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International Conference on Soils, Sediments and Water

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Soils and ecological transition

The levers linking agricultural policy, value chain and farmers to take action

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Liens entre changement climatique et usage des terres : Un nouveau rapport alarmant du GIEC

« Changement climatique, désertification, dégradation des sols, gestion durable des terres, sécurité alimentaire, flux de gaz à effet de serre dans les écosystèmes terrestres », voilà le vaste programme sur lequel se sont penchées les délégations de 195 pays membres du Giec réunis à huis clos à Genève depuis vendredi 2 août. Décryptage.

Rédigé par **Séverine Bascot**, le 8 Aug 2019, à 11 h 40 min

RÉCHAUFFEMENT CLIMATIQUE

Le Giec alerte sur la dégradation des terres de la planète

Par Christophe Josset,
publié le 08/08/2019 à 10:00 , mis à jour à 10:03


Le nouveau rapport du Giec se penche sur notre usage des terres, dont la qualité est altérée par le dérèglement climatique. (En photo: l'assèchement du lac Laguna de Aculeo, au Chili.) REUTERS/Matias Delacroix

Agriculture, déforestation, urbanisation... De plus en plus exploités, les sols perdent en

NEWSLETTER L'EXPRESS

RAPPORT SPÉCIAL DU GIEC SUR LE CHANGEMENT CLIMATIQUE ET L'UTILISATION DES SOLS

Le jeudi 8 août 2019, le Giec a publié son Rapport spécial sur le changement climatique, la désertification, la dégradation des sols, la gestion durable des terres, la sécurité alimentaire et les flux de gaz à effet de serre dans les écosystèmes terrestres, approuvé lors de la 50e session plénière du Giec (Genève, 2-6 août 2019).

Soil degradation and soil organic carbon

- World soils are under threats
- Soil functions form the key of arch of ecosystem services
- Soil quality « the ability of soil to function » is depending on Soil Organic Carbon at first
  - Humus → Soil Organic Carbon

Intensified agriculture and SOC loss

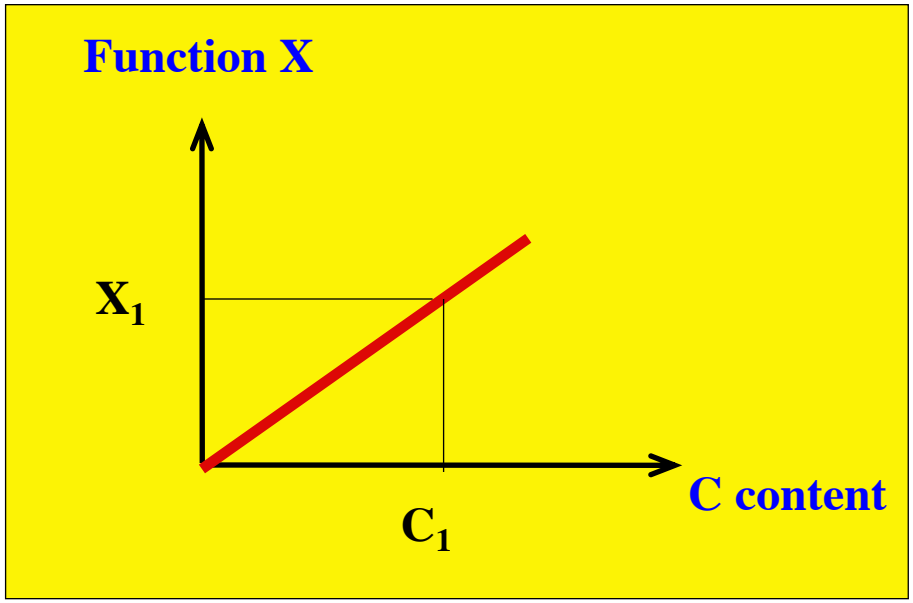
- Intensification – shortened rotations – residue exportation etc.
- Deep ploughing, powerful trucks → ↗weight and speed
- Carbon loss

Cultivated soils have lost 50-70% of their SOC *(Lal, 2009)*

(nach TRACHSEL, 2007)

Background

- Organic matter (OM) is **the major indicator** of soil quality – (co)determining most soil parameters and functions **linearly**.



- Porosity
- Water retention
- Aeration
- Infiltration
- Bearing
- Stability – mechanical properties
- Nutrients
- Biological activity
- Biodiversity
- Water depuration
- Etc.

Break point?

- Agricultural business model to its end
- Soil degradation - environmental hazards
- Working-poor farmers
- Food security
- Consumers demand
- Etc.

Harvard Business Review

Social Responsibility | 181 Top CEOs Have Realized Companies Nee

SOCIAL RESPONSIBILITY

181 Top CEOs Have Realized Companies Need a Purpose Beyond Profit

by Claudine Gartenberg and George Serafeim

August 20, 2019

Summary Save Share 18 Comment Print $8.95 Buy Copies

Climate change

Climat change and agriculture

" An annual increase of the world soil organic carbon by 4‰ (or 0,4%) of its value can halt the annual increase in CO_2 in the atmosphere "

The 4per1000 Initiative, COP21 (2015)

Source: UNID

Storing CO_2 as soil organic matter (SOM) is the only NET that is both effective, affordable and immediately deployable at large scale

EASAC (2018-2019)

4/1000

$MO_{Year2} - MO_{Year1} = MO_{Année1} * 4/1000$

4 PER 1000

CARBON SEQUESTRATION IN SOILS FOR FOOD SECURITY AND THE CLIMATE

The quantity of carbon contained in the atmosphere increases by 4.3 billion tons every year

