Environmental assessment of sludge spreading practices and equipments : A simplified LCA tool (acv3E) designed for stakeholders

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acv3E – a tool resulting from scientific research

- **ECODEFI project (NRA funding - 2007-2011) =>** Ecodesign and development of assessment methods for innovative spreading technologies

    => Reposition environmental aims in the heart of technologies design

- **3 main methodological issues**
    - Adapt Life Cycle Analysis (LCA) methods by developing data sources on specific impacts (nitrogen pollutions, soil compaction effects …)
    - Set up specific eco-evaluation protocols in order to quantify relevant technological parameters (experimental approach)
    - Support manufacturers R&D activities by editing practical guides and tools devoted to small enterprises.

Development of a simplified LCA tool (acv3E) to help stakeholders to better understand the environmental contributions of sewage sludge spreading process

acv3E objectives

- **Educational**
  - Expose a wide public to multicriteria results of LCA (main impact comprehension, pollution transfer problematic…)
    - » All audiences

- **Spreading scenario optimisation**
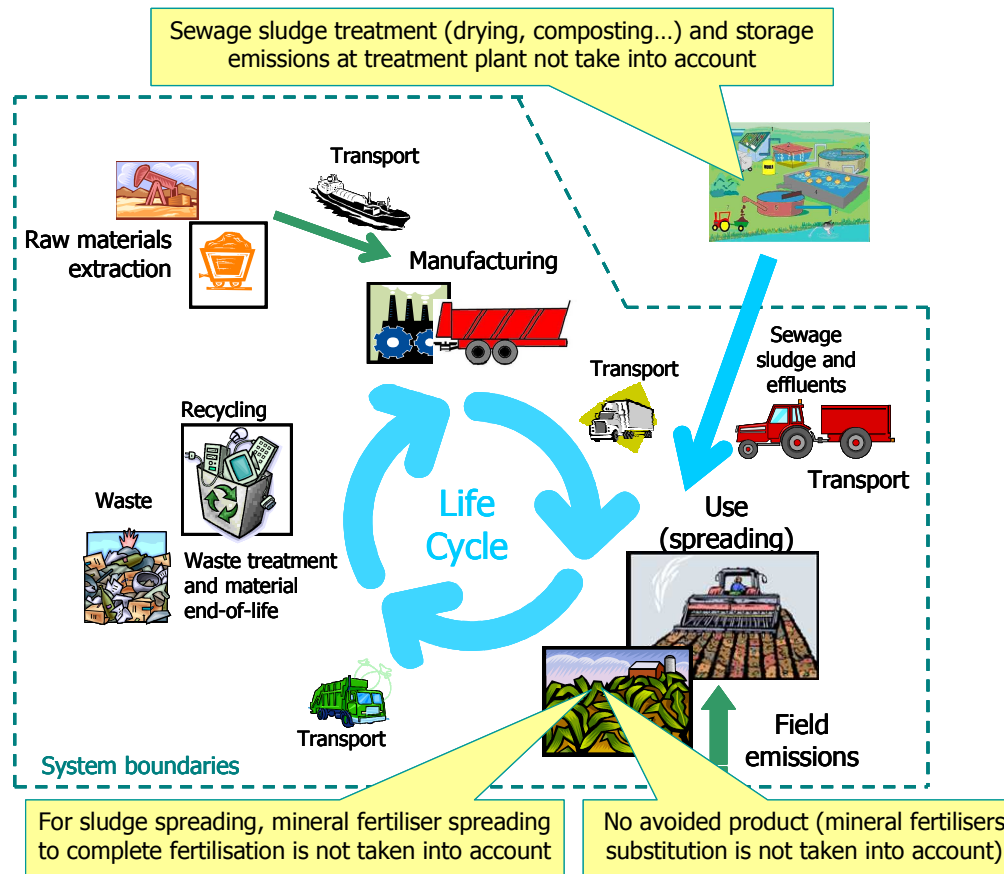 - Allow a rough estimate of environmental impacts for each step of a sludge spreading scenario
    - » Agricultural works companies specialised in spreading operation and other stakeholders dealing with spreading (public administration, private companies…)

