



URSA PROJECT ALQUEVA BYPRODUCTS RECIRCULATION UNITS

EDIA – Environmental Department



IMPORTANCE OF ORGANIC MATTER IN SOIL

- Soil – present reality;
- Importance of organic matter in soil;
- URSA concept;
- Climate change and agricultural sustainability;
- Final considerations.



IMPORTANCE OF ORGANIC MATTER IN SOIL

Agriculture depends on the physical, chemical and biological characteristics of the soil. Soil fertility combines the highest potentials of each of these 3 aspects. Soil is a nonrenewable resource on our timescale.





IMPORTANCE OF ORGANIC MATTER IN SOIL

- EDIA's soil monitoring since 2009 indicates low levels of soil organic matter throughout the EFMA, often below 1%.

Perfil	Prof. (cm)	pH (IS O)	Catiões troca (cmol _c kg ⁻¹)					CTC no _c kg _c	ESP (%)	V (%)	CEe (dS/m)	Soma Cat/10	Catiões solúveis (mmol _c L ⁻¹)				SAR neq _L L ⁻¹	NO ₃ mg/kg	NH ₄ mg/kg	Cl (mg/L)	Carbon (%)	C org. (g kg ⁻¹)	M.O. (%)	Kjeldal N (g kg ⁻¹)	P2O5 mg kg ⁻¹	K2O mg kg ⁻¹	c. Húmico c. (%)	Fúlvicos (%)
			Na	Ca	Mg	K	SOMA						Na	Ca	Mg	K												
MN-1	0-27	6,71	0,133	17,950	7,491	0,121	25,70	26,74	0,50	96,1	0,28	0,26	0,52	1,20	0,83	0,03	0,51	44,27	nd	1,08	nd	9,98	1,72	0,68	42	54	0,205	0,102
	27-50	6,88	0,227	22,967	10,456	0,119	33,77	38,36	0,59	88,0	0,13	0,13	0,39	0,56	0,33	0,02	0,59	1,41	nd	0,52	nd	4,50	0,78	0,42	3	60	0,090	0,077
MN-2	0-15	6,58	0,081	20,306	5,404	0,190	25,98	26,78	0,30	97,0	0,51	0,44	0,50	2,20	1,66	0,07	0,36	102,08	nd	1,74	nd	20,34	3,51	1,09	109	116	0,423	0,211
	15-40	6,55	0,100	14,971	4,286	0,164	19,52	24,46	0,41	79,8	0,14	0,14	0,30	0,71	0,35	0,03	0,41	10,95	nd	0,47	nd	8,06	1,39	0,59	69	124	0,101	0,161
MN-3	0-15	6,20	0,070	6,146	2,412	0,301	8,93	15,60	0,45	57,2	0,71	0,69	0,85	3,43	2,34	0,24	0,50	21,01	nd	2,50	nd	10,54	1,82	0,66	79	192	0,199	0,142
	15-34	6,30	0,219	11,391	3,347	0,114	15,07	18,50	0,19	81,5	0,53	0,53	1,00	2,83	1,39	0,04	0,69	32,55	nd	1,73	nd	5,54	0,96	0,41	20	52	0,052	0,049
MN-5	0-15	6,32	0,300	11,512	3,438	0,090	15,34	21,04	1,42	72,9	1,22	1,20	4,09	4,51	3,29	0,06	2,07	157,26	nd	4,16	nd	13,8	2,38	0,76	122	54	0,092	0,065
	15-40	6,30	0,059	9,841	3,068	0,179	13,15	16,39	0,36	80,2	0,32	0,31	0,56	1,56	0,85	0,08	0,51	14,92	nd	1,68	nd	8,9	1,54	0,48	32	124	0,073	0,038
MN-6	40-60	6,56	0,210	22,774	7,312	0,194	30,49	33,71	0,62	90,5	0,14	0,13	0,45	0,58	0,29	0,03	0,68	0,00	nd	0,87	nd	4,3	0,76	0,31	2	136	*	*
	0-20	6,43	0,044	1,980	0,638	0,147	2,81	2,99	1,46	93,9	0,21	0,20	0,84	0,65	0,40	0,09	1,17	8,87	nd	1,05	nd	8,7	1,51	0,48	63	68	0,123	0,063
MN-7	20-40	6,60	0,213	2,134	0,542	0,062	2,95	3,51	6,07	84,1	0,42	0,39	3,09	0,55	0,26	0,02	4,84	28,06	nd	1,87	nd	6,6	1,15	0,25	59	20	0,031	0,016
	40-60	7,11	0,408	2,201	1,422	0,072	4,10	5,56	7,34	73,8	1,14	1,07	8,58	0,94	1,12	0,02	8,47	13,81	nd	3,32	nd	7,5	1,31	0,15	5	24	*	*
MN-8	0-20	6,65	0,051	4,040	1,322	0,106	6,12	18,79	0,27	32,6	0,28	0,26	0,55	1,15	0,90	0,04	0,54	23,14	nd	1,25	nd	6,7	1,17	0,48	27	69	0,073	0,037
	20-55	6,78	0,046	6,545	3,726	0,099	10,42	14,03	0,32	74,2	0,19	0,19	0,34	0,86	0,69	0,03	0,39	15,94	nd	0,45	nd	8,0	1,39	0,39	19	60	0,050	0,079
MN-9	55-80	6,84	0,146	11,872	6,798	0,114	18,93	21,84	0,67	86,7	0,18	0,17	0,50	0,58	0,55	0,02	0,67	0,00	nd	0,68	nd	3,3	0,54	0,31	17	66	*	*
