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## Towards sustainable land & soil carbon management in Laos maize-prone areas

Pascal Lienhard, JC Castella, Bounma Leudphanan, Florent Tivet, Soulikone Chaivanhna *et al.*

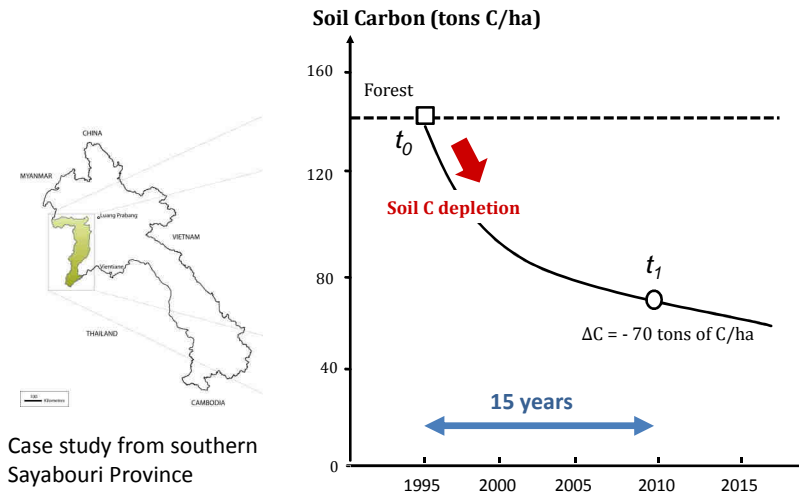
*Soil carbon is what we need! Investing in soils to sustain agriculture in Lao Uplands, Vientiane, IFL, 23 Nov 2017*



## Outline

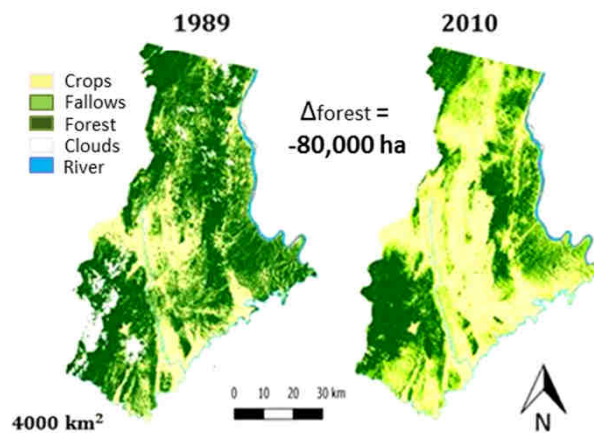
- « Mining » agriculture: case studies from Xieng Khouang and Sayaboury provinces
- Engaging farmers into soil-carbon friendly practises: lessons learnt from a decade of R-D interventions
- What tools and approaches to monitor soil carbon changes at large scale?
- Take home messages

- « Mining » agriculture? Extracting carbon and nutrients from soils with limited to no restitutions to the soils



- Drivers of soil carbon depletion?
  - Local/ environmental factors: climate, soil texture...
  - Human-related factors:

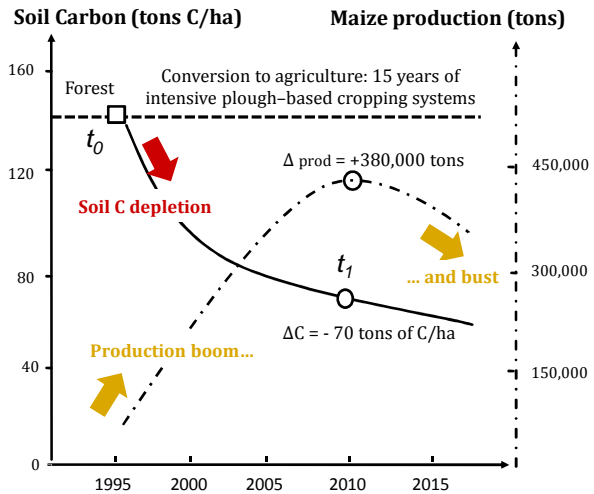
- Deforestation, land conversion to agriculture



▪ Drivers of soil carbon depletion?

– Human-related factors:

- Deforestation, land conversion to agriculture



▪ Drivers of soil carbon depletion?

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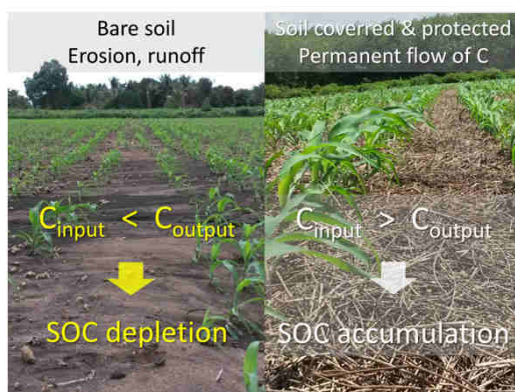
- Deforestation, land conversion to agriculture
- Intensity of soil tillage/disturbance  
*(the more soil disturbance, the more soil C depletion)*



▪ Drivers of soil carbon depletion?

– Human-related factors:

- Deforestation, land conversion to agriculture
- Intensity of soil tillage/disturbance (*the more soil disturbance, the more soil C depletion*)
- The quantity of C input/restitution to the soils (*the more C input, the more soil C accumulation*)



▪ Engaging farmers into soil-carbon friendly practises?