- **Spreading machine ecodesign**
  - Additional tool of an ecodesign guide used to show the main emissions generated through the logistic and spreading phases
    - » Spreader manufacturers
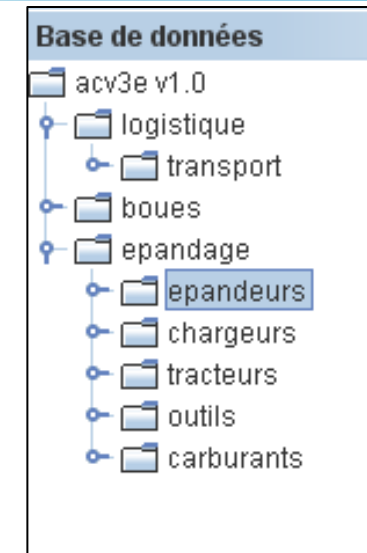
System boundaries and functional unit used for acv3E

Sewage sludge treatment (drying, composting...) and storage emissions at treatment plant not take into account

Raw materials extraction

Transport

Manufacturing

Transport

Sewage sludge and effluents

Transport

Recycling

Waste

Waste treatment and material end-of-life

Life Cycle

Use (spreading)

Field emissions

Transport

System boundaries

For sludge spreading, mineral fertiliser spreading to complete fertilisation is not taken into account

No avoided product (mineral fertilisers substitution is not taken into account)

Functional unit :
1 dry matter ton of sewage sludge spread in the field

This FU takes into consideration both the respect of legislation and an application rate calculated on the basis of the nutrient, which first fits the plant requirements

acv3E software structure

- **A « Database » frame**

Sludge spreading capability

Simplified LCA characterisation values

Spreader technological performances such as application rate, soil compaction, spatial distribution…

acv3E software structure

- **A « spreading scenario » frame**

Logistic => sludge transport from the WWTP to the field with possible intermediate storage, choice of application rate and travelling distance

Spreading => choice of the spreading equipment and spreading characteristics

Incorporation (optional) => choice of the incorporation equipment and incorporation characteristics

nouveau scénario

Nom scénario 6

Auteur

Créé le 24 janv. 2011

Métadonnées

Logistique

Transport par train de marchandise

Distance de transport entre le site de stockage initial et le bord de parcelle (km) 0

Boue Boue liquide à 6%MS

Dose à épandre (masse brute) 0 t/ha

Epandage

Epandeur

Profondeur d'enfouissement (cm) nc

Tracteur

Consommation 0 l/h (conso moyenne)

Carburant Fabrication du fuel et émissions liées à la combustion du fuel pour un tracteur

Chargeur

Rendement total du chantier 0 ha/h

% de temps de chargement 0

☐ Enfouissement (second passage)

○ dans les 24h suivant l'épandage

○ au-delà de 24h après l'épandage

Tracteur

Consommation 0 l/h (conso moyenne)