	0-15	6,26	0,065	4,702	3,819	0,175	8,76	17,59	0,37	49,8	0,13	0,12	0,383	0,540	0,170	0,073	0,64	4,36	0,01	0,46	nd	9,0	1,57	0,78	56	94	0,220	0,108
MN-10	10-40	6,47	0,132	6,061	4,869	0,141	11,20	24,76	0,53	45,2	0,11	0,11	0,427	0,500	0,160	0,031	0,74	0,71	0,00	0,28	nd	4,0	0,78	0,66	32	62	0,066	0,044
	40-60	7,81	0,139	7,182	5,194	0,079	12,59	25,73	0,54	48,9	0,12	0,11	0,418	0,470	0,150	0,020	0,75	0,17	0,01	0,21	nd	2,5	0,40	0,23	6	47	*	*
MN-11	60-100	7,77	0,169	9,426	5,947	0,080	15,62	24,88	0,68	62,8	0,11	0,10	0,436	0,450	0,100	0,016	0,83	3,99	0,04	0,24	nd	0,0	0,14	0,10	5	26	*	*
	0-39/40	5,79	0,153	8,308	5,846	0,076	14,38	27,00	0,57	53,3	0,14	0,11	0,409	0,490	0,180	0,045	0,71	6,59	0,15	0,30	nd	3,7	0,67	0,32	35	37	0,044	0,031
MN-12	39/40-60/6	7,42	0,257	6,151	10,619	0,082	17,11	31,03	0,83	55,1	0,12	0,09	0,516	0,230	0,140	0,018	1,20	7,94	0,20	0,30	nd	6,3	1,10	0,08	16	35	0,002	0,002
	60/65-90	6,23	0,171	5,788	8,093	0,092	14,14	30,60	0,56	46,2	0,10	0,08	0,436	0,240	0,140	0,019	1,00	0,28	0,19	0,36	nd	4,7	0,82	0,28	4	60	*	*
MN-13	0-15	6,34	0,082	5,292	1,123	0,118	6,61	9,82	0,84	67,4	0,49	0,46	0,97	2,67	0,88	0,07	0,72	34,65	nd	2,24	nd	4,8	0,81	0,45	30	70	0,032	0,030
	15-45/50	6,17	0,061	5,820	1,791	0,087	7,76	14,03	0,43	55,3	0,19	0,18	0,52	0,94	0,29	0,03	0,66	27,23	nd	0,65	nd	4,2	0,72	0,38	31	42	0,032	0,030
MN-14	45/50-80	6,35	0,171	14,776	5,391	0,179	20,52	24,54	0,70	83,6	0,11	0,11	0,42	0,46	0,17	0,02	0,74	0,97	nd	0,51	nd	2,8	0,48	0,36	1	58	*	*
	0-10	8,65	0,237	28,140	4,139	0,128	32,64	34,91	0,68	93,5	0,90	0,79	0,960	5,480	1,290	0,156	0,52	77,39	0,11	2,12	nd	7,8	1,36	0,66	101	62	0,087	0,116
MN-15	10-35	8,15	0,210	29,259	4,161	0,138	33,77	34,08	0,62	99,1	0,60	0,42	0,500	2,880	0,800	0,048	0,37	36,94	0,11	1,76	nd	7,2	1,24	0,59	28	60	0,101	0,059
	35-70	8,96	0,149	34,040	3,632	0,106	37,93	37,93	0,39	100,0	0,36	0,32	0,380	2,470	0,330	0,034	0,32	1,61	0,07	1,32	nd	2,0	0,35	0,31	13	54	*	*
MN-16	70-95	9,30	nd	nd	nd	nd	nd	nd	nd	nd	0,17	0,18	0,360	1,260	0,160	0,018	0,43	2,99	0,38	0,28	nd	1,40	0,24	0,09	10	27	*	*
	0-10	7,50	0,108	21,993	4,655	0,443	27,20	30,34	0,35	89,6	0,49	0,67	0,680	4,360	1,470	0,210	0,40	62,13	0,11	2,12	nd	14,8	2,56	1,16	232	240	0,266	0,190
MN-17	10-40	7,28	0,102	23,229	5,502	0,198	29,03	34,43	0,30	84,3	0,30	0,26	0,460	1,580	0,510	0,054	0,45	32,63	0,14	0,27	nd	9,20	1,58	0,76	187	116	0,203	0,174
	40-70	7,14	0,240	25,850	6,806	0,181	33,08	33,93	0,71	97,5	0,23	0,25	0,520	1,020	0,890	0,076	0,53	4,84	0,10	0,17	nd	6,94	1,20	0,46	18	102	*	*
MN-18	0-25	6,14	0,905	7,551	4,271	0,099	12,83	17,70	5,11	72,5	0,30	0,27	0,54	1,31	0,77	0,04	0,53	42,47	nd	0,87	nd	9,43	1,63	0,43	59	48	0,063	0,048
nd: não detectado																												
vest: vestígios																												
* valor não determinado																												
1,17																												

nd: não detectado

vest.: vestígios

* valor não determinado

1,17



IMPORTANCE OF ORGANIC MATTER IN SOIL

In surveys of EFMA farmers, other than burners, part of the farmers indicate that it is common practice to spread the soil surface (ground) or bury organic remains (stubble), but it appears that this does not result in the creation of of humus in the soil.