+ 4.3 bn tons carbon / year

CO_2 emissions

Human activities ⊕⊕⊕⊕

Deforestation ⊕

Forests ⊙⊙

Oceans ⊙⊙

⊙ absorption ⊕ emission

The world's soils contain 1 500 billion tons of carbon in the form of organic material

absorption of CO_2 by plants

storage of organic carbon in soils

1 500 bn tons carbon

While pursuing the indespensible effort to decrease drastically the green house gases (GHG) emissions due to human activities, increasing soil organic carbon sequestration could make a substantial contribution to GHG mitigation efforts. A theoretical annual increase of the world soil organic carbon stock by 0.4% of its value would be larger than the 2015 annual increase in CO_2 in the atmosphere, which is a major contributor to the greenhouse effect and climate change : this is the origin of the "4 per 1000" title of this initiative.

increased absorption of CO_2 by plants : farmlands, meadows, forests…

+4‰ carbon storage in the world's soils

soils better able to cope with the effects of climate change

= less CO_2 in the atmosphere

HOW CAN SOILS STORE MORE CARBON?

The more soil is covered, the richer it will be in organic material and therefore in carbon.
Until now, the combat against global warming has largely focused on the protection and restoration of forests.
In addition to forests, we must encourage more plant cover in all its forms.

- Never leave soil bare and work it less, for example by using no-till methods
- Introduce more intermediate crops, more row intercropping and more grass strips
- Add to the hedges at field boundaries and develop agroforestry
- Optimize pasture management – with longer grazing periods, for example
- Restore land in poor condition e.g. the world's arid and semi-arid regions
- Improve water and fertilizers management and use organic fertilizers and compost

This way ?

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Is Conservation Agriculture working? A conflicting and confusing research issue

frontiers in Environmental Science

EDITORIAL
published: 12 November 2018
doi: 10.3389/fenvs.2018.00135

Geoderma 292 (2017) 59–86

Contents lists available at ScienceDirect

Geoderma

Geoderma 309 (2018) 118–123

Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment 188 (2014) 134–146

Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment

journal homepage: www.elsevier.com/locate/agee

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David S. Powl
and Kenneth

hes·so
Haute Ecole Spécialisée de Suisse occidentale

Long-term effect of contrasted tillage and crop management on soil carbon dynamics during 41 years

Bassem Dimassi[a], Bruno Mary[a,*], Richard Wylleman[c], Jérôme Labreuche[b], Daniel Couture[b], François Piraux[b], Jean-Pierre Cohan[b]

How much organic matter do we need in our soils ?

- Let's focus on cropped – arable land, A horizon
- Theories have changed with time
- There is few available data indeed, current recommendations, if existing, are not science-based
- Now available

OM:Clay and structure quality

Geoderma 302 (2017) 14–21

Contents lists available at ScienceDirect

Geoderma

journal homepage: www.elsevier.com/locate/geoderma

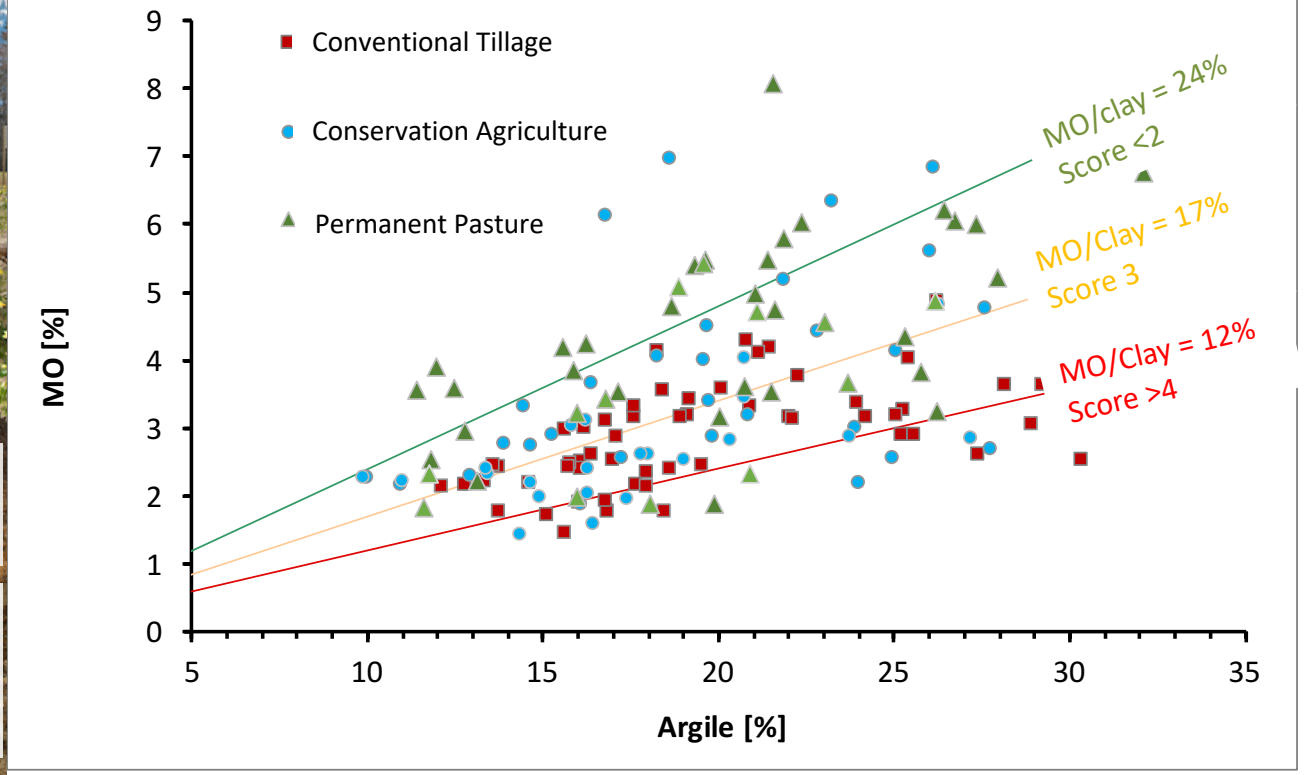
Optimal organic carbon values for soil structure quality of arable soils. Does clay content matter?