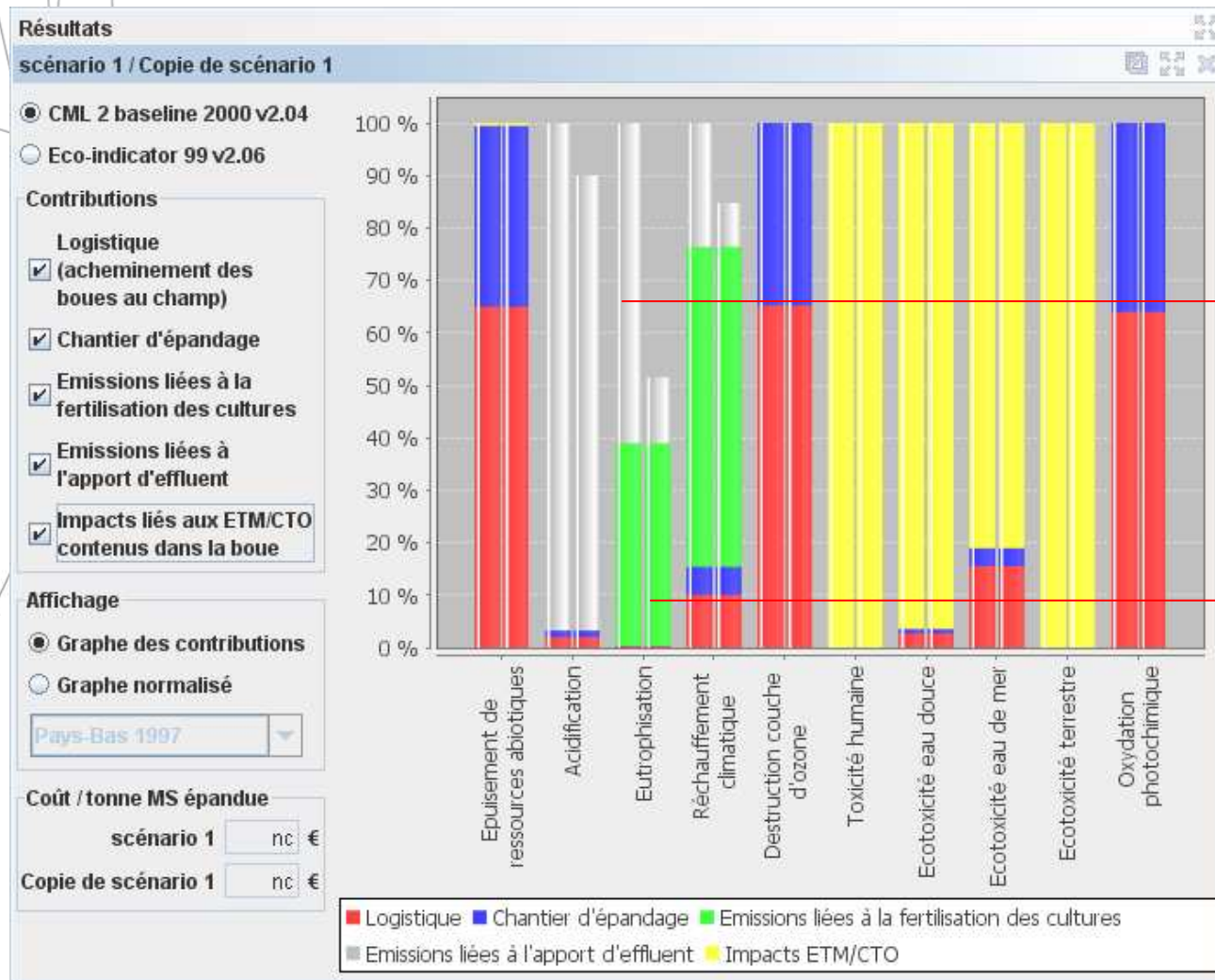Carburant Fabrication du fuel et émissions liées à la combustion du fuel pour un tracteur

