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Cambodia Center of Conservation Agriculture in Southeast Asia

Manny Reyes, Vira Leng, Florent Tivet, Lyda Hok, Saruth Chan, Stéphane Boulakia, Rada Kong, Veng Sar, Lucien Séguy, Pao Srean, Lor Lytour, Timothy Rendal, Alan Hansen



Sustainable Agriculture in Cambodia: Current knowledge, application and future needs
Siem Reap, Cambodia, August 27-29, 2018





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Thanks to my lovely wife



Dr. Lorna Reyes
Analytics Software
Tester
SAS, Cary, NC



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Thanks to my son Micah

Micah

North Carolina State University,
BS Civil and Environmental
Engineering, and MS in Marine
Sciences; currently designing
various gadgets, 33 years old no
girlfriend. I told him my need to
be a grand dad, he said not yet.



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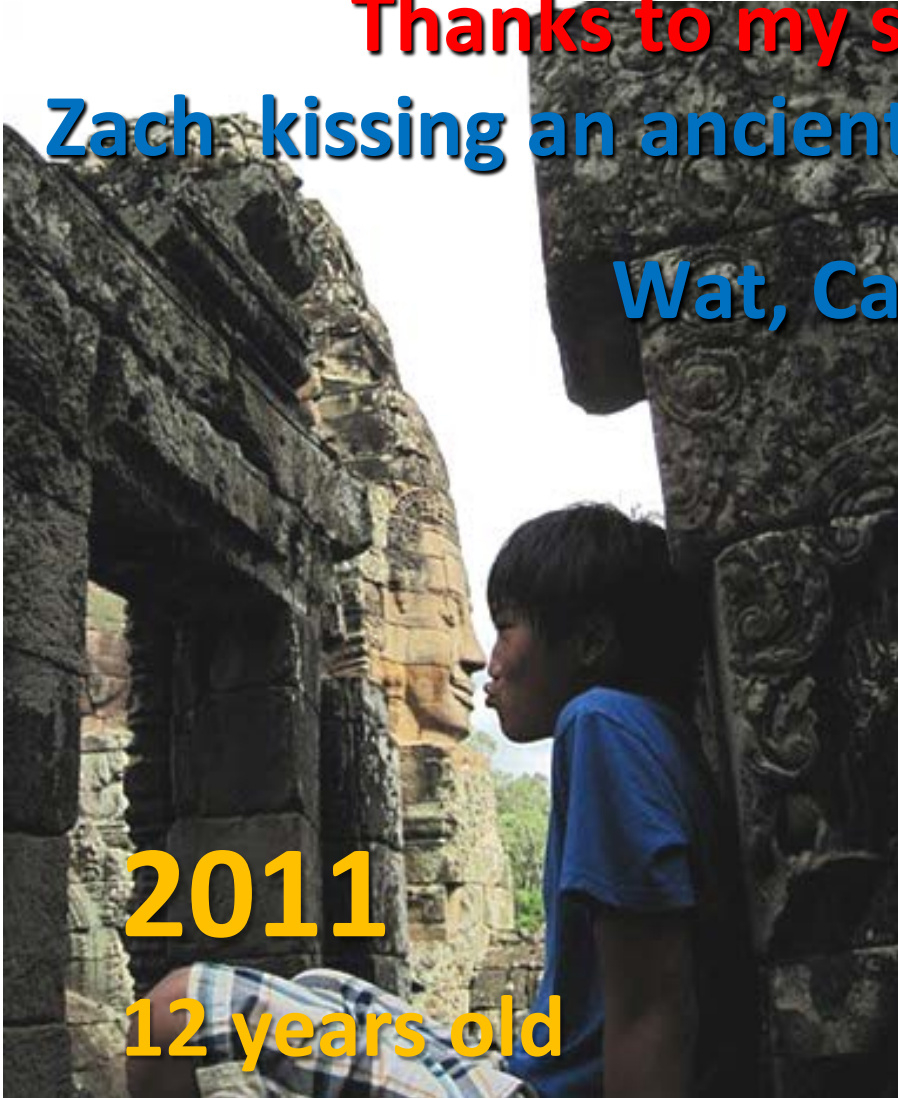
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Thanks to my son Zach

