



CSAM



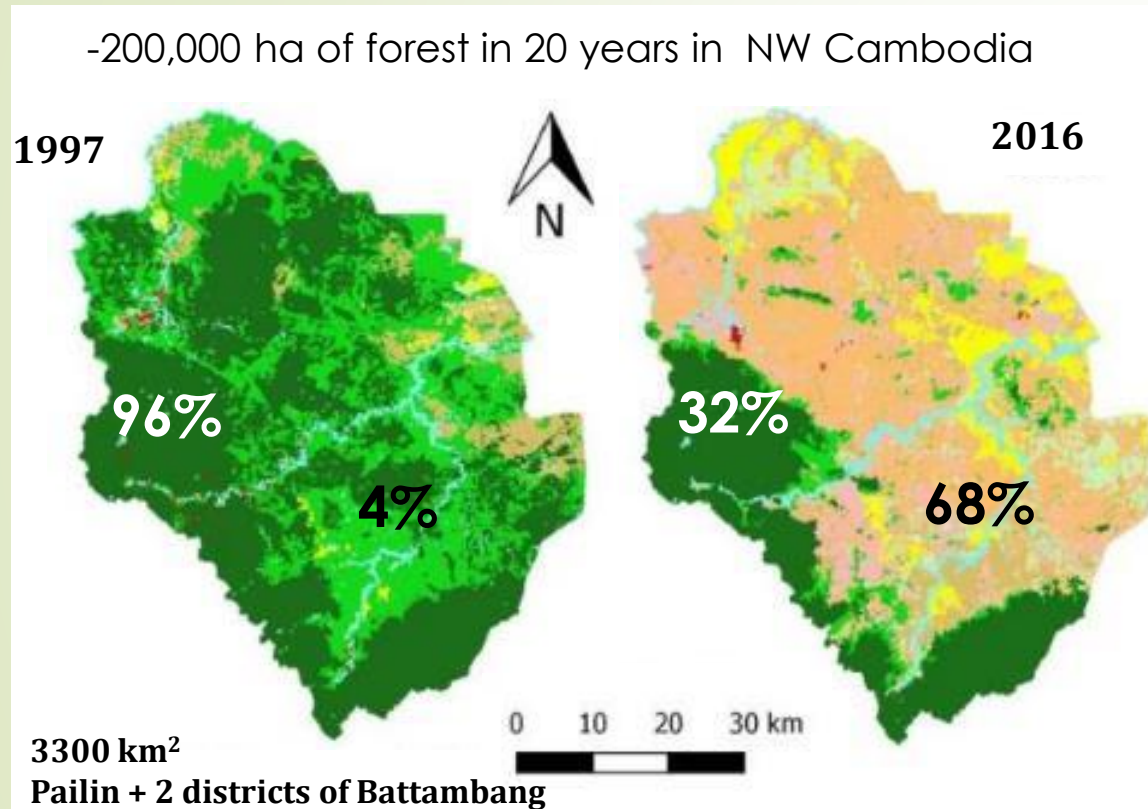
Soil health, no-till cropping systems and appropriate-scale machinery in Cambodia

Presented by Florent TIVET

*Regional Workshop on the Role of Mechanization in Strengthening Smallholders' Resilience through Conservation Agriculture in Asia and the Pacific
18-20 April 2018, Phnom Penh, Cambodia*