Alice Johannes[a,b,c], Adrien Matter[a], Rainer Schulin[b], Peter Weisskopf[c], Philippe C. Baveye[d], Pascal Boivin[a]

Structure quality and MO:clay are proportional

The higher the clay content – the more OM is needed for the same quality

< 2 fair ; 3: limit value ; > 4 degraded

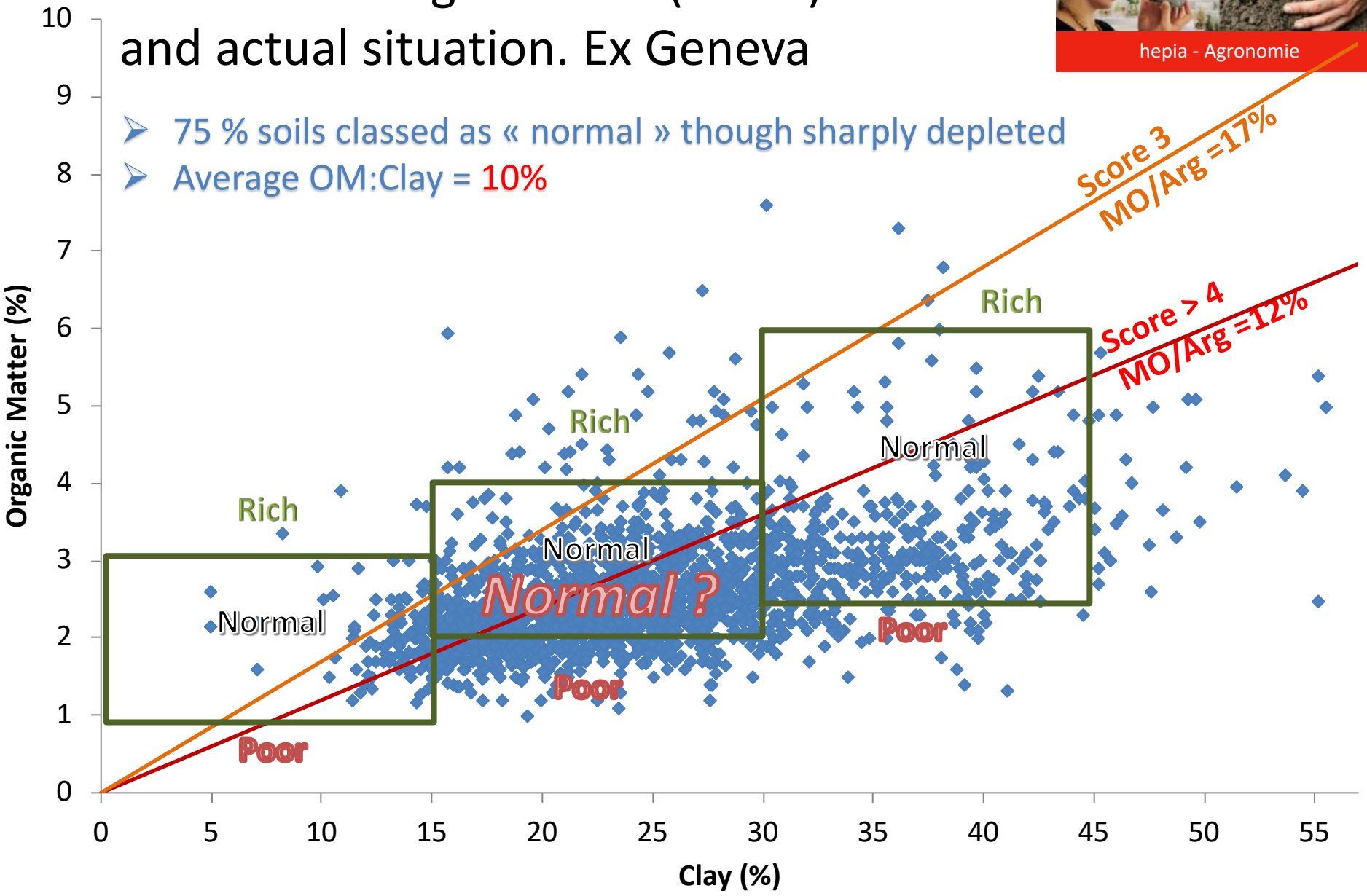


SOC : Soil Organic Carbon ; OM : Soil organic matter

OM = SOC X 1.734

Current Swiss guidelines (OFAG) and actual situation. Ex Geneva

- 75 % soils classed as « normal » though sharply depleted
- Average OM:Clay = 10%