The formation of humus implies the creation of specific conditions for the evolution of materials such as moisture, temperature and CN ratio, since this transformation is performed by microorganisms that feed on it.

Organic remains are not humus!





IMPORTANCE OF ORGANIC MATTER IN SOIL

In the last decades of agriculture in Alentejo, little importance has been given to the importance of organic matter in the soil. However, this is the distinguishing feature that allows the soil to cope with the sudden variations caused by agriculture.



Some examples: Exposure to erosion, mobilization, irrigation, compaction, germination, rooting, pH change, nutrient retention and other productivity requirements.

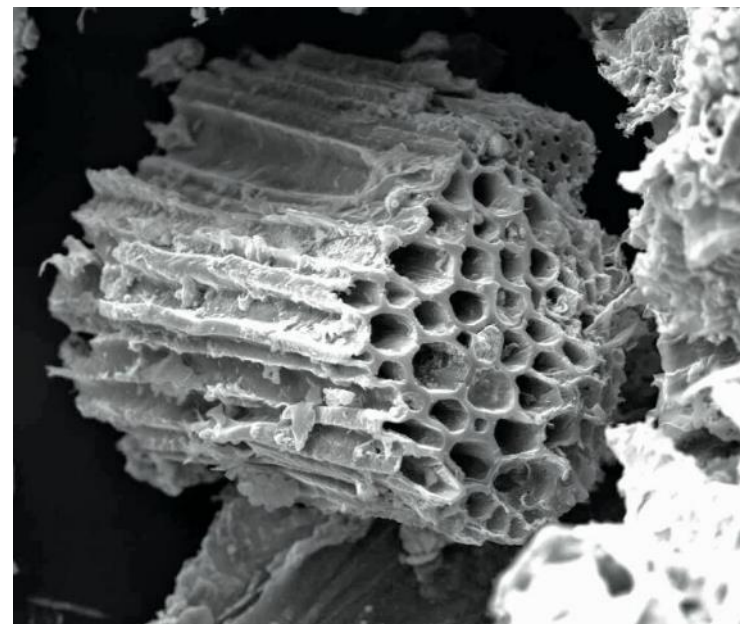


IMPORTANCE OF ORGANIC MATTER IN SOIL

Humus is a complex of organic, non-compact, entangled, three-dimensional structures with nonlinear open spaces within its composition as a result of thermal and biological transformation.

These spaces allow for longer retention and storage of water and nutrients, favoring gradual and more efficient use by plants.

Humus increases the stability of soil aggregates as it favors organic bonds, creating cohesion between particles and increasing soil resistance against erosion.





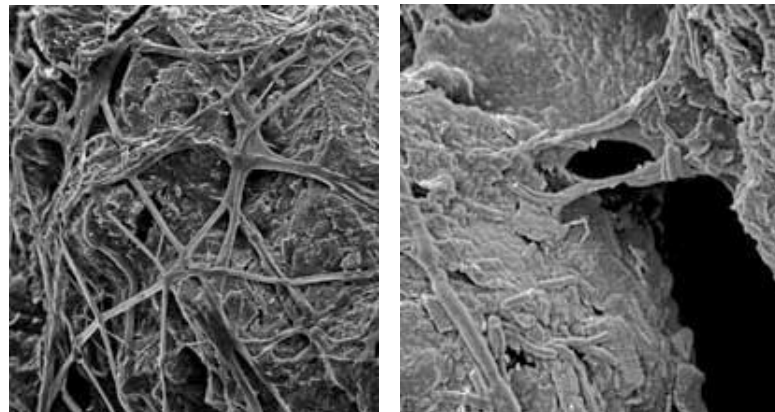
IMPORTANCE OF ORGANIC MATTER IN SOIL

The presence of humus favors the presence of beneficial microorganisms in the soil structure, increases the cohesion between particles and favors the cation exchange capacity.

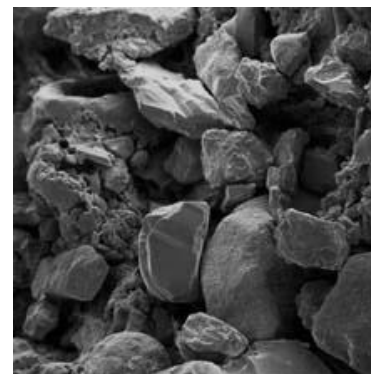
Humus reduces soil density, making it more porous, favoring water infiltration and rooting through its voids, reducing runoff.

Thus, with reduced runoff there is less soil and nutrient loss and a greater efficiency in soil water recharge.

Soil with húmus



Soil without húmus





IMPORTANCE OF ORGANIC MATTER IN SOIL

Organic matter represents the soil aggregating element and feeds the universe of soil microorganisms, the MICROBIOMA, which in their metabolism transform organic and inorganic substances into plant-absorbable biological forms.



In a gram of soil there are 10 million microorganisms.