Zach kissing an ancient smiling face in Angkor

Wat, Cambodia



2011

12 years old



2012

13 years old



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Thanks to my son Zach



2013

14 years old

2014

15 years old





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Funding for Study



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SANREM INNOVATION LAB

Feed the Future Innovation Lab for Collaborative Research on Sustainable Agriculture and Natural Resource Management



**French Agency
for International
Development**



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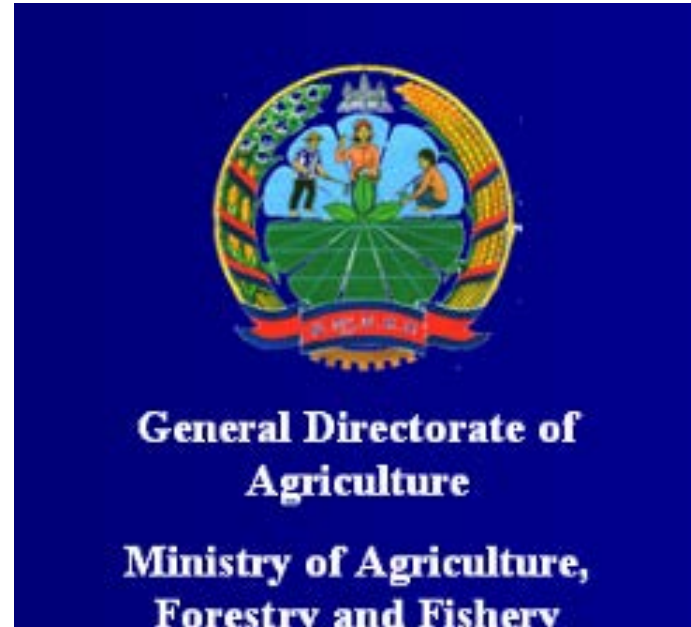
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Strong Partnership 2010 to 2015



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Implementing quality of education & training of the Young
UNiversities in rural area of CAMbodia

UNICAM

Programme countries



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Thanks Dr. Pao Srean and H.E. Rector Sieng Emtotim (UBB) for our partnership



IMPLEMENTING QUALITY OF
EDUCATION & TRAINING OF
THE YOUNG **UN**IVERSITIES IN
RURAL AREA OF CAMBODIA

European contact: unicam@udg.edu

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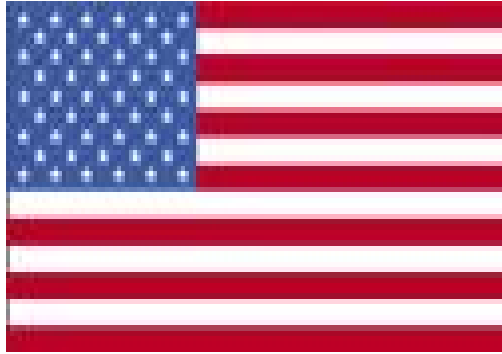
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Stephane 'macho' Boulakia - CIRAD Scientist, former host country coordinator, Cambodia, started CA in Cambodia 2004, he taught me conservation agriculture



