SOIL ORGANIC AMENDMENTS FOR RESTORING DEGRADED DRYLANDS: STRATEGIES, RECOMMENDATIONS AND CHALLENGES FOR LARGE-SCALE APPLICATION

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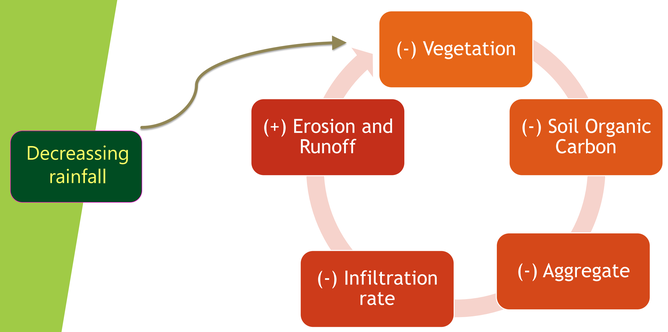
LAND DEGRADATION IN DEGRADED DRYLANDS AREAS. SOLUTIONS, RESTORATION AND ORGANIC AMENDMENTS

LAND DEGRADATION IN SEMIARID AREAS

There is an increasing concern at the global scale about interrelated environmental problems such as soil degradation, desertification, erosion, and climate change impacts.

DEGRADATION CYCLE FOR ARID AND SEMIARID NATURAL ECOSYSTEMS



DIMENSION AND CONSEQUENCES

Dimension	Consequences	References
Socio-economic	Crop reduction	*Zaman (1997)*
	Livestock reduction	*Ferdrickson et al. (1998)*
	Loss of Traditional Agricultural Structures	*Gallar et al. (1994)*
	Changes in land use patterns	*Zhao et al (2005)*
	Loss of species with economic interest	*Bollig and Schulte (1999)*
Biophysic	Loss of soil nutrients	*Schlesinger et al. (1999)*
	Infiltration rate reduction	*Sharma (1998)*
	Erosion increase	*Kelley and Nater (2000)*
	Vegetation cover reduction	*Asner et al. (2003)*
	Loss of species and ecosystems richness	*Gonzalez (2001)*
	Changes on primary productivity	*Huenneke et al. (20002)*
	Loss of biodiversity	*Whilford (1993)*
	Carbon stock reductions	*Janson et al. (2002)*
	Loss of ecosystems resilience	*Von Handenbergar et al. (2001)*
	Climate changes	*Rosenfeld et al. (2003)*

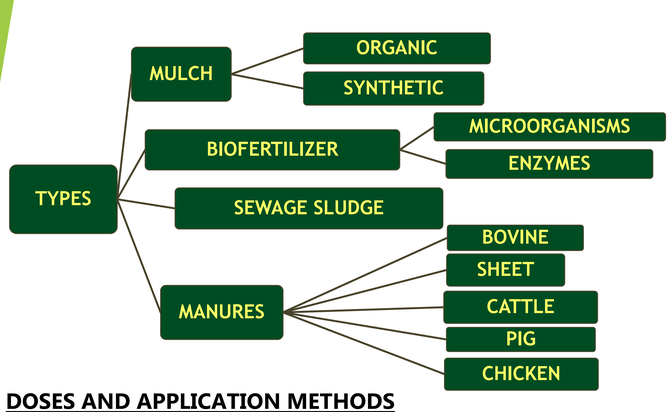
Intended alteration of a site aimed at establishing a native historical given ecosystem. The main goal is to mimic the structure, functioning, diversity and dynamics of the ecosystem.

The decline in organic matter content of many soils is becoming a major cause to restore, particularly in dryland regions where low soil fertility cannot maintain sustainable production.

Under the new paradigm of the **European Circular Economy Strategy**, all European Union member countries must transition to a green economy where resources are environmentally conserved, and generated waste is reused.

ORGANIC AMENDMENTS: TYPES, DOSES, BENEFITS AND RISKS DERIVATES FOR THEIR APPLICATION

TYPES OF AMENDMENTS



DOSES AND APPLICATION METHODS

•**DOSES:** THE ONLY SCIENTIFIC CONSENSUS IS THAT AMENDMENT RATES MUST BE THE MINIMUM EFFECTIVE DOSES WITHOUT RISK FOR THE ENVIRONMENT.

•**APPLICATION**: THE MOST WIDELY ACCEPTED METHOD IS OVER THE TOPSOIL.

BENEFITS ARISING FROM THE USE

Effects on Soil Properties

-SOC increase (Ferreras et al.. 2006)
-Bulk density decrease *(García-Orenes et al., 2005)*
-Soil porosity increase *(Luna et al., 2016)*
-Favour soil aggregation *(Albiach et al., 2001)*
-pH modification *(Guerrero et al., 2007)*
-EC modification *(Albaladejo et al., 1994)*
-Soil nutrients increase *(Roldán et al., 1996)*
-Soil Microbiota increase *(Lax et al., 1993)*
-Calcium carbonate decrease *(Hemmat et al., 2010)*

Effects on Runoff and Soil Erosion

-Overlandflow decrease *(Guerrero et al.. 2001)*
-Erosion decrease *(Galdos et al.. 2004)*
-Soil moisture increase *(Pagliali et al.. 1981)*
-Soil sealing decrease *(Abrol et al.. 2013)*
-Reduction on the splash effect *(Jordán et al.. 2010)*
-Soil roughnes increase *(Gholami et al.. 2012)*
-Water storage enhancement *(Tejada y González, 2006)*
- Better water store redistribution *(Flanagan et al., 1997)*

Effects on Vegetation Recovery

-Decrease of sappling mortality *(Bretón et al., 2016)*
-Increase of available water content for plant *(Hueso González et al., 2016)*
-Increase of available water content for plant *(Hueso González et al., 2016)*
-Reduce the summer drought stress *(Hoseini Bai et al., 2014)*
-Plant height increase *(Hueso González et al., 2017)*
-Diameter of the canopy increase *(Hueso González et al., 2016)*

RISKS ARISING FROM THE APPLICATION

Risk	Control
-Excess of soluble salts and sodium *(Guerrero et al., 2007)*	-Transitory effect requiring follow-up
-Poor organic matter estabilization *(García-Gomez et al., 2005)*	-Transitory effect in case of non vegetation recovery
-Excessive nitrogen mineralization *(Hueso González et al., 2015)*	-Do not use high N content amendments in anaerobic micro-sites
-Patogenic Agents *(Garcia-Orenes et al., 2007)*	-Amendment thermophilic composting
-Presence of no-native species and seeds *(Hueso González et al., 2016)*	-Monitoring of vegetation
-Nitrophylous species appearance *(Hueso González et al., 2015)*	-Monitoring of vegetation
-Heavy Metals *(Guerrero et al., 2007)*	-Previous amendment chemical analyses

More info and references in:

Hueso-Gonzalez et al. (2018). Current Opinion in Environmental Science & Health 2018, 5:1–6 https://doi.org/10.1016/j.coesh.2017.12.002