Outil Cover crop - petit gabarit

Rendement du chantier d'enfouissement 0 ha/h

Ok   Annuler

acv3E software structure

- ## A « Results » frame
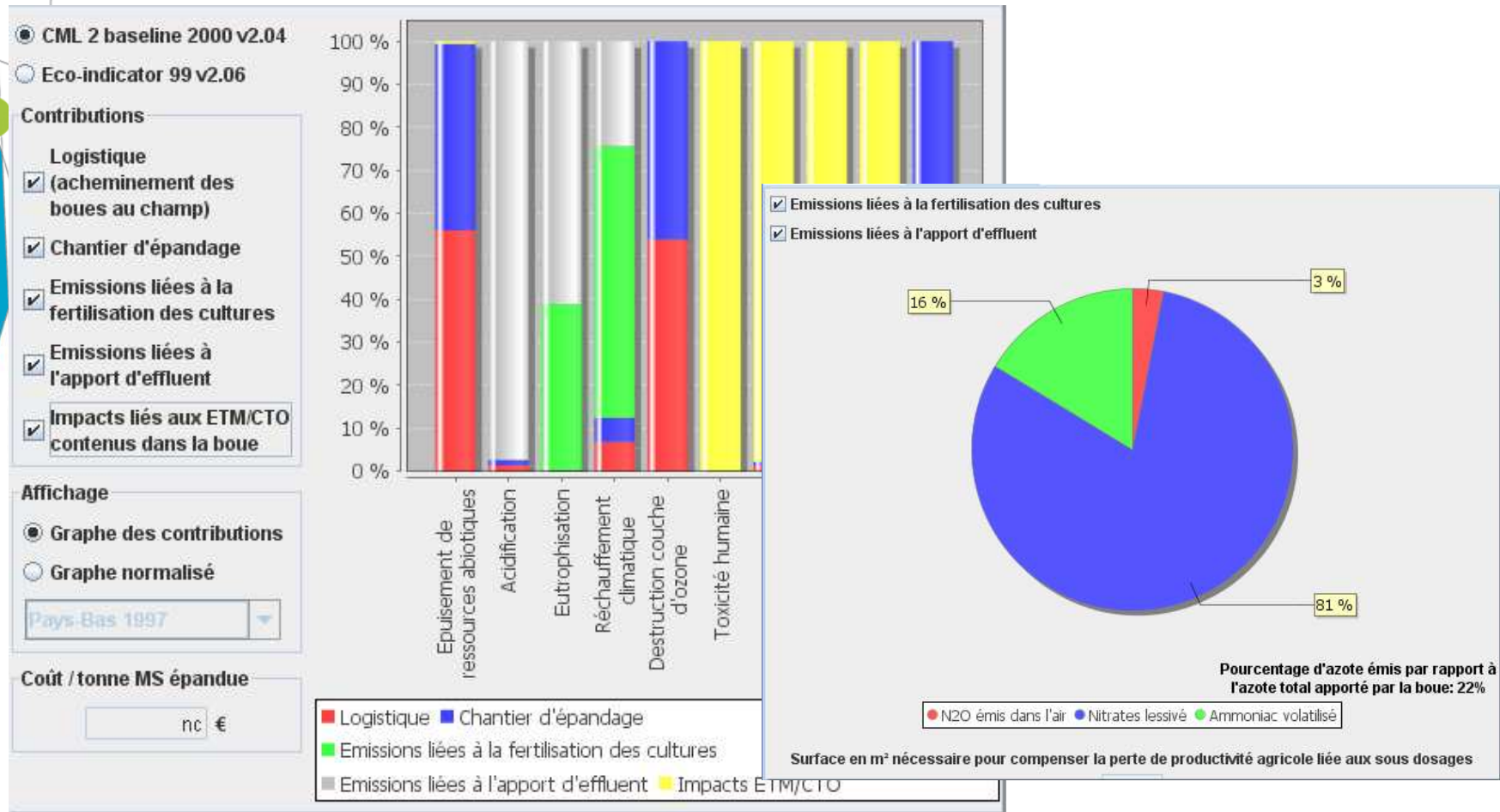
Example of acv3E outputs