- 2003 – 2009: Promotion of conservation agriculture (CA)



Permanent soil cover

Minimum soil disturbance  
and no burning



Diversified crop rotations



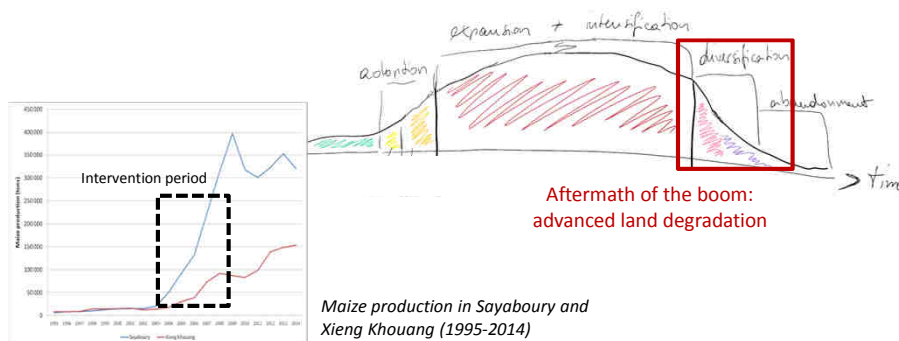


- Engaging farmers into soil-carbon friendly practises?
  - 2003 – 2009: Promotion of conservation agriculture
    - Promising results (soil C, gross margin) at plot scale / model farmer ([https://www.youtube.com/watch?v=cr\\_9I-kyiXo](https://www.youtube.com/watch?v=cr_9I-kyiXo) )
    - Limited adoption at larger scale, after project end
  - Issues for large-scale adoption/dissemination?
    - **Technical** issues: managing multi-cropping systems, sowing in a mulch, rodents/insects
    - Economic/**value chain** issues: market for secondary crops, access to equipments (no-till planters)
    - **Organisational** issues: animal free roaming

*After main crop harvest, animals are left roaming freely in the whole village territory. Animal free roaming is a major constraint to the adoption of agroecological practices, e.g. need to protect cover plants and crop residues in conservation agriculture.*



- Engaging farmers into soil-carbon friendly practises?
- Issues for large-scale adoption/dissemination?
  - **Windows of opportunity**
    - **Limited technical intervention** possible during the expansion-intensification phase of the boom,
    - Main opportunity windows for intervention -> distress diversification



- Engaging farmers into soil-carbon friendly practises?
- Since 2015: Participatory landscape approaches
  - Participatory identification and financial support for the protection / **permanent fencing** of crop and livestock areas (*relay crops/residues Mgt*)
  - Improving communication and negotiation processes using **role play games** to foster interactions / negotiations between players, reflexion on inter-individual and spatial coordination (*secondary crops Dvpt*)
  - Facilitation of **value chain development** to foster diversification crops (e.g soybean) (*diversification of fresh organic matter restitutions*)
  - Entry point with **diversification** with legume crop rather than no-till



Impact on soil carbon? Tools & approaches for soil carbon monitoring?

Low tech



High tech

In situ visual assessment:

- Surface soil color (*the darker, the richer in C*)
- Surface soil odor (*the more pungent, « earthy » odor, the richer in C*)
- Soil erosion (*the more gullies, the more degraded is the soil*)

No calibration  
Depends on the observer

In situ assessment:

- Soil biological activity (*the more insects, ~ the richer in C*)
- Soil microbial respiration (*the higher, the more C output*)
- Permanganate oxidizable C (POxC) (*the higher, the more C input*)

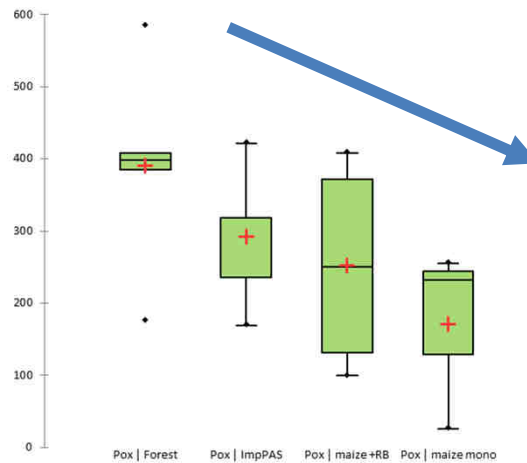
Lab analysis:

- Dry/wet combustion of SOM (*the higher, the richer in C*)

Time and money consuming



Permanganate Oxidizable Carbon  
•POxC



Permanganate Oxidizable C (POxC) (mg C/kg of soil)  
according to land use  
(Nadou village, Xieng Khouang, n=20)

## Take home messages

- Technologies for protecting and rehabilitating land and soil at plot and farm levels are well known

**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

- but are (yet) seldom applied at large scale.

## Take home messages

- Successful adoption – and adaptation – at scale in Laos Uplands context is conditional on our capacity to engage the whole community into the design and implementation of soil-carbon friendly practices & the definition of rules and regulations regarding forest preservation and animal roaming control
- In line with « 4 per 1000 » initiative, **what policy** to support broad-scale dissemination of soil-carbon friendly practices in Laos Uplands?

**4 PER 1000**  
CARBON SEQUESTRATION IN SOILS  
FOR FOOD SECURITY AND THE CLIMATE



***Thank you for your attention !***

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