Swiss Jura Arable land – Median = 12%

Temporary pastures + Cattle

OM:Clay should be 17%
A soil fertility target
A new sequestration potential calculation

MO:Clay = 24%
MO:Clay = 17%
MO:Clay = 12%

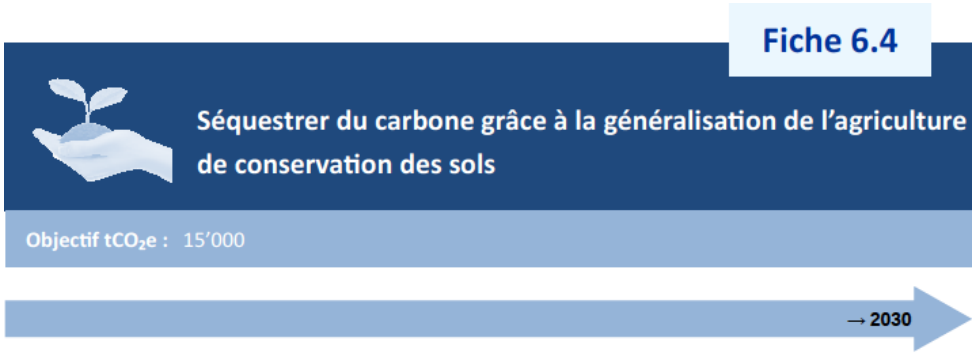
MO %

Clay %

Intersoil2020

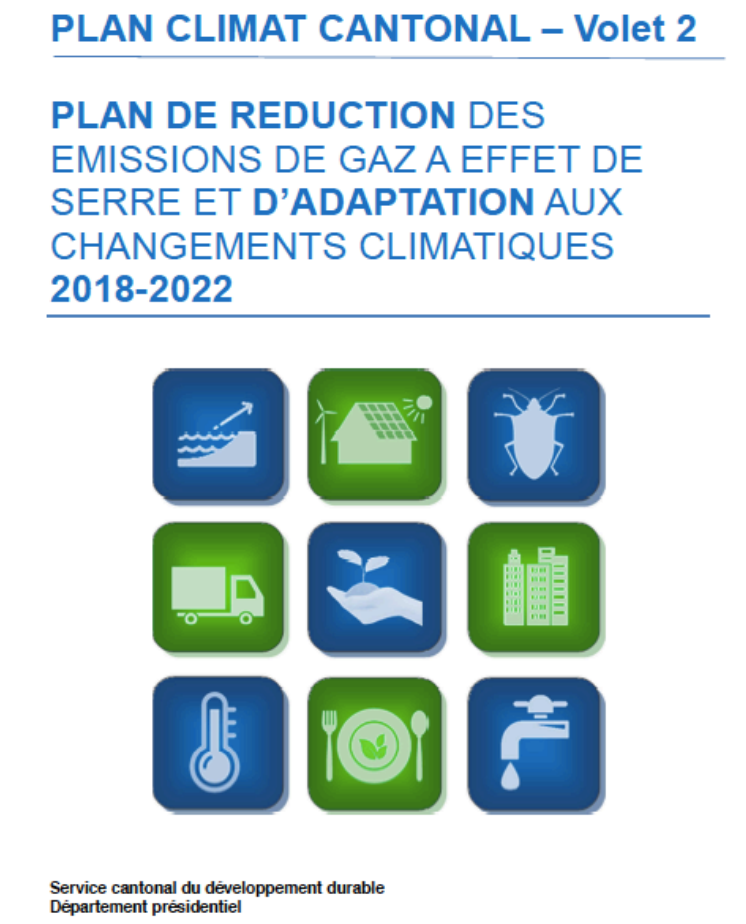
Geneva Climate Plan

- Objectif 2030 : -1’700’000 t CO_2
- Goal 6.4: 15’000 t / y in arable land
- Deficit≈ 700’000 t for **minimum soil quality** (70% increase needed)



