOICE OF PLANTS OR REQUIRE SPECIAL CONSERVATION PRACTICES, OR BOTH
IV	SOILS HAVE VERY SEVERE LIMITATIONS THAT RESTRICT THE CHOICE OF PLANTS OR REQUIRE VERY CAREFUL MANAGEMENT, OR BOTH
v	SOILS HAVE LITTLE OR NO HAZARD OF EROSION BUT HAVE OTHER LIMITATIONS, IMPRACTICAL TO REMOVE, THAT LIMIT THEIR USE MAINLY TO PASTURE, RANGE, FORESTLAND, OR WILDLIFE FOOD AND COVER
VI	SOILS HAVE SEVERE LIMITATIONS THAT MAKE THEM GENERALLY UNSUITED TO CULTIVATION AND THAT LIMIT THEIR USE MAINLY TO PASTURE, RANGE, FORESTLAND, OR WILDLIFE FOOD AND COVER
VII	SOILS HAVE VERY SEVERE LIMITATIONS THAT MAKE THEM UNSUITED TO CULTIVATION AND THAT RESTRICT THEIR USE MAINLY TO GRAZING, FORESTLAND, OR WILDLIFE
	SOUS AND MISCELLANEOUS AREAS HAVE LIMITATIONS THAT PRECLUDE THEIR USE FOR

INTRINSEC FERTILITY DECREASES FROM A TO C. N = YEARS FOR C MINERALIZATION  $N = ORG. C / K_2$  $K_2 = 1200 \times (1 / (CLAY + 20)) \times (1 / (CACO_3 + 20))$ 



FERTILITY

Α

Π

INTRINSEC FERTILITY

Β

Π

III

С

Π

III

Ш

VIII COMMERCIAL PLANT PRODUCTION AND LIMIT THEIR USE TO RECREATION, WILDLIFE, OR WATER SUPPLY OR FOR ESTHETIC PURPOSES

CHEMICAL FERTILITY DECREASES FROM 1 TO 5

34-44

45-55

>55

CLAY>35 %

FERTILITY DECREASES FROM I TO V

FOR EACH SOIL LCC CLASS AGREES TO THE MOST SEVERE CLASS ASSIGNED TO A PARAMETER.

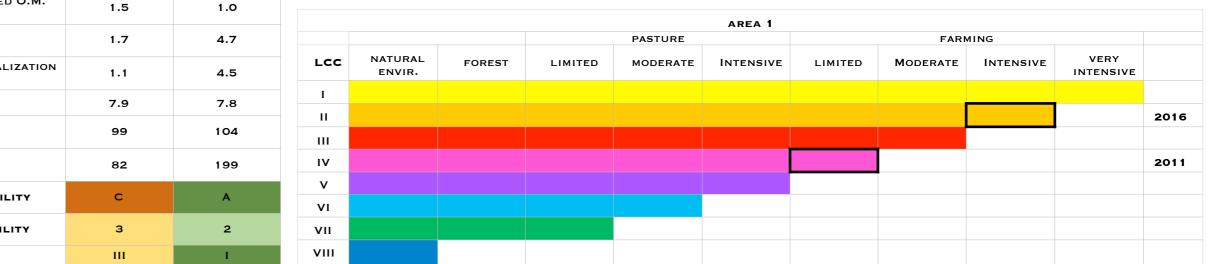
## COMPARISONS OF 5 SOIL SAMPLES BEFORE AND AFTER RECONSTITUTION SHOW HOW RECONSTITUTION IMPROVES LCC AND FCC CLASSES