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Serious Problem



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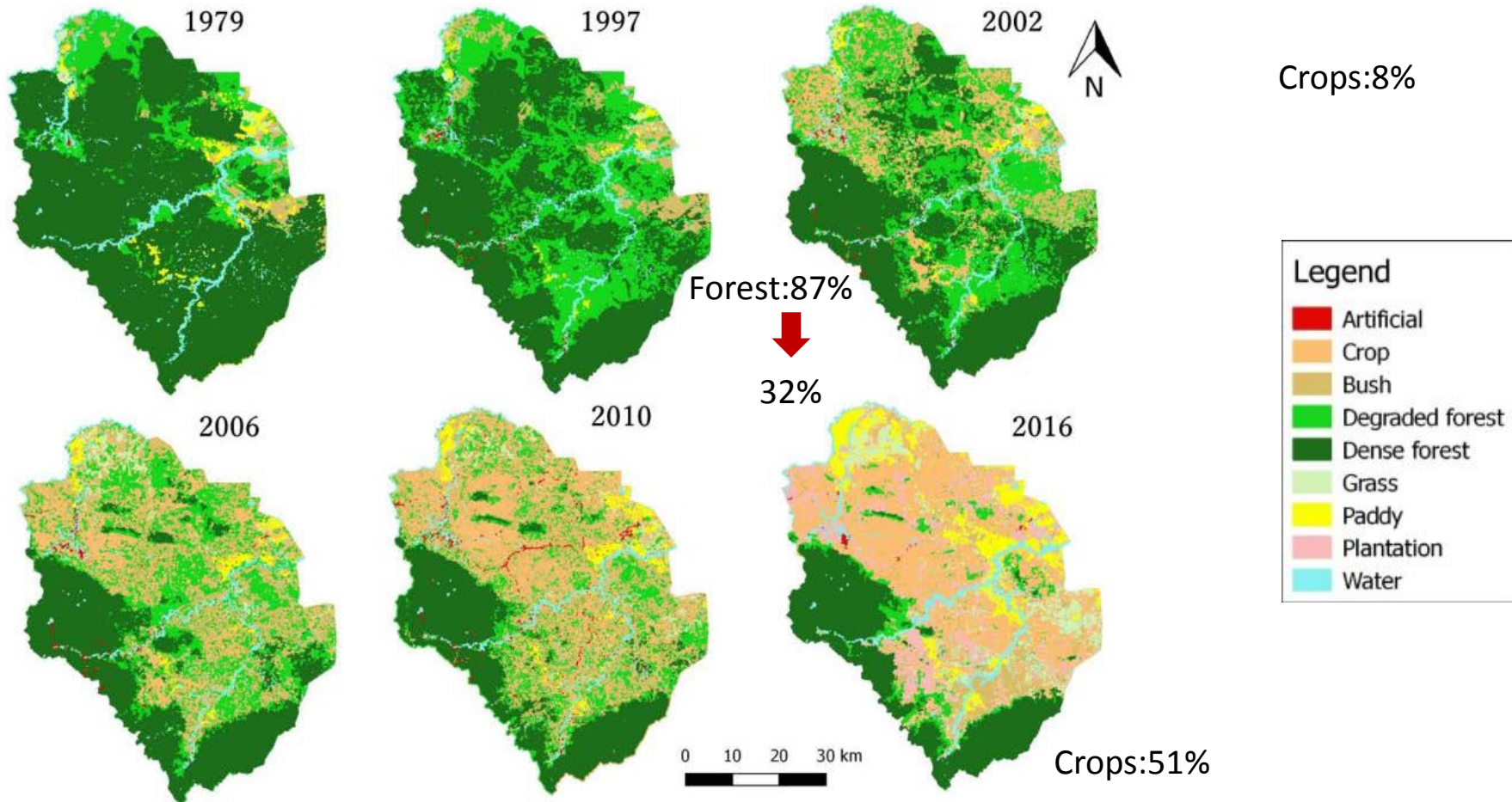
Serious Problem of Land Degradation and Eventual Decrease in Income and Food Insecurity in Cambodia





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Land use and land cover changes in NW Cambodia (from Kong et al., 2016, forthcoming)



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**In the NW, ~500,000
ha of Forest converted
to agriculture from
1996-2010**



**Conventional plow and ridge cassava in
Trapeang Prasat, Oddar Meanchey**



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Fast transition

Cambodia - Bare soil and hills in Battambang province (NW)



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The Good News is we have a Solution



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Conservation

Agriculture

'increasing yield while enhancing soil health'



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What is Conservation Agriculture (CA)?