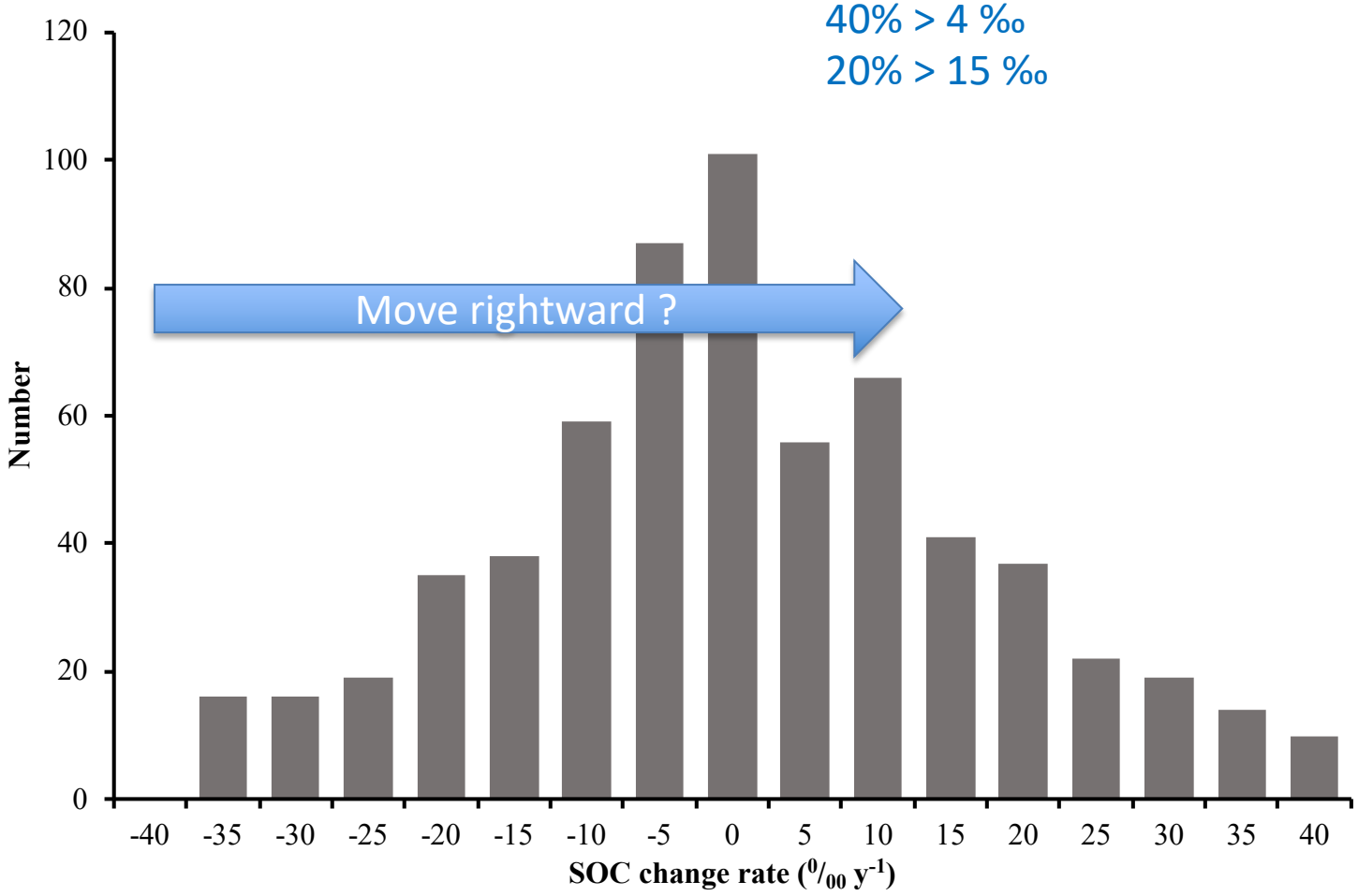
4 ‰ X 30 years : + 13%

Needed for soil: + 70%



Geneva main crops fields
SOC change rate / y

40% > 4 ‰
20% > 15 ‰



Based on 900 monitored fields

Geneva fields - Time trend

1998

- **Cover crops mandatory**
- **4 y rotation min**

y= 0.5942 x + -1191.825

pvalue= 0.0186

Average -4‰

Average +9‰

2008 → TCS … → AC …

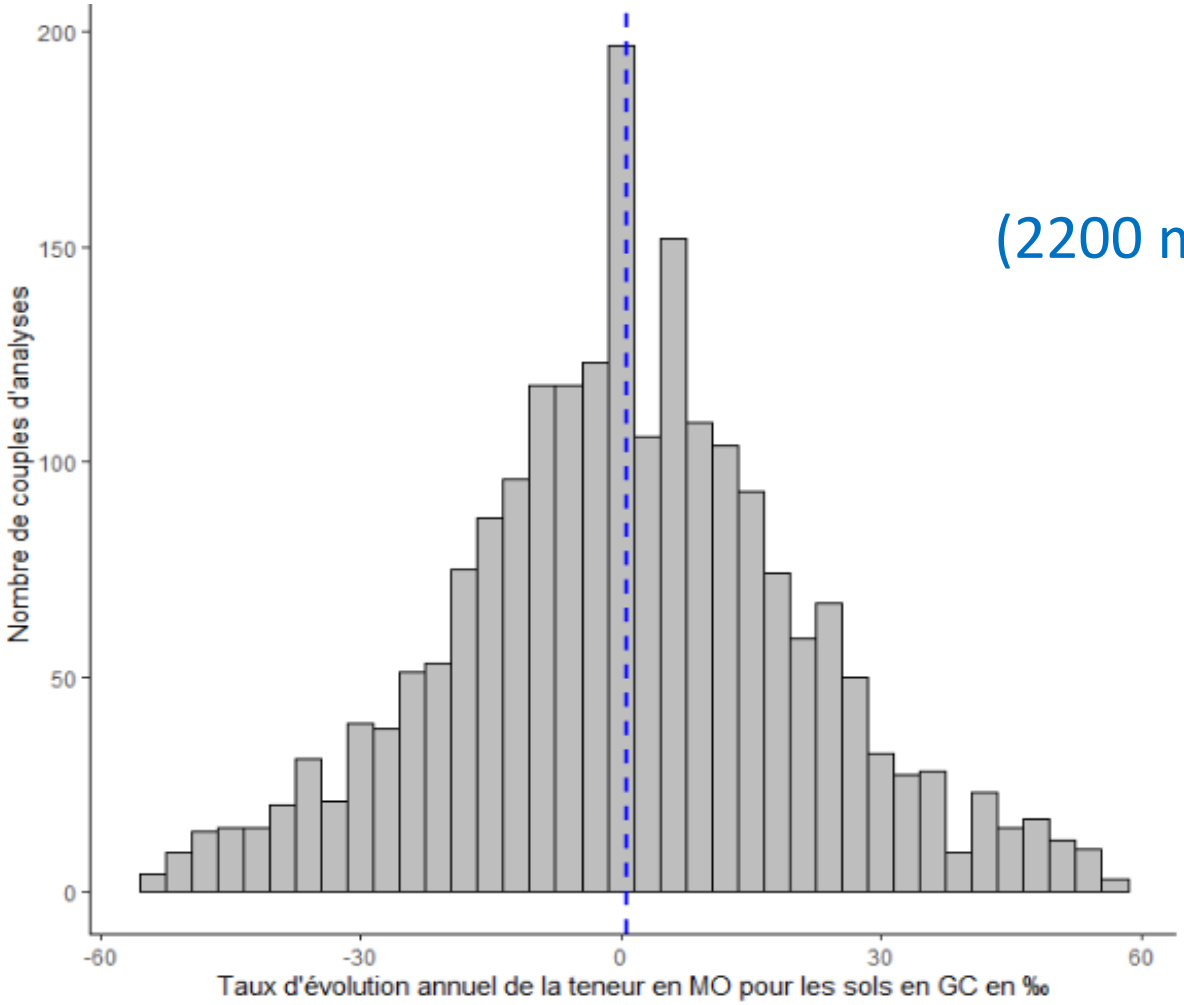
Annual SOC change rate (‰)