- **Scenario characteristics**
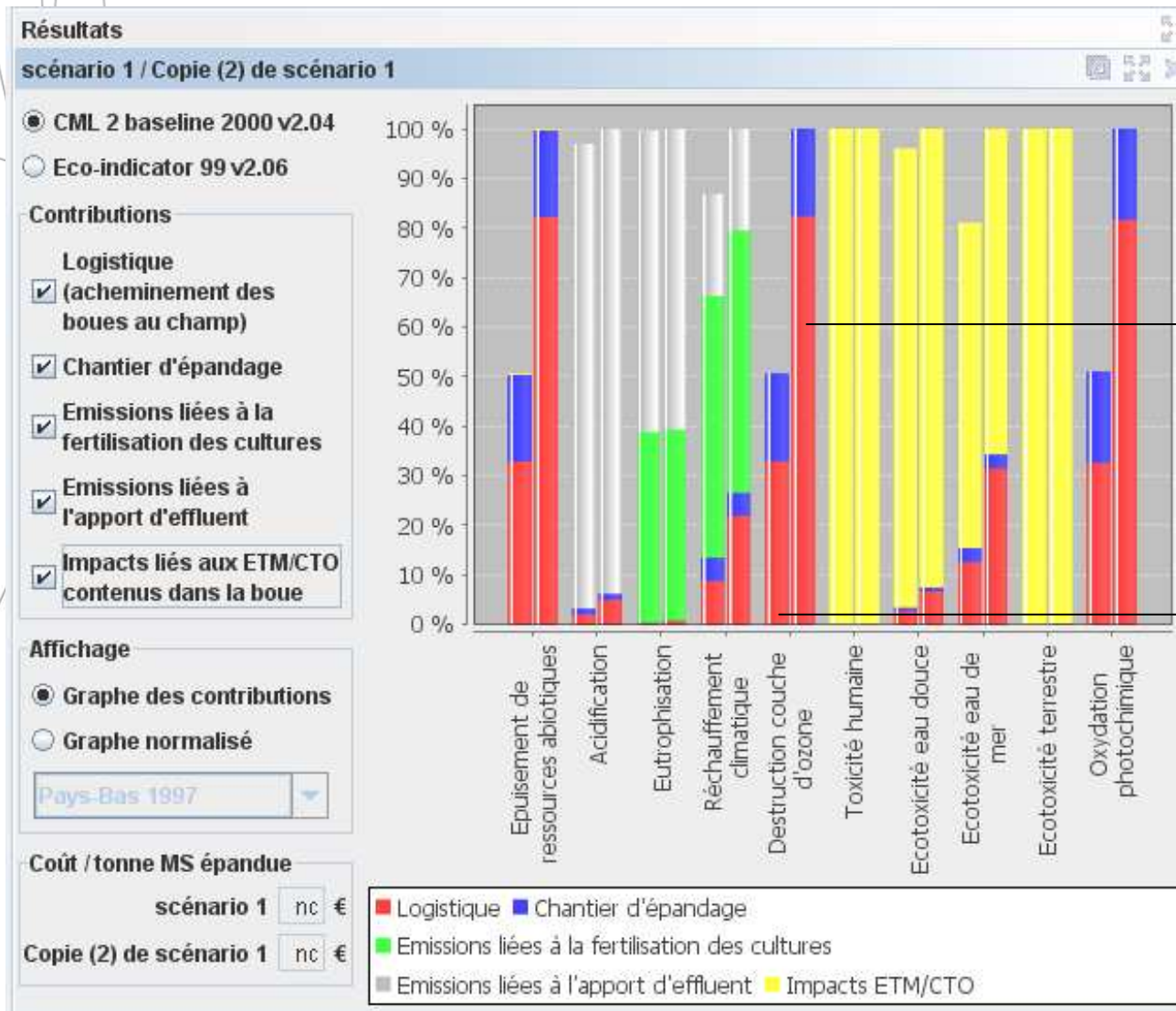
Using CML 2 baseline

Liquid sewage sludge spreading results with the real technological spreader performances

Liquid sewage sludge spreading results with the ideal technological spreader performances

Example of scenario comparison for a spreading management use

Using CML 2 baseline

4 km distance from the WWTP to the field

10 km distance from the WWTP to the field

Conclusion

- **Simplified LCA tool**

  and/or

- **Recommendations based on « static » and « definitive » LCA report established with « theoretical » scenarios?**

Conclusion

- **Simplified LCA tool**

  > **Relevant for local stakeholders** in order to optimise spreading scenario using local available technologies and conditions

  > **Infinite quantity** of scenarios can be assessed

  > **Educational** approach

Some perspectives

⇨ Adapt acv3E to other effluent (slurry, manure)

⇨ Translate acv3E for an European use

⇨ …