Three components if one is
missing it is *not* Conservation Agriculture



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What is Conservation Agriculture?

Pictures are in Cambodia



**Minimum soil disturbance
(permanent no-till)**

**Permanent organic soil
cover**

**Diversification of species in
rotation, sequence or
associations**



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In Cambodia

Depletion
Very Sick Soil

Enhancement
Very Healthy Soil



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What is Conservation Agriculture (CA)?

Three components if one is
missing it is not Conservation Agriculture



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MCD



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Minimum soil disturbance

No tillage



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Minimum soil disturbance no-tillage





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Minimum soil disturbance no-tillage

Kudos to the SIIL
Appropriate Scale
Mechanization
Consortium team look
at the posture



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MCD

Continuous mulch



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Continuous mulch



Continuous mulch





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Diverse species



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Diverse in time



Diverse in space





Diverse in space



What is Conservation Agriculture?

Pictures are in Cambodia



**Minimum soil disturbance
(permanent no-till)**



**Permanent organic soil
cover**

**Diversification of species i
rotation, sequence or
associations**

Copying the Forest



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1

Cambodia is the Leader in Southeast Asian Countries on Conservation Agriculture



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Cambodia has the longest (13 years) conservation agriculture experiment under no tillage in Southeast Asia for upland Agronomic Crops

Thanks to:



Technology Park of Bos Khnor, 15 ha (Kampong Cham) Ministry of Agriculture, Forestry, and Fisheries





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Cropping systems design and assessment



+ finger millet + sunnhemp



Soybean after sorghum



Maize with Pigeon pea

Early maize followed by cassava



Farmer field of maize in Battambang



Dry season cassava after early maize



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**Sowing maize on green
cover of sorghum +
juncea + cowpea, 0
herbicide**

A close-up photograph of a young maize seedling with two green leaves emerging from a dense, tangled layer of dried, yellowish-brown crop residue. The residue consists of long, thin stalks and leaves, likely from sorghum, juncea, and cowpea. The background is slightly blurred, showing more of the same residue and some green vegetation in the distance under a bright sky.



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Sowing maize on green cover of sorghum + juncea + cowpea



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High flexibility
Sowing any time
+ rolling



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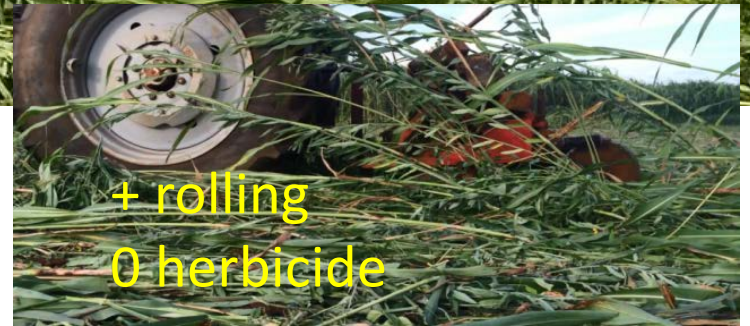


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+ rolling
0 herbicide



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Rolling first
Sowing any time



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0 post-emergent



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Cambodia is the Leader in Southeast Asian Countries on Conservation Agriculture



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Cambodia has the longest (9 years) conservation agriculture experiment under no tillage in Southeast Asia for Lowland Rice