	AREA 1	(2011)	AREA 1	(2016)							
		LCC		LCC							
OOT RESTRICTING LAYER CM	35	IV	>150	I							
TEXTURE	SL	II	SL	II							
PARENT MATERIAL %	12	II	<5	I							
GRAVEL %	6.5	IV	<0.3	I							
STONINESS	NO	I	NO	I			CHEMIC	AL FERT			
							AREA 1 (2011)	)		AREA 1 (2016)	
CHEMICAL FERTILITY	-	I	-	I			EVALUATION	LCC		EVALUATION	LC
SALINITY	0.2	I	0.8	I	ΡН	7.9	GOOD	I	7.8	GOOD	I
D <b>S</b> м <sup>-1</sup>	0.2		0.8	1	SALINITY	0.2	GOOD	I	0.8	GOOD	I
SLOPE	<0.2	I	<0.2	I	D <b>S</b> м <sup>-1</sup>	0.2	2300	•	0.0	2200	•
%	<b>NO.2</b>	1	<b>NO.2</b>	1	C.E.C.	19.7	GOOD	I	31.2	GOOD	I
EROSION RISK	NO	I	NO	I	MEQ/100G	19.7	GOOD	1	51.2	GCOD	
CLIMATIC LIMITATION	NO	I	NO	I	CACO₃ TOT G KG <sup>-1</sup>	38	GOOD	I	124	GOOD	I

	AREA 1 (2011)	AREA 1 (2016)
CLAY %	15	11
САСО₃ тот G кG <sup>-1</sup>	38	124
1 YEAR MINERALIZED O.M. %	1.5	1.0
ORG. C %	1.7	4.7
YEARS FOR C MINERALIZATION	1.1	4.5
РН	7.9	7.8
P₂O₅ MG KG <sup>-1</sup>	99	104
K <sub>2</sub> O MG KG <sup>-1</sup>	82	199
INTRINSEC FERTILITY	с	А
CHEMICAL FERTILITY	3	2
FERTILITY	ш	I

AREA 1 IMPROVES FROM CLASS IV SOIL WITH VERY SEVERE LIMITATIONS THAT RESTRICT THE CHIOSE OF PLANTS AND/OR REQUIRE VERY CAREFUL MANAGEMENT TO CLASS II SOILS HAVE MODERATE LIMITATIONS THAT RESTRICT THE CHOICE OF PLANTS OR THAT REQUIRE MODERATE CONSERVATION PRACTICES; FERTILITY IMPROVES FROM CLASS III TO I.



AREA 2	

	AREA 2	(2011)	AREA 2	(2016)					
		LCC		LCC					
ROOT RESTRICTING LAYER CM	26	IV	>150	I					
TEXTURE	SL	II	L - SL	I - II					
PARENT MATERIAL %	18	111	<5	I					
GRAVEL %	5	IV	<0.3	I					
STONINESS	NO	I	NO	I			CHEMIC	AL FERT	ILITY
							AREA 2 (2011)	)	
CHEMICAL FERTILITY	-	I	-	I			EVALUATION	LCC	
SALINITY	0.3	I	2.8	II	РН	7.5	GOOD	I	7.8
D <b>S</b> M <sup>-1</sup>		-	2.0		SALINITY DS M <sup>-1</sup>	0.3	GOOD	I	2.8
SLOPE	<0.2	I	<0.2	I	DS M <sup>1</sup>				
%		-		-	C.E.C.	12.1	GOOD	I	34.5
EROSION RISK	NO	I	NO	I	MEQ/100G	12.1	GOOD	I	54.5
CLIMATIC LIMITATION	NO	I	NO	I	CACO₃ TOT G KG <sup>-1</sup>	55	GOOD	I	243
J									

			AREA 2 (2011)	AREA 2 (2016)
		CLAY %	12	10
		САСО <sub>3</sub> тот G кG <sup>-1</sup>	55	243
		1 YEAR MINERALIZED O.M. %	1.5	0.9
		org. C %	2.7	6.6
		YEARS FOR C MINERALIZATION	1.8	7.3
AREA 2 (2016)		РН	7.5	7.7
EVALUATION	LCC			
GOOD	I	Р₂О₅ мд кд <sup>-1</sup>	48	95
GOOD	н	К <sub>2</sub> О мд кд <sup>-1</sup>	95	211
GOOD	I	INTRINSEC FERTILITY	с	А
		CHEMICAL FERTILITY	з	2
GOOD	I	FERTILITY	111	1

