

A new method for drawing up the fertilization plans with livestock waste in alpine areas.

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Predazzo, Val di Fiemme, Province of Trento (Italy): the economy is based on tourism and on dairy farming. The milk is processed into **Puzzone di Moena PDO cheese**.

Nutrition of dairy cows is based on hay obtained from permanent meadows that are a fundamental element of the environment and the landscape.

The farms produce liquid manure, whose agronomic use is often cause of gripes by tourist operators and residents.

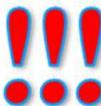
The farmers' cooperative "BIOGASPREDAZZO" envisages the realization of an anaerobic digestion plant (AD) to process the livestock waste with the aim of exploiting the energy content of this biomass, improving its agronomic characteristics thus reducing the environmental (olfactory) impact.



It is mandatory for these farms to possess the "PUA" a normative tool to correctly plan the use of their own livestock waste

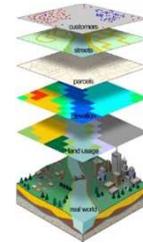


The method proposed by the regulations must be adapted to the conditions of the mountain farms and grasslands.



THE NEW METHOD ON 5 STEPS

1 - Managing and integrating mapping geo-data



We collected all the farms' dossiers involved in this project and managed all these data using a geographic information systems (GIS). This approach allows the integration of the original sources with both existing layers (the slope map, the soil map, restricted area where the spreading of the livestock waste is not allowed...) and new informative layers developed for the study (different macro-areas grassland, botanical-management, type of grass...)

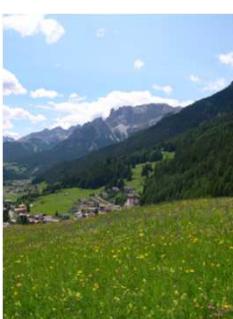
2 - Mapping of hay meadows (botanical and management characterisation) – more than 500 ha

- 1 – species rich meadows: at field botanical and agronomic characterization;
- 2 – valley bottom meadows: characterization by altitude and slope;
- 3 – sloping meadows: not in 1 & 2

3. Nitrogen balance equation for each different hay-meadow types

$$FO = \frac{(Y * B) - Nc - Nf - An}{K0}$$

Meadow area	Y	B	Y * B	An	K0	FO
	D.m. production ($t \text{ ha}^{-1} \text{ year}^{-1}$)	Nitrogen removal kg t d.m.^{-1}	Nitrogen removal ($\text{kg ha}^{-1} \text{ year}^{-1}$)	Nitrogen natural input ($\text{kg ha}^{-1} \text{ year}^{-1}$)	Livestock waste Nitrogen efficiency rate (%)	Nitrogen livestock waste input ($\text{kg ha}^{-1} \text{ year}^{-1}$)
Valley bottom meadows	8.07	0.21	169.5	17	50	304.9
Sloping meadows	5.33	0.19	101.3	17	50	168.5
Species rich meadows	3.62	0.17	61.5	17	50	89.1



4 - Definition of slope-threshold for the spreading of the digestate in an alpine environment

The law forbids the spread of liquid manure on steep surfaces to avoid the runoff, but a limiting value for the minimum slope is not declared.

So, we determined the critical slope threshold using the Runoff Curve Number, developed by the USDA Natural Resources Conservation Services (USDA-SCS, 1985) and using the method proposed by Hawkins et al. (2002) for the calculation of the effective precipitation, fixing the threshold slope at 40% .



5. Development of the map of the interdicted area:

we developed a suitability map considering the informations developed at stage 4 with more additional restrictions based on the proximity of urban centers and infrastructures, water sources and sensitive points (for each farm).