100
80
60
40
20
0
-20
-40
-60
-80
-100
-120

1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

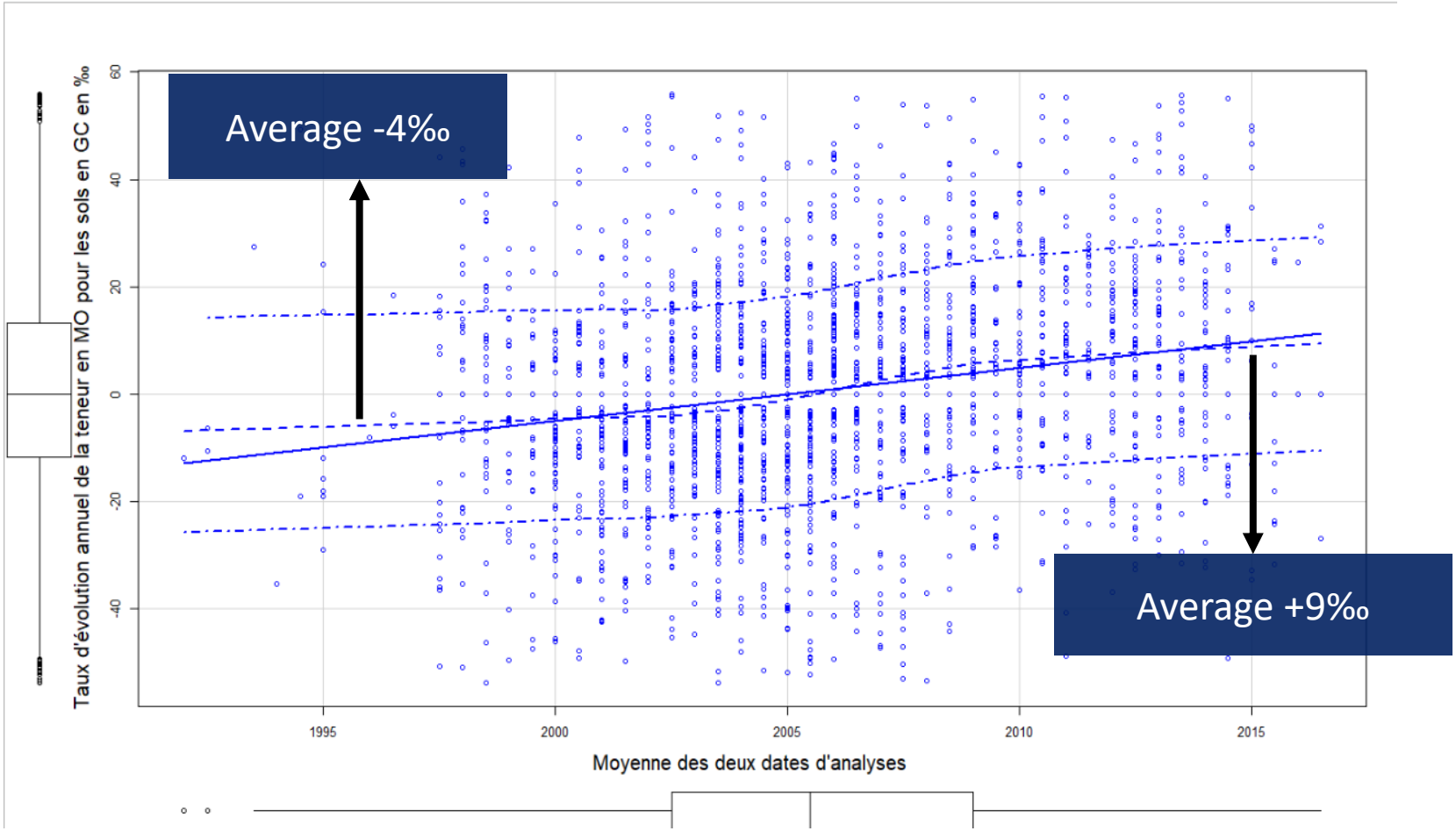
Midyear of calculation period

Vaud fields



(2200 monitored fields)

Vaud – Time trend



Research: Overconclusion, hyperbole and confusion

Agriculture, Ecosystems and Environment 286 (2019) 106654

Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment

journal homepage: www.elsevier.com/locate/agee

Loss of soil organic carbon in Swiss long-term agricultural experiments over a wide range of management practices

S.G. Keel, et al.