7.8

2.8

34.5

243

CHEMICAL FERTILITY

I

T

7.5

2.7

37

189

AREA 5 (2011)

GOOD

GOOD

GOOD

EVALUATION LCC

AREA 5 (2016)

GOOD

GOOD

GOOD

GOOD

EVALUATION LCC

AREA 2 IMPROVES FROM CLASS VI SOILS HAVE SEVERE LIMITATIONS THAT MAKE THEM GENERALLY UNSUITABLE FOR CULTIVATION AND THAT RESTRICT THEIR USE MAINLY TO PASTURE, RANGELAND, FORESTLAND, OR WILDLIFE HABITAT TO CLASS II SOILS HAVE MODERATE LIMITATIONS THAT RESTRICT THE CHOICE OF PLANTS OR THAT REQUIRE MODERATE CONSERVATION PRACTICES; FERTILITY IMPROVES FROM CLASS III TO I.



		APEA 3	(2011)	AREA 3	(2016)																					
		AREA	LCC		LCC									AREA 3 (2011)	AREA 3 (2016)					VII SOILS						
	ROOT RESTRICTING LAYER CM	24	VII	>150	I								CLAY %	12	11					ND THAT R I SOILS HA						-
	Texture	SL	П	SL	II								CACO₃ TOT G KG <sup>-1</sup>	130	173		ANTS OF		QUIRE M	ODERATE C	CONSERVAT	ION PRAC	TICES; FE	RTILITY I	MPROVES	FROM
3	PARENT MATERIAL %	37	IV	<5	I								1 YEAR MINERALIZED O.M. %	1.1	0.9	CLAS					AREA 3					
	GRAVEL	28	VII	<0.3	I								org. C %	1.9	5.1					PASTURE	AREA 5		FARM	MING	,	
	70 STONINESS	NO	I	NO				CHEMIC	AL FERT	ILITY			YEARS FOR C MINERALIZATION	1.7	3.1	LCC	NATURAL ENVIR.	FOREST	LIMITED	MODERATE	INTENSIVE	LIMITED	MODERATE	INTENSIVE	VERY INTENSIVE	
			-		•		AR	REA 3 (2011)			AREA 3 (2016		РН	7.9	7.7	I										4
	CHEMICAL FERTILITY	-	I	-	I		E	EVALUATION	LCC		EVALUATION	LCC	P <sub>2</sub> O <sub>5</sub>			II										2016
	SALINITY	2.0		2.4		РН	7.9	GOOD	I	7.7	GOOD	Ι	MG KG <sup>-1</sup>	18	85	Ш										
	DS M <sup>-1</sup>	2.0		2.4		SALINITY DS M <sup>-1</sup>	2.0	GOOD	I	2.4	PARTIALLY GOOD	II	К₂О мд кд <sup>-1</sup>	98	284	IV										
	SLOPE %	<0.2	I	<0.2	Ι	C.E.C.	8.5	GOOD	I	33	GOOD	I	INTRINSEC FERTILITY	с	А	V VI										
	EROSION RISK	NO	I	NO	I	MEQ/100G			•			•	CHEMICAL FERTILITY	5	2	VII									,,	2011
	CLIMATIC LIMITATION	NO	I	NO	I	CACO <sub>3</sub> TOT G KG <sup>-1</sup>	130	GOOD	I	173	GOOD	I	FERTILITY	V	I	VIII										