Food and Agriculture Organization
of the United Nations

O SOLO ESTÁ REPLETO DE VIDA



O SOLO
ALOJA UM
QUARTO
DA
BIODIVERSIDADE
DO NOSSO PLANETA



Dia do Solo
5 Dezembro



IMPORTANCE OF ORGANIC MATTER IN SOIL

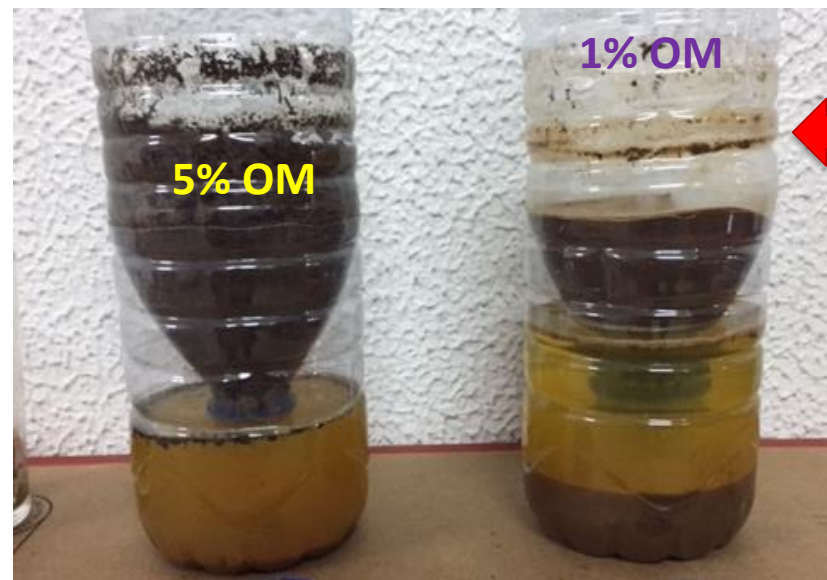
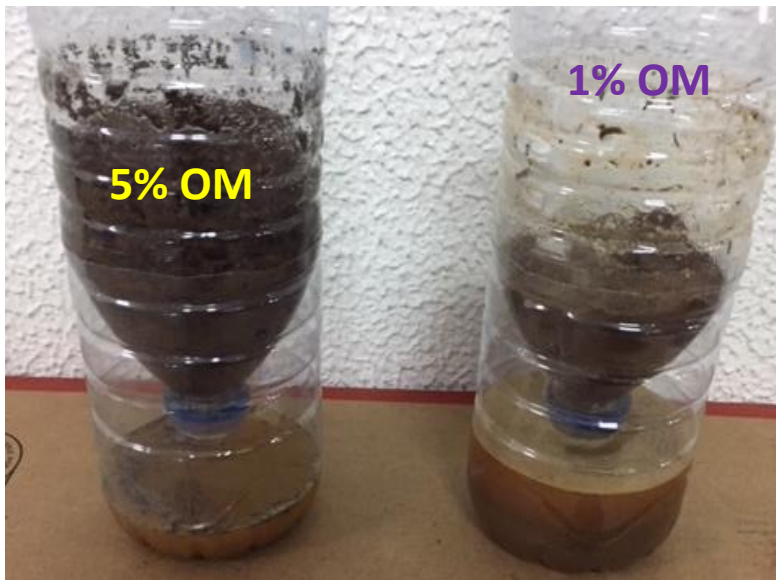
Agricultural production depends on 4 essential factors in the root zone:
soil, water, air and temperature.

Without organic matter the soil has greater difficulty: having open spaces for air, having spaces for rooting, having open spaces for water, and for its natural heating which influences its metabolism.





Soil characteristics determine the retention capacity of its components (sediment, nutrients and water). Elements that the soil does not retain will end up in water bodies and reservoirs, degrading their quality and making it difficult to manage. A soil that is poor in compact organic matter more easily, favoring runoff and water erosion.





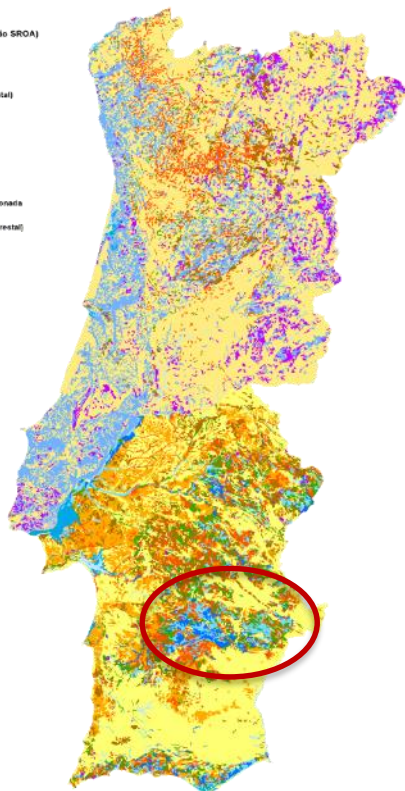
Soil represents nature's great filter, retaining in its structure nutrients and other chemicals applied in agriculture, but these filtering functions only occur with a percentage of organic matter greater than 3%.