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Pictures all in Cambodia



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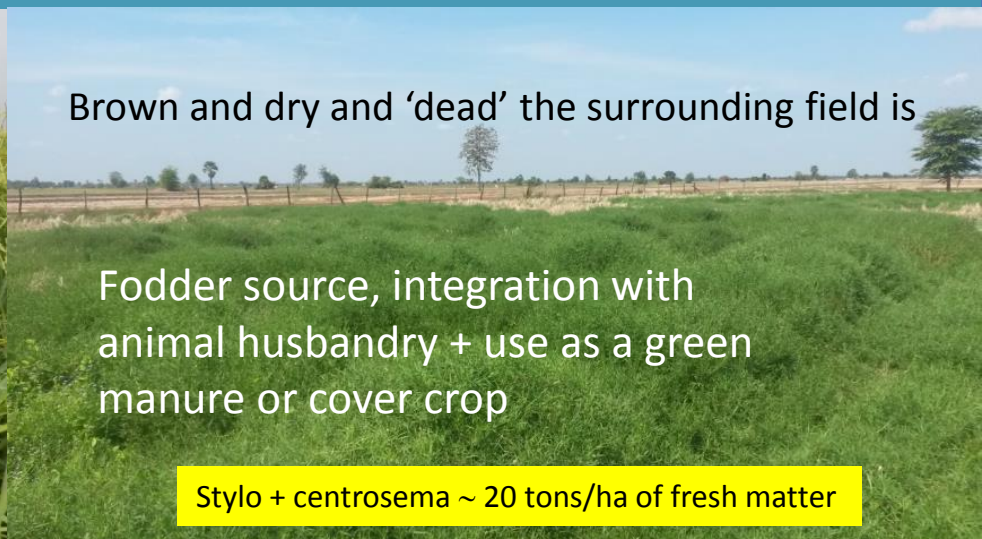
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Banan, Battambang, Rain-fed lowland (80% sand), started 2009



Broadcasting fodder legumes and grass on rice or 2nd crops (mung-bean, sesame, radish ...)



Brown and dry and 'dead' the surrounding field is

Fodder source, integration with animal husbandry + use as a green manure or cover crop

Stylo + centrosema ~ 20 tons/ha of fresh matter



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Banan, Battambang, Rain-fed
lowland (80% sand), started 2009

the surrounding field is Brown and dry and 'dead'

Fodder source, integration with
animal husbandry + use as a green
manure or cover crop

Stylo + centrosema ~ 20 tons/ha of fresh matter



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Rice Farmers in Banan



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Cambodia has the longest (five years) conservation agriculture plots under no tillage in Southeast Asia for Vegetable Production Thanks to:



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on Sustainable Agriculture and Natural Resource Management



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From 15 now about 50 farmers in Siem Reap and 35 farmers in Battambang practice conservation agriculture for vegetable production system



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Conservation agriculture in commercial
vegetable home gardens provides income

Highest \$1,323 higher than
Per capita income of \$1,159



4

Cambodia is the Leader in Southeast Asian Countries on Conservation Agriculture



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**Cambodia has a USAID
Appropriate Scale
Mechanization Consortium
tasked for identifying
appropriate conservation
agriculture machines and
tools for agronomic and
horticulture production
systems that began in 2015.**





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Last month, USAID provided funding to incentivize the engagement of the private sector and farmers to move from soil degrading conventional tillage production systems to conservation agriculture production systems in the project:

Private Sector Engagement in Conservation Agriculture Machinery and Service Provision to Smallholder Farmers



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To Invest in Conservation Agriculture through a Profitable Business Model



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**by Providing Agricultural
Services with a fee for
conservation agriculture
production systems**



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5

Cambodia is the Leader in Southeast Asian Countries on Conservation Agriculture



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Cambodia has several Cambodian faculty, graduate and undergraduate students, international scientists and students who conducted and are conducting research on Conservation Agriculture Research in Cambodia and wrote dissertations and theses and published them.



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Dr. Lyda Hok Cambodian Dissertation two articles published

Site Technology Park of Bos Khnor





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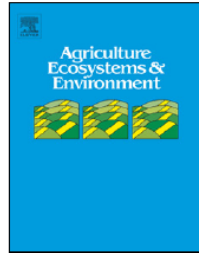
Contents lists available at ScienceDirect

Agriculture, Ecosystems and Environment

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



ELSEVIER



Short-term conservation agriculture and biomass-C input impacts on soil C dynamics in a savanna ecosystem in Cambodia