			LCC		LCC								AREA 3 (2011)	AREA 3 (2016)								RE LIMITAT			
J.E.	ROOT RESTRICTING LAYER CM	24	VII	>150	I							CLAY %	12	11								MAINLY TO ATIONS THA		•	
	Texture	SL	II	SL	II							САСО <sub>3</sub> тот G KG <sup>-1</sup>	130	173		ants or V to I.	THAT RE	QUIRE MC	DERATE C	ONSERVAT	ION PRAC	TICES; FEF	RTILITY IN	<b>IPROVES</b>	FROM
	PARENT MATERIAL %	37	IV	<5	I							1 YEAR MINERALIZED O.M. %	1.1	0.9	CLASS	• 10 1.									
	GRAVEL	28	VII	<0.3	I							org. C %	1.9	5.1					PASTURE	AREA 3		FARM	ING		
	% STONINESS	NO						СНЕМІС	AL FERTILITY			YEARS FOR C MINERALIZATION	1.7	3.1	LCC	NATURAL ENVIR.	FOREST	LIMITED	MODERATE	INTENSIVE	LIMITED	MODERATE	INTENSIVE	VERY INTENSIVE	
· · ·	STONINESS	NO	1	NO	1		AREA 3	(2011)	)	AREA 3 (201	6)	PH	7.9	7.7	I										
THE REAL PROPERTY OF THE PROPERTY OF THE REAL PROPE	CHEMICAL FERTILITY	-	I	-	I		EVAL	JATION	LCC	EVALUATIO	N LCC		7.5		п									1	2016
_	SALINITY	2.0	I	2.4		ΡΗ	7.9 G	DOD	I 7.7	GOOD	I	P <sub>2</sub> O <sub>5</sub> MG KG <sup>-1</sup>	18	85	111										
	D <b>S</b> M <sup>-1</sup>	2.0		2.4		SALINITY D <b>S</b> M <sup>-1</sup>	<b>2.0</b> G	DOD	I 2.4	GOOD	, II	К <sub>2</sub> О MG КG <sup>-1</sup>	98	284	IV										
	SLOPE %	<0.2	I	<0.2	I	C.E.C.	85 6	DOD	1 33	GOOD	1	INTRINSEC FERTILITY	с	A	V VI										
	EROSION RISK	NO	I	NO	I	MEQ/100G	0.0 0			GOOD		CHEMICAL FERTILITY	5	2	VII										2011
	CLIMATIC LIMITATION	NO	I	NO	I	CACO <sub>3</sub> TOT G KG <sup>-1</sup>	1 <b>30</b> G0	DOD	I 17	GOOD	I	FERTILITY	v	1	VIII										

AREA 3



	AREA 4	(2011)	AREA 4	(2016)							
		LCC		LCC							
ROOT RESTRICTING LAYER CM	35	IV	>150	I							
Texture	SL	II	SL	II							
PARENT MATERIAL %	12	IV	<5	I							
GRAVEL %	6.2	IV	<0.3	I							
STONINESS	NO	I	NO	I			снеміс Агеа 4 (2011)		ILITY	AREA 4 (2016)	
CHEMICAL FERTILITY	-	I	-	I			EVALUATION	LCC		EVALUATION	LCC
SALINITY	0.2	I	1.4	II	ΡΗ	8.1	GOOD	I	7.6	GOOD	Ι
D <b>S</b> M <sup>-1</sup>	0.2	1	1.4	11	SALINITY	0.2	GOOD	I	1.4	GOOD	П
SLOPE %	<0.2	I	<0.2	I	DS M <sup>-1</sup>						
EROSION RISK	NO	I	NO	I	C.E.C. MEQ/100G	32.2	GOOD	I	41	GOOD	I
CLIMATIC LIMITATION	NO	I	NO	I	САСО₃ тот G КG <sup>-1</sup>	138	GOOD	I	199	GOOD	I

AREA 5 (2011) AREA 5 (2016)

>150

<5

<0.3

NO

-

2.7

<0.2

LCC

VII

Ш

IV

22

25

0.1

<0.2

ROOT RESTRICTING LAYER

СМ

TEXTURE

PARENT MATERIA

%

GRAVEL

STONINESS

CHEMICAL FERTILITY

SALINITY

D**S** м<sup>-1</sup>

SLOPE

%

EROSION RISK

CLIMATIC LIMITATION

LCC

I

1

ΡН

SALINITY

D**S** м-1

C.E.C.