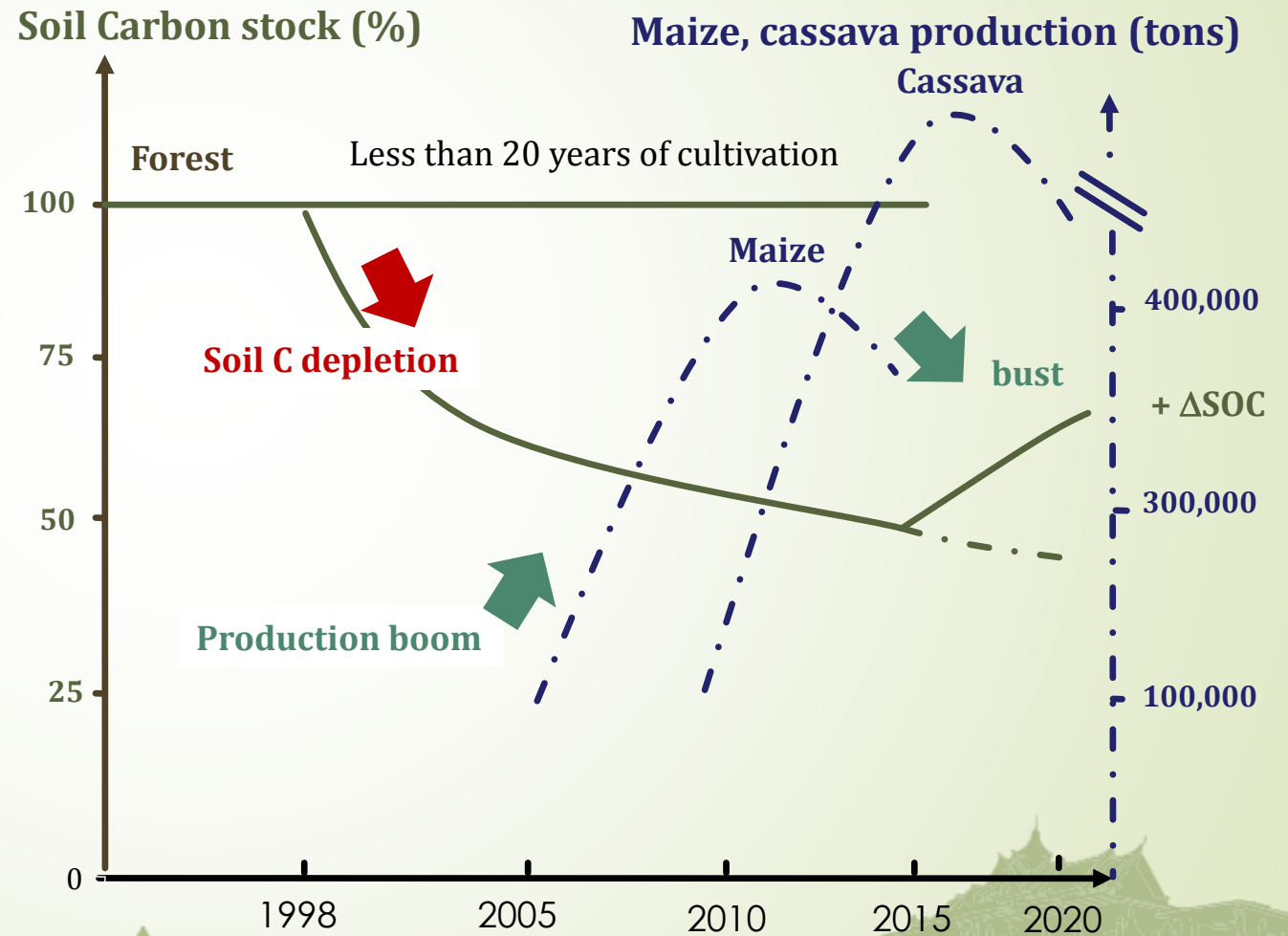
Soil restoration: the engine of economic development, transforming rural communities



Land rehabilitation is extremely important for maintaining the possibilities for vulnerable communities to earn a livelihood from natural resources management.

Kong et al., forthcoming. Applied Geography

Challenges: Invest in Soil Organic C



Soil Organic C as a driver

SOC depletion

$C_{input} < C_{output}$

Bare soil
Erosion, runoff

➔ SOC accumulation

$C_{input} > C_{output}$

Soil protected
Permanent flow of C

Maize under plough-based management

Maize under CA management

Sustain healthy soils and agroecosystems



Different elements should be combined (no-tillage, permanent soil protection, diversified cropping system) ...



Sustain healthy soils and agroecosystems

... **plant and cropping systems diversity are the engine** that drives soil-crop interactions and enhances ecosystem services.



Mix of sorghum, sunnhemp, rice-bean and cowpea



Stylosanthes guianensis

Examples of cover crops – Need for genetic materials and seeds!

A range of cropping systems under CA management - Cambodia

Rice



Soybean



Cassava



Maize, sowing on green cover crops



CA and Appropriate-scale machinery

Consortium RUA/FAE/CESAIN, GDA/DAEng/DALRM, University of Illinois Urbana – Champaign, Kansas State University, CIRAD (USAID funding, Feed the Future, SIIL)



NT planter, roller crimper, seed broadcaster ...