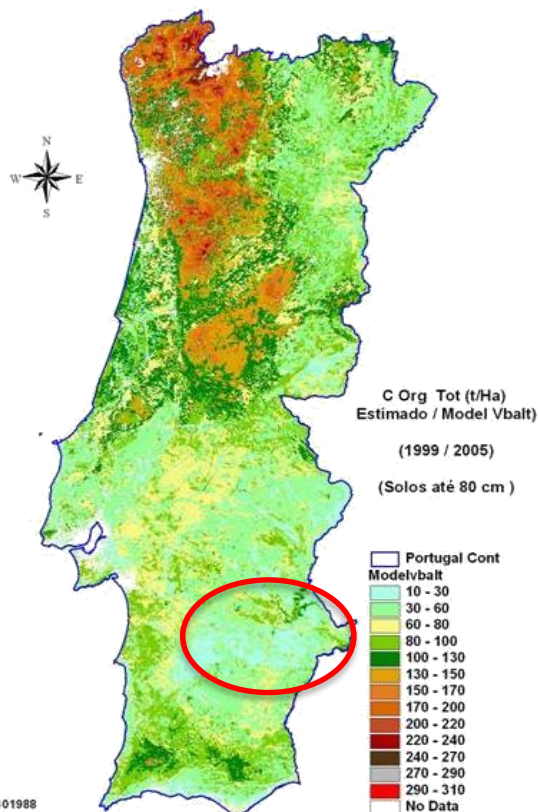


IMPORTANCE OF ORGANIC MATTER IN SOIL

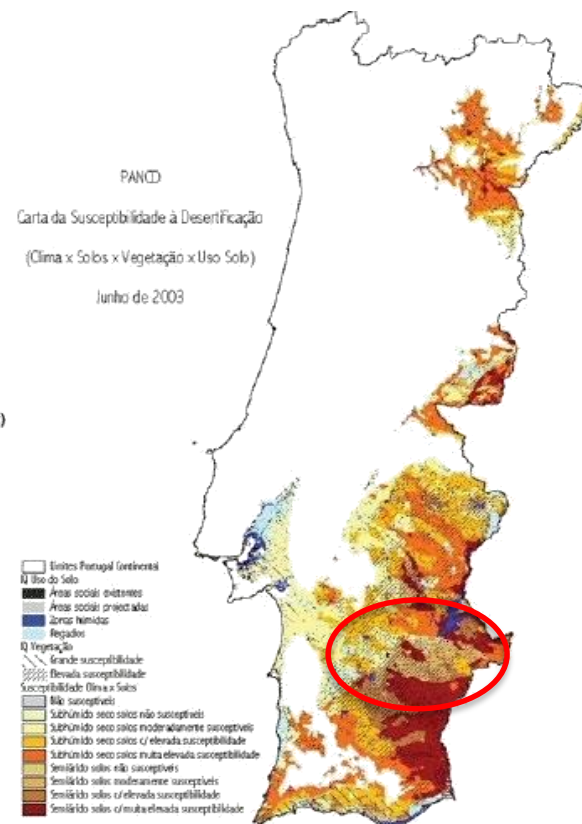
Legenda
CAPACIDADE DE USO DO SOLO (classificação SROA)
 I - Sul do Rio Tejo - Utilização agrícola
 Classe A - Zonas irrigadas
 Classe B - Limitações moderadas
 Classe C - Condicionada por limitações severadas
 II - Sul do Rio Tejo - Utilização não agrícola (florestal)
 Classe D - Limitações moderadas
 Classe E - Limitações severadas
 III - Sul do Rio Tejo - Complexos
 Classe A ou B ou C
 Classe A ou B ou C ou D
 Classe C ou D ou E
 IV - Norte do Rio Tejo - Utilização agrícola
 Classe A
 V - Norte do Rio Tejo - Utilização agrícola condicionada
 Classe D
 VI - Norte do Rio Tejo - Utilização não agrícola (florestal)
 Classe F
 VII - Norte do Rio Tejo - Complexos
 Classe A ou C
 Classe A ou F
 Classe C ou F
 VIII - Sul e Norte - Outras utilizações
 Zonas de Regadio
 Áreas Rústicas
 Rios, Lagos e Albufeiras



Land use
capacity



Soil organic
matter content



Desertification
susceptibility

The low soil organic matter content of the Alqueva irrigation areas negatively affects their profitability and their productive potential, reducing the farmer's ability to efficiently use water and nutrients;

The irrigated areas of Alqueva have a surplus of organic by-products (stubble, straw, pruning residues, leaves, bagasse), which are left on the ground or burned on or off the farm – 500,000 tons;





BURNING AS A SOLUTION...





REDUÇÃO DA QUALIDADE AMBIENTAL DA REGIÃO





Placement of weeds and branches in sandy areas for planting the Leiria pine forest.





URSA CONCEPT – ALQUEVA BYPRODUCTS RECIRCULATION UNIT

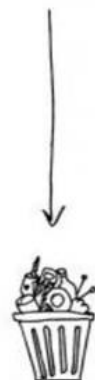


URSA

UNIDADES DE RECIRCULAÇÃO
DE SUBPRODUTOS DE ALQUEVA

Creation of 12 units scattered
across the territory, each with
a radius of influence of less than 10km.

