**Crops organically fertilized**: Cereals, forage, pulses, fresh fruits, dried fruits, vineyards, olive groves, intensive pastures

**Crops ONLY synthetically fertilized**: Horticulture, industry

**Manure mechanism**: Manure is distributed according to the ruminant and non-ruminant specifications. Crop application proportions (as % of manure N spread) are derived from an AHP. There may be manure surplus if total manure N FRV exceeds crop N requirements. In such cases, crop manure application rates is assumed to be crop N requirements.

**Biosolids mechanism**: Biosolids are often purchased on purpose by the farmers, therefore we assumed all biosolids are applied with no left space for biosolids mechanism. To make sure this occurs, sludge N was distributed according to crop fractions comparatively to total crop acreage where biosolids can be applied.

fcrop = Acrop / ∑ AALLCROPS

Accordingly, sludge N crop application rates were calculated as well as crop sludge N FRV

**Synthetic fertiliser mechanism**: Based on manure and biosolids mechanism. Briefly, synthetic fertilisers for organically fertilized crops were calculated as given:

FertNcrop = CropNreqcrop – ManureFRVcrop – BiosolidsFRVcrop > 0

Horticulture and industry crops were assumed to be only satisfied through synthetic fertilisers, so:

FertNhorticulture, industry = FertNratehorticulture, industry

Pseudocode and narrative:

1 – Calculate crop manure N\_FRV

2 – Calculate manure crop application rates

***man N demand = Crop N requirements – crop manure N\_FRV***

# condition 1: if man N demand <0 && ha>0, manure\_app <- crop N req / ha

# condition 2: if man N demand > 0 && ha>0, manure\_app <- manure\_H / ha

# condition 3: if man N demand = 0 && ha>0, manure\_app <- 0

3 – Calculate manure surplus

if man N demand < 0 && ha>0, manure surplus = man N demand \* -1

4 – Calculate sludge N

4.1 – Distribute Lisbon’s sludge N to the remaining AML’s municipality

5 – Distribute sludge N to crops and calculate sludge N FRV accordingly.

6 – Calculate organically fertilized crop N