Although practices […] might enhance SOC stocks in Switzerland, **these measures will probably not be sufficient to sequester the required amounts of C to reach the goal of the 4 per 1000 initiative**

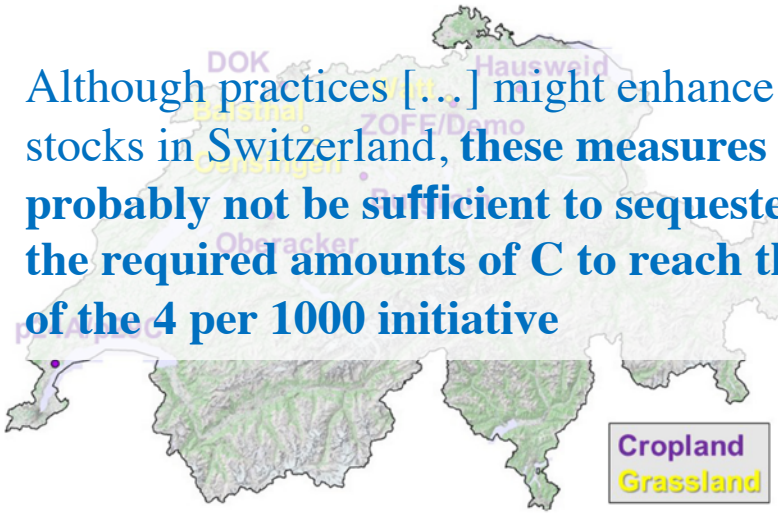
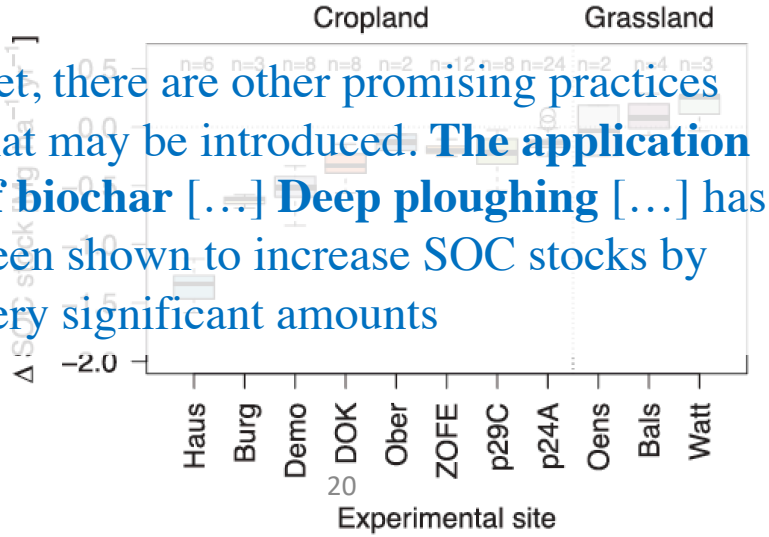


Fig. 1. Map of Switzerland showing location of 11 experimental sites.

Yet, there are other promising practices that may be introduced. **The application of biochar** […] **Deep ploughing** […] has been shown to increase SOC stocks by very significant amounts



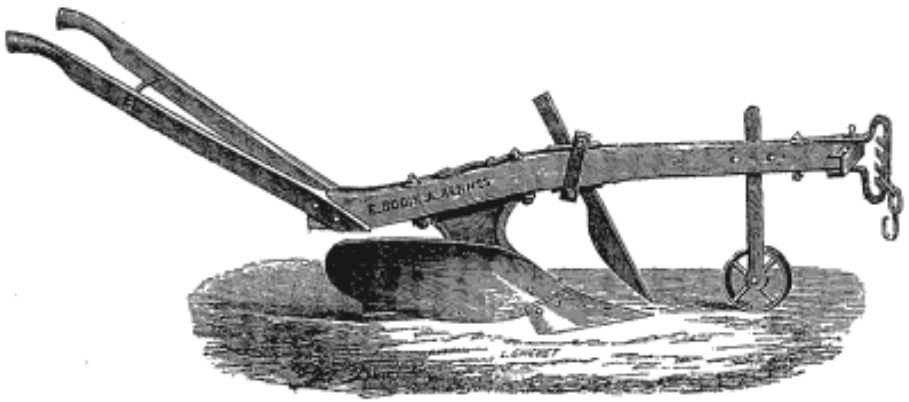
The merry-go-round…

RAPPORT

fait à la Société d'Agriculture de Wassy, par M. C. VAILLANT,
au nom de la 1re Section, sur cette question :

Des labours profonds, de leur utilité et des Instruments propres à les exécuter.