Lyda Hok^{a,b}, João Carlos de Moraes Sá^{c,*}, Stéphane Boulakia^d, Manuel Reyes^a, Vira Leng^e, Rada Kong^e, Florent Elie Tivet^d, Clever Briedis^f, Daiani da Cruz Hartman^f, Lucimara Aparecida Ferreira^f, Tomas Magno^f, Sovuthy Pheav^e

^a Department of Natural Resources and Environmental Design, North Carolina A&T State University, Greensboro, NC 27411, USA

^b Department of Soil Science, Faculty of Agronomy, Royal University of Agriculture, P.O. Box 2696, Phnom Penh, Cambodia

^c Department of Soil Science and Agricultural Engineering, State University of Ponta Grossa, Av. Carlos Cavalcanti 4748, Campus de Uvaranas, 84030-900, Ponta Grossa, PR, Brazil

^d Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIARAD), GIZ/IRAD/CSIA, Avenue Agroplois, 34398 Montpellier, France

^e Conservation Agriculture Service Centre, General Directorate of Agriculture, Ministry of Agriculture, Forestry and Fisheries, Phnom Penh, Cambodia

^f Graduate and Undergraduate Program in Agronomy, State University of Ponta Grossa, Av. Carlos Cavalcanti 4748, Campus de Uvaranas, 84030-900, Ponta Grossa, PR, Brazil

2015



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Soil and Tillage Research

Volume 177, April 2018, Pages 125-133



Enzymes and C pools as indicators of C build up in short-term conservation agriculture in a savanna ecosystem in Cambodia

Lyda Hok ^{a, b}, João Carlos de Moraes Sá ^c ✉, Manuel Reyes ^e, Stéphane Boulakia ^f, Florent Tivet ^f, Vira Leng ^g, Rada Kong ^g, Clever Briedis ^h, Daiani da Cruz Hartman ^d, Lucimara Aparecida Ferreira ^d, Thiago Massao Inagaki ⁱ, Daniel Ruy Pottinga ^d, Pamela Thaísa Bressan ^d

2018

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<https://doi.org/10.1016/j.still.2017.11.015>

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Dr. Kieu Ngoc Le Vietnames Dissertation three articles published



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Agriculture, Ecosystems and Environment 251 (2018) 37–47

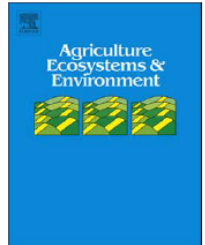


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Agriculture, Ecosystems and Environment

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Evaluating carbon sequestration for conservation agriculture and tillage systems in Cambodia using the EPIC model



Kieu Ngoc Le^{a,*}, Manoj K. Jha^b, Manuel R. Reyes^c, Jaehak Jeong^d, Luca Doro^d, Philip W. Gassman^e, Lyda Hok^f, João Carlos de Moraes Sá^g, Stéphane Boulakia^h

^a Department of Energy & Environmental Systems, North Carolina A & T State University, Greensboro, NC, USA

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^c Sustainable Intensification Innovation Lab, Kansas State University, Manhattan, KS, 66506, USA

^d Texas A & M AgriLife Research, Temple, TX, USA

^e Resource and Environmental Policy (REP) Division at CARD, Iowa State University, Ames, IA, USA

^f Department of Soil Science, Faculty of Agronomy, Royal University of Agriculture, Phnom Penh, Cambodia

^g Department of Soil Science and Agricultural Engineering, State University of Ponta Grossa, Av. Carlos Cavalcanti 4748, Campus de Uvaranas, 84030-900, Ponta Grossa,

2018



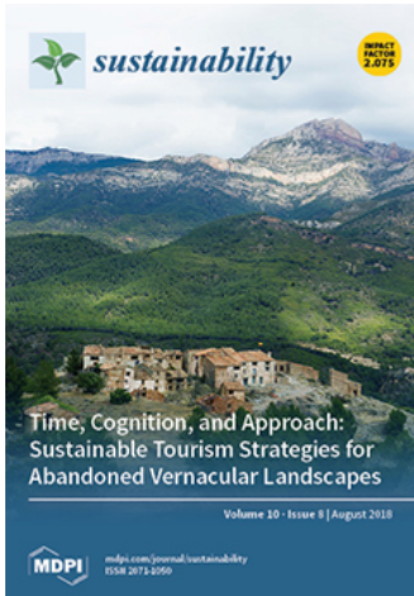
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Volume 10, Issue 8