Economia
linear



Economia
reciclagem

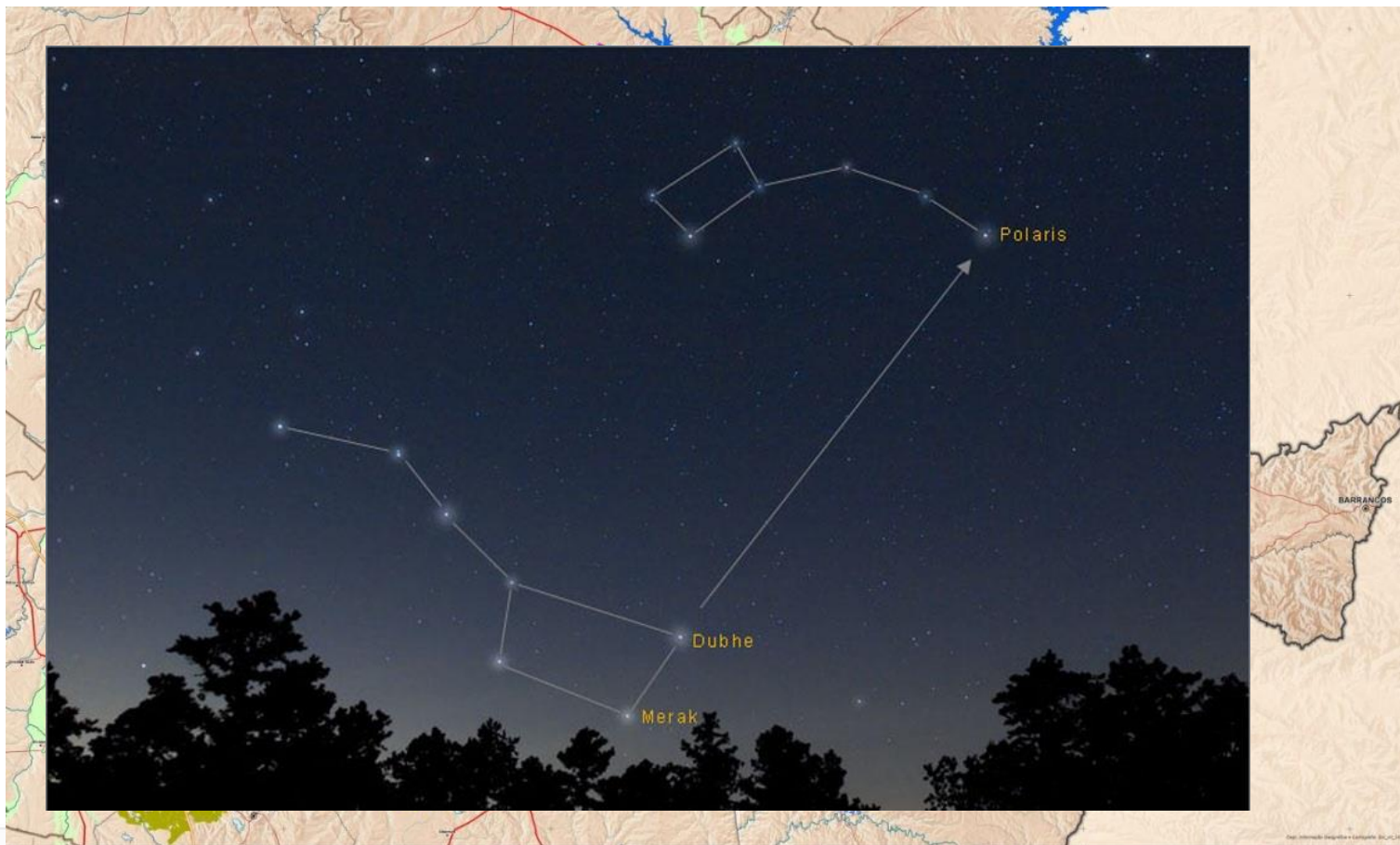


Economia
circular



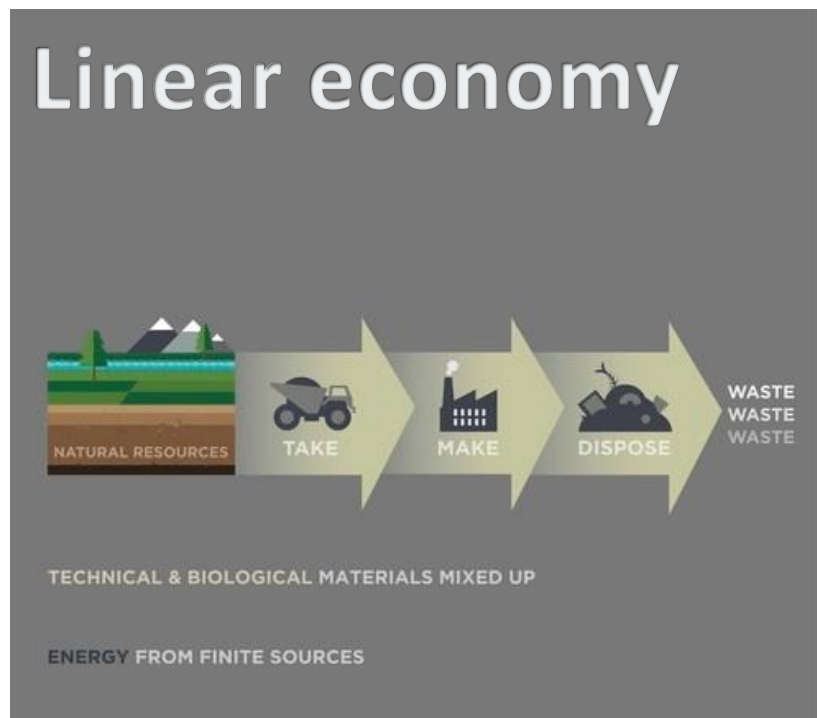


CONCEITO URSA – UNIDADES DE RECIRCULAÇÃO DE SUBPRODUTOS EM ALQUEVA





LIGAÇÃO COM AS ALTERAÇÕES CLIMÁTICAS



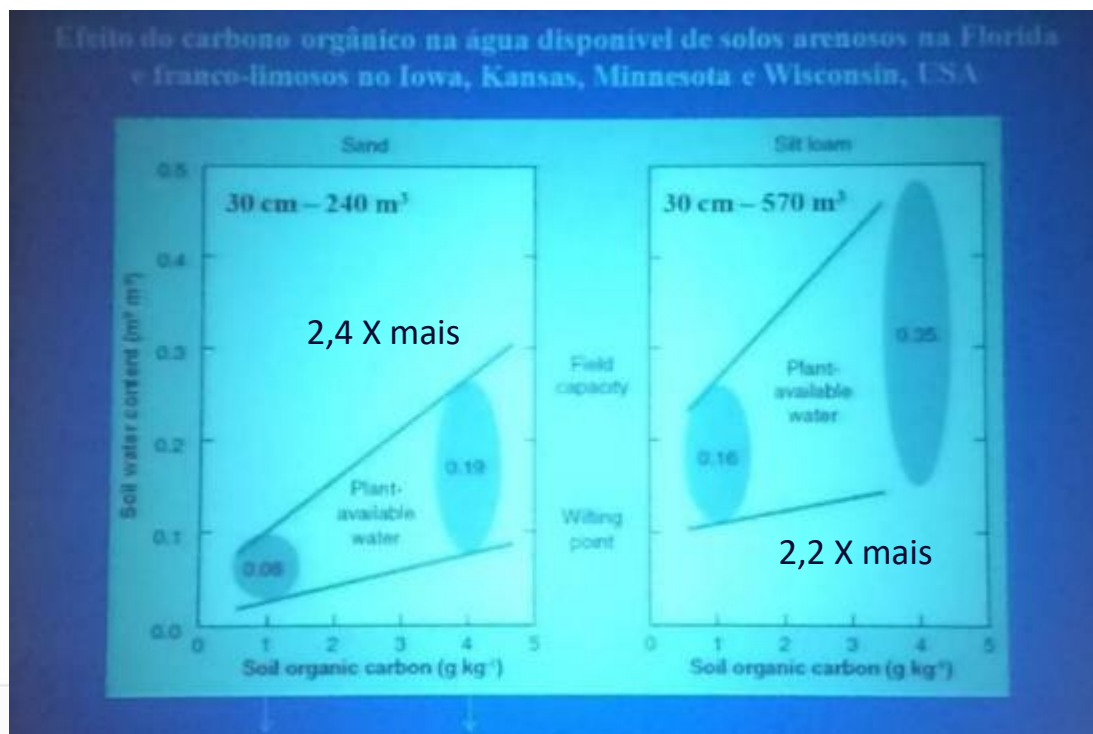
Vicious cycle



Virtuous Cycle



The water available to the plants more than doubles with an addition of 0.5% organic matter, in terms of quantity and in terms of duration in the root zone, keeping the plant in water comfort for longer.





O SOLO E A MATÉRIA ORGÂNICA

It is surprising to observe that the addition of water to a soil with more than 3% organic matter can exceed 500 m³ per hectare, that is, about 25% of the irrigation needs of a crop such as olive trees, which implies an increase in hidric comfort of the plants with the same water and the increase in time between waterings.

In perspective we can irrigate more area with the same water...

... or the same area with less water.

Varição do teor de carbono orgânico	Carbono orgânico (kg/m ²)	Água extra armazenada (litros/m ²)	Água poupada (m ³ /ha)	CO2 sequestrado (ton/ha)
1%	4.2	16.8	168	154
2%	8.4	33.6	336	308
3%	12.6	50.4	504	462
4%	16.8	67.4	672	616

Fonte: www.amazingcarbon.com



O SOLO E A MATÉRIA ORGÂNICA

Soil represents the largest terrestrial reservoir of carbon on the planet, which implies that the more organic matter that is sequestered in the soil, the smaller the amount in the atmosphere, representing an important sink and a simple way of mitigating climate change and global warming.

Regarding the increase of carbon in the soil with 3% of m.o., around 460 tons per hectare, which is roughly equivalent to the weight of 1000 cows per hectare.





WHERE DO THE CARBON

COME?
The storage of other materials, namely structuring elements, should be carried out throughout the year (almond branches, olive trees leaves).





WHERE DO THE CARBON

COME? The storage of other materials, namely structuring elements, should be carried out throughout the year (grapes material, almond cap, garlic straw).





WHERE DO THE CARBON

COME?
The storage of other materials, namely structuring elements, should be carried out throughout the year (algae from cleaning reservoirs).