MEQ/100G

CACO3 TOT

G KG<sup>-1</sup>

0.1

15.9

60

	AREA 4 (2011)	AREA 4 (2016)
CLAY %	12	13
CACO <sub>3</sub> TOT G KG <sup>-1</sup>	138	199
1 YEAR MINERALIZED O.M. %	1.1	0.9
org. <b>C</b> %	2.3	7.5
YEARS FOR C MINERALIZATION	2.1	8.3
РН	8.1	7.6
P₂O₅ MG KG <sup>-1</sup>	139	121
K₂O MG KG <sup>-1</sup>	99	183
INTRINSEC FERTILITY	в	А
CHEMICAL FERTILITY	з	2
FERTILITY	ш	1

AREA 5 (2011) AREA 5 (2016)

10

189

1.0

4.9

3.3

7.5

133

206

Α

2

10

60

1.5

2.7

1.7

8.0

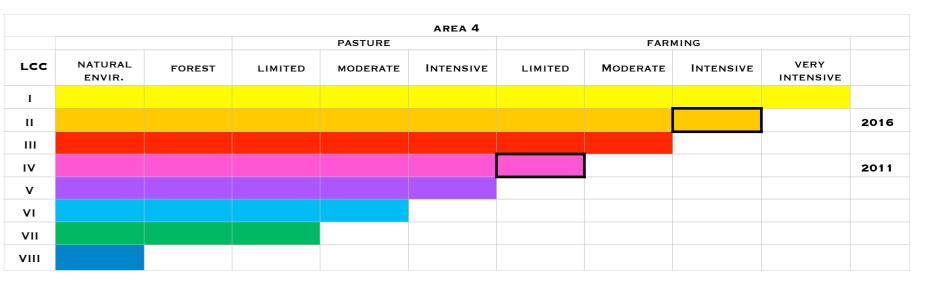
80

82

з

Ш

AREA 4 IMPROVES FROM CLASS IV SOIL WITH VERY SEVERE LIMITATIONS THAT RESTRICT THE CHIOSE OF PLANTS AND/OR REQUIRE VERY CAREFUL MANAGEMENT TO CLASS II SOILS HAVE MODERATE LIMITATIONS THAT RESTRICT THE CHOICE OF PLANTS OR THAT REQUIRE MODERATE CONSERVATION PRACTICES; FERTILITY IMPROVES FROM CLASS III TO I.



AREA 5 IMPROVES FROM CLASS VII SOILS HAVE VERY SEVERE LIMITATIONS THAT MAKE THEM UNSUITABLE FOR CULTIVATION AND THAT RESTRICT THEIR USE MAINLY TO GRAZING, FORESTLAND, OR WILDLIFE HABITAT TO CLASS II SOILS HAVE MODERATE LIMITATIONS THAT RESTRICT THE CHOICE OF PLANTS OR THAT REQUIRE MODERATE CONSERVATION PRACTICES; FERTILITY IMPROVES FROM CLASS III TO I.



AREA 5

	Je v e		10 00 1 1 1 00 00 00 00 00 00 00 00 00 0
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CLAY

CACO<sub>3</sub> TOT

1 YEAR MINERALIZED O.M.

%

org. C

YEARS FOR C MINERALIZATION

Ν

ΡН

P<sub>2</sub>O<sub>5</sub>

MG KG<sup>-1</sup>

K<sub>2</sub>O

MG KG<sup>-1</sup>

INTRINSEC FERTILITY

CHEMICAL FERTILITY

FERTILITY

G KG

## RECONSTITUTION IS ABLE TO MODIFY ENVIRONMENTAL AND AGRONOMIC CONDITIONS FROM A PREDOMINANT USE OF PASTURE TO A

## **POSSIBILITY OF INTENSIVE CULTIVATION.**

SoWaSe, 2018 ESSC INTERNATIONAL CONFERENCE, IMOLA (ITALY), JUNE 6-8, 2018