Views

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Sustainability 2018, 10(8), 2665; <https://doi.org/10.3390/su10082665>

Open Access Article

Evaluation of Long-Term SOC and Crop Productivity within Conservation Systems Using GFDL CM2.1 and EPIC

Kieu N. Le ^{1,2,*} , Manoj K. Jha ³ , Jaehak Jeong ⁴ , Philip W. Gassman ⁵ ,
Manuel R. Reyes ⁶ , Luca Doro ⁴ , Dat Q. Tran ⁷  and Lyda Hok ⁸ 

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- 2 Department of Biological and Agricultural Engineering, University of Arkansas, Fayetteville, AR 72701, USA
- 3 Civil, Architectural & Environmental Engineering, North Carolina A&T State University, Greensboro, NC 27411, USA
- 4 Texas A&M AgriLife Research, Blackland Research and Extension Center, Temple, TX 76502, USA
- 5 Center for Agricultural and Rural Development, Iowa State University, Ames, IA 50011-1054, USA
- 6 Sustainable Intensification Innovation Lab, Kansas State University, Manhattan, KS 66506, USA
- 7 Department of Agricultural Economics and Agribusiness, University of Arkansas, Fayetteville, AR 72701, USA
- 8 Department of Soil Science, Faculty of Agronomy, Royal University of Agriculture, Phnom Penh 12401, Cambodia

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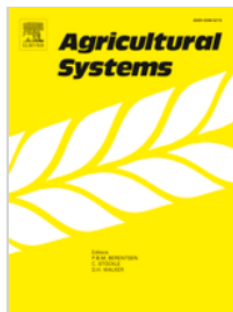


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Article

Evaluation of the performance of the EPIC model for yield and biomass simulation under conservation systems in Cambodia

Corresponding author

Kieu Ngoc Le

Journal

Agricultural Systems

Our reference

AGSY 2510

Date article posted

08-Aug-2018

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Dr. Don Immanuel Edralin

Filipino

Dissertation two articles published



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2016



International Journal of Plant & Soil Science

11(1): 1-13, 2016; Article no.IJPSS.25339

ISSN: 2320-7035



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Dynamics of Soil Carbon, Nitrogen and Soil Respiration in Farmer's Field with Conservation Agriculture, Siem Reap, Cambodia

Don Immanuel A. Edralin¹, Gilbert C. Sigua^{2*} and Manuel R. Reyes¹

¹*North Carolina Agricultural and Technical State University, Greensboro, NC, USA.*

²*United States Department of Agriculture, Agricultural Research Service, Coastal Plains Soil, Water,*



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Agron. Sustain. Dev. (2017) 37:52
DOI 10.1007/s13593-017-0461-7



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RESEARCH ARTICLE

Conservation agriculture improves yield and reduces weeding activity in sandy soils of Cambodia

Don A. Edralin¹ · Gilbert C. Sigua² · Manuel R. Reyes³ · Michael J. Mulvaney⁴ · Susan S. Andrews⁵

2017

Accepted: 22 September 2017

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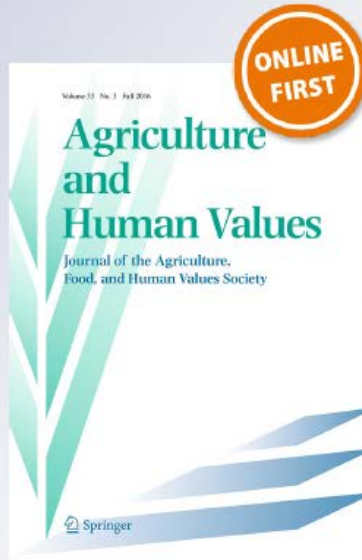
Conservation agriculture and gendered livelihoods in Northwestern Cambodia: decision-making, space and access