1875



Farmers interviews: what fails and what works ? (200 farms)

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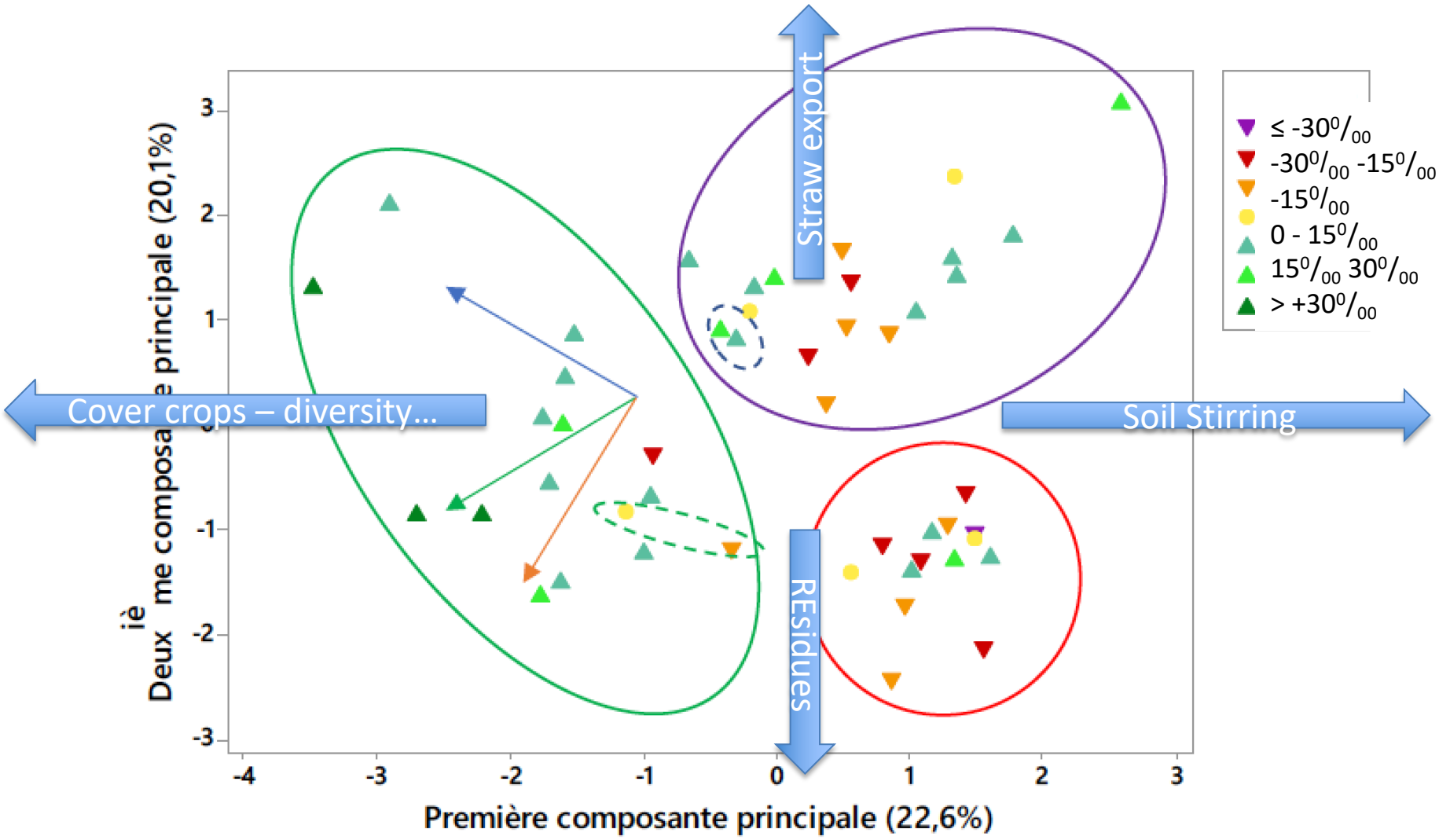

C storage - Main conclusions

- > 20‰ storage rate in average is highly possible in many European arable lands
- Major factors : no unique solution
- Importing carbon (e.g. manure) is not requisite
- Vegetal intensity +++
  - Diversity and continuity of crop cover including main crops
  - Biomass
- Farmers income is at least equal with these methods
- CO_2 emissions are smaller
- It is a matter of policy and management scheme

Result-oriented management schemes

- The failure of action-based schemes
- roAEMs: huge potential to improve Agri environmental results
  - Indicators & Framework requirements

Land Use Policy 30 (2013) 628–641

Contents lists available at SciVerse ScienceDirect

Land Use Policy

journal homepage: www.elsevier.com/locate/landusepol

Review

Result-oriented agri-environmental schemes in Europe and their potential for promoting behavioural change

Rob J.F. Burton[a,*], G. Schwarz[b]

Indicators

- *Indicators should be measurable and identifiable*
- *Indicators should not conflict with agricultural goals*
- *Indicators should be consistent with ecological goals*
- *Indicators should reflect the effort of participating farmers*

  Burton&Schwarz, 2013

- → Design of a result oriented Soil Quality management scheme

  Sauzet et al., 2018

Framework criteria

roAEMs : principal difficulties, requirements and risks (Burton & Schwarz, 2013)

(i) the need for effective indicators

(ii) the risk that farmers will not reach objectives for reasons beyond their control (eg climate, neighborhood)

(iii) lack of proportionality between effort and payment

roAEMs : key dimensions

- *The proportion of income derived from outcomes*
- *The sensitivity of the payment structures*
- *The temporal extent of the contracts and schemes*

Finally

- Farmers largely agree with soil regeneration methods and result-based schemes
  - Opens the door to effective soil regeneration and C storage
- Conservation Agriculture calls for a new business model
  - Major agro-industries have got it
  - They need to be carbon neutral
- Consumers involvement is considered as essential
  - No more labels (action oriented !)
  - Soil score ?
- Technically, ecological transition is feasible and win-win for all actors. Methods are known.
- Are we going to do it ? Is Homo *Sapiens* ?

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23-28 August 2020

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