CA-based rice production in the floodplains (41ha, 19hhs)



Sowing rice on green cover crop

- Higher flexibility, high efficiency
- Reduction of production cost
- Towards 0 herbicide
- Quality of the products



NT rice sowing

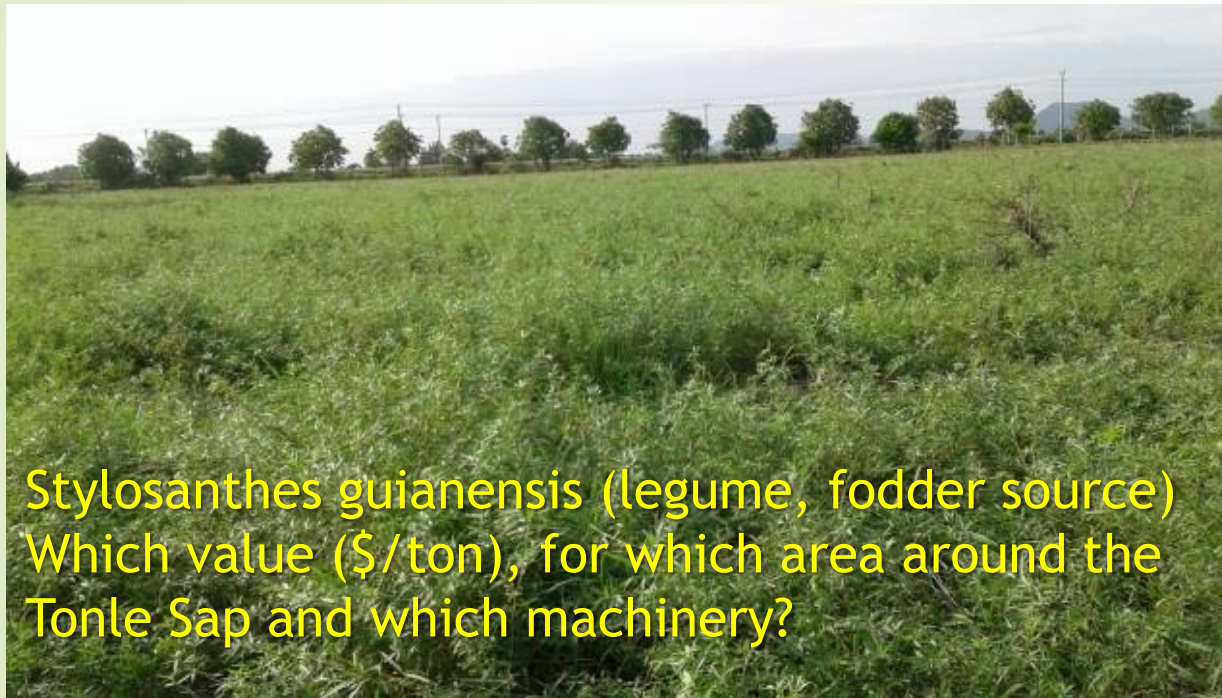


Rice seed broadcasting

- 1 seed broadcaster + 1 roller
- Low investment
- Low operational cost

Floodplains: CA open ways to diversification after rice ... on residual soil moisture

Generate new income, markets, transforming rural communities



Stylosanthes guianensis (legume, fodder source)
Which value (\$/ton), for which area around the Tonle Sap and which machinery?



Sunnhemp
Soil fertility improvement
Potential for seed production in the dry season

700,000 ha of floodplains around the Tonle Sap Lake, bare soil during the dry season, free roaming cattle → production of protein and sustain soil fertility

Floodplains: CA open ways to diversification after rice ... on residual soil moisture

- Increase yield of rice of 1 ton/ha when using mix of cover crops (jasmine rice).
- High demands to use cover crops during dry season both for soil fertility management and fodder sources.
- Expected area of rice sowing + cover crops in 2018: >100 ha (lack of NT planters)