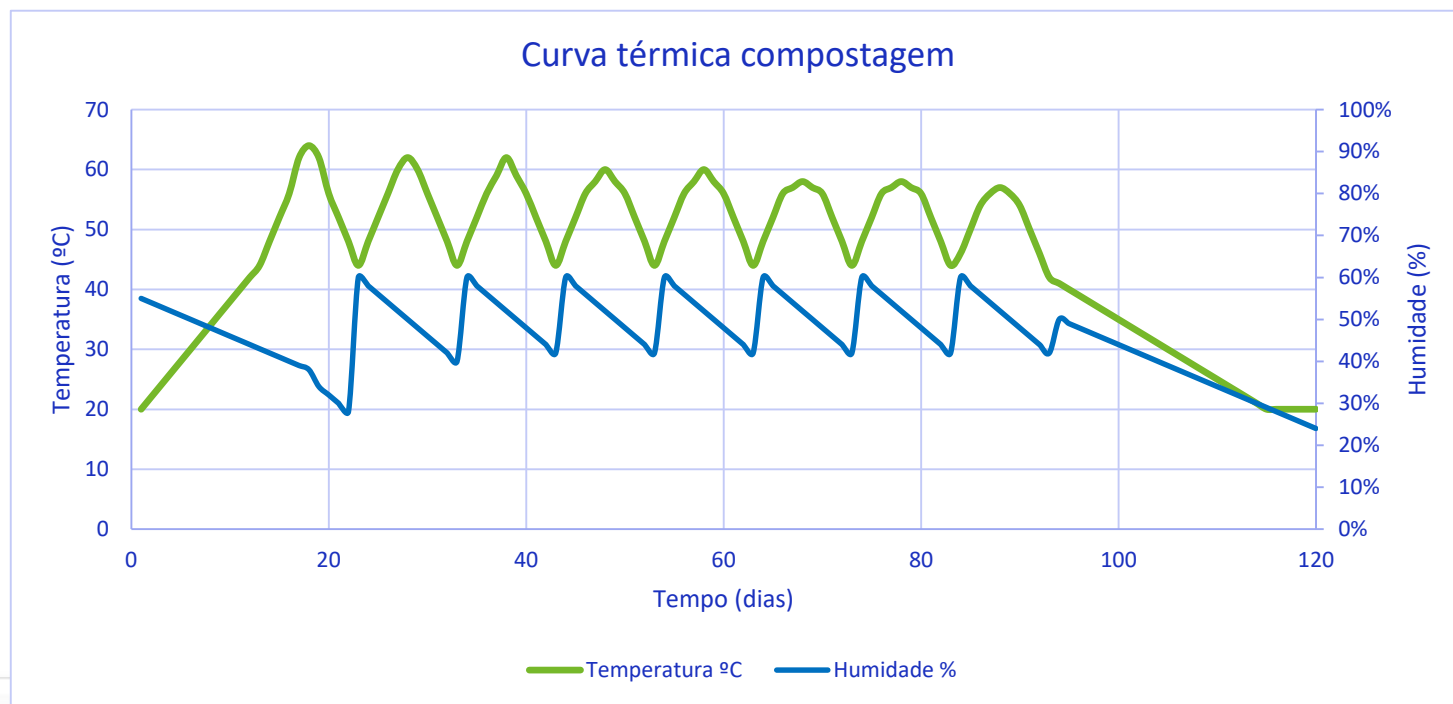
FIRST URSA (SERPA) – 2019





THERMAL TREATMENT

The thermal curve represents the corollary of the combination of diferente elements and the combinations with water and air.





FIRST URSA - 2019





FIRST URSA - 2019





SECOND URSA - 2020

The composition of the pile can be corrected throughout the composting process, and it is important to record the incorporated materials in detail.





SECOND URSA - 2020

Incorporating pasty materials, such as olive pomace, directly into the pile is an interesting option, as it reduces the need for storage. However, it is mandatory to turn over the pile after this incorporation.





THIRD URSA - 2021

Water-drop lines





FOURTH URSA - 2021





FIFTH URSA - 2022

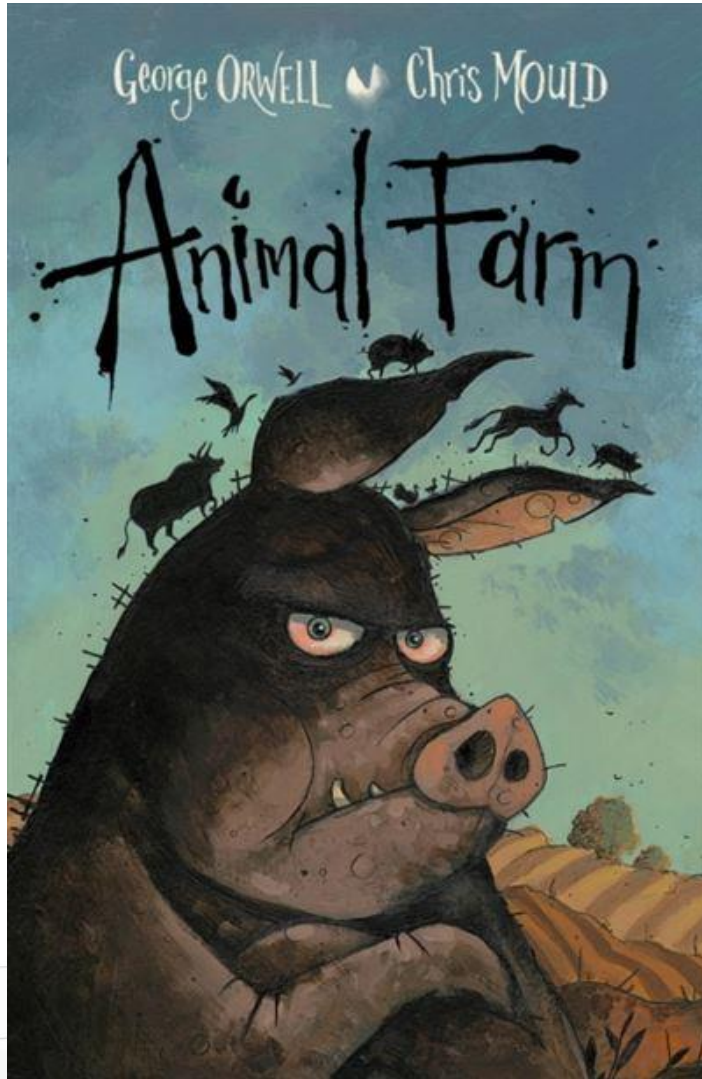






EDIA Empresa de Desenvolvimento
e Infra-estruturas do Alqueva, S.A.





If we don't change
the path we're
taking... we'll hardly
get to a different
place!





A PEGADA CERTA NUM CAMINHO CIRCULAR