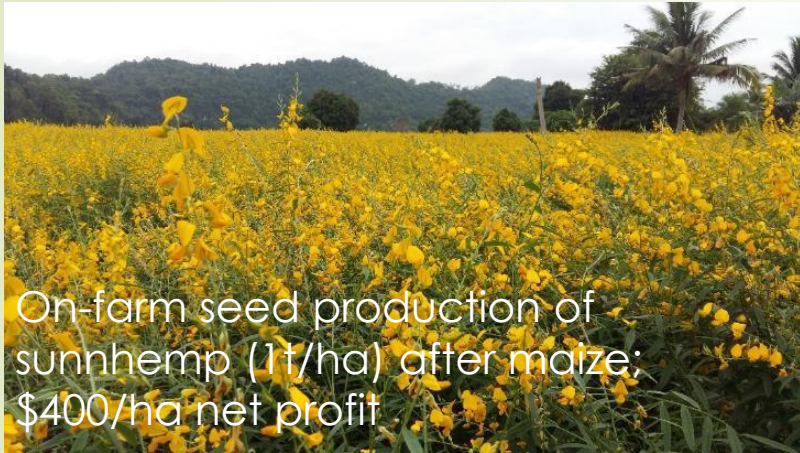


For annual upland crops: maize, cassava...

Farmer network, 2017: 265 ha, 94hhs (only 2 planters operating)
Service: \$40/ha for NT sowing
\$490/ha net profit for maize; +200\$/ha when compared with CT



CA is also about seed production and sharing: example of sunnhemp



On-farm seed production of sunnhemp (1t/ha) after maize; \$400/ha net profit



Farmers shared/purchased seed of juncea with seed producers and established juncea early March as a cover crop before maize (on area going from 1 to 10ha)

Cassava under CA management and diversified cropping systems

Early CA maize



5 to 9t/ha

CA Cassava



25 to 35 t/ha

No plough, no ridge



Mix of cover crops after early maize that will cross the dry season (15 to 20 t DM/ha)

Bos Khnor Station
Field visit on April 20th

Cassava under CA management and diversified cropping systems

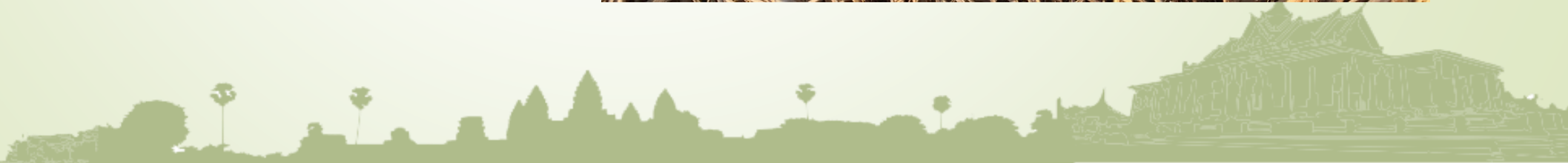


- Offsetting the scarcity of labor force
- Improving cropping efficiency
- Minimizing soil disturbance



A long term effort to show benefits to producers, policymakers ...

- What about the value of 1 t of soil organic C: H_2O , nutrients, O_2 flow, structure ...
- Environmental, economic and social values?



On-farm & long-term experiments - Bos Khnor Station, field visit on 20th

A long term effort and
a collective
investment:

- GDA: DALRM,
DAEng
- RUA, CESAIN, SILL,
CIRAD
- USAID, AFD, CCCA



Cropping system design, germplasm, soil health
assessment, machinery
Scientific recognition
Building a national training centre on Conservation
Agriculture and germplasm preservation/sharing

A long term effort to build technical reference and scientific recognition ...

Using CA combined with plant biodiversity to increase soil fertility and water-use efficiency (experiments and on-farms):

- Increasing soil C from 500 to 1200 kg/ha/year in upland and rice farming.
- Increasing nutrients cycling, soil biota.
- Up to two times water infiltration avoiding runoff, soil erosion and retaining more water in fields.

*Hok et al., 2015, AEE; Hok et al., 2018, STR; Ngoc Le et al., 2018, AEE
Leng et al., forthcoming; Pheap et al., forthcoming*

It's time to scale-up!

- Availability (and affordability) of NT planter.
- Involvement of medium-entrepreneurs, service providers (skills).
- Explore mechanisms (PPP) to support a transition from plough-based to CA management.



It's time to scale-up!

- Policy, implementation and financial mechanism.
- Make CA an integral part of the agenda: (i) to build resilient farming, (ii) to fulfil obligations related to climate change.
- Farm's profitability, attract youth in agriculture, food safety.
- **Identifying the entry point:** example of policy in India to avoid rice straw burning through the combination of straw management system with the Turbo happy seeder (availability, skills).

Advocacy, advertise

Sustainable farming to sustain Cambodia's future



Thanks

florent.tivet@cirad.fr

<https://vimeo.com/121032329>