Daniel Sumner, Maria Elisa Christie & Stéphane Boulakia

Agriculture and Human Values
Journal of the Agriculture, Food, and Human Values Society

ISSN 0889-048X

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**Several Cambodian students doing
research in conservation agriculture:
University of Battambang
Master of Science in
Sustainable Agriculture**



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THE WORLD FOOD PRIZE



[2018 Borlaug Dialogue](#)

[Previous Years](#)

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Borlaug Dialogue International Symposium

Save the Date for the 2018 Borlaug Dialogue - October 17-19

THE NORMAN E. BORLAUG INTERNATIONAL SYMPOSIUM, known informally as the "Borlaug Dialogue," each year brings together over 1,200 people from more than 65 countries to address cutting-edge issues related to global food security and nutrition. The three-day conference convenes a wide array of scientific experts, policy leaders, business executives and farmers and has been called "the premier conference in the world on global agriculture." Through the Borlaug Dialogue, the World Food Prize Foundation helps build alliances in the struggle against world hunger and malnutrition.

The Borlaug Dialogue occurs each October on or around World Food Day in conjunction with the awarding of the World Food Prize in Des Moines, Iowa, USA. Additional events surrounding the conference include the Global Youth Institute, which aims to inspire the next generation of scientific and humanitarian leaders; the Iowa Hunger Summit, a free, grassroots event for regional hunger-fighting organizations; and several side events held by partner organizations.



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CHANNATY NGANG

Institution: University of Battambang

Country: Cambodia

Degree Type: Master's (M.S.)

Program of Study: Sustainable Agriculture

Principal Advisor: Srean Pao

THESIS TOPIC

Conservation agriculture has been shown to improve soil health, and I am studying how conservation agriculture specifically improves the soil health of commercial vegetable home gardens in Battambang province in Cambodia. In agriculture production there can be many different approaches to achieving the expected yield every year; however, in our research we are specifically looking at conventional tillage and conservation agriculture systems. We are studying the soil health of conservation agriculture (CA) and conventional tillage (CT) management practices, by comparing the biomass-C inputs (quality, quantity). We are also assessing the changes of soil quality in the different agricultural management practices by using the Biofunctool package, i.e. a set of in-field, cost and time-effective measurements to assess the soil functions. We will focus on a set of indicators to assess three key soil functions: carbon transformation, nutrient cycling and soil structure evolution in the different agricultural management practices between CA and CT.



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POST-GRADUATION PLANS

After graduating with my Master's Degree, I want to continue on with my Ph.D. I can further my research on soil quality with conservation agriculture, looking at how the soil quality improves after 4 years of growing vegetables using conservation agriculture. In the future, I plan to share all of my research with farmers to help them improve their knowledge of agricultural practices and to help them achieve sustainability and achieve high yielding crops. Ultimately, I want to be a professor at a university, to help spread knowledge to students about the innovations in farming systems and the need for sustainable intensification in Cambodia.



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Empowering Women in the Commercial Vegetable Home Garden Through Appropriate Farming Tools for Conservation Agriculture in Vegetable Production Systems.

*Sreyngat Lo
Rien Sothea*



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Cambodian student alumnus of: University of Battambang



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Impact on women of community-based conservation agriculture in vegetable production system in Puok District, Siem Reap, Cambodia. SEARCA scholar, 2018 completed MS at the University of the Philippines Los Banos.

*Sel
Rechaney
MS 2018*



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**Cambodian students
alumni of:
Royal University of
Agriculture**



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France



Name: KONG Rada

Place of birth: Kampong Chhnang province

Specialization: Ecological functions and agronomic science

Pursuing degree: PhD student

Host institution: GAIA/SupAgro with research lab UR-AIDA/CIRAD in France and ECOLAND-RUA in Cambodia

Former degree: Master in France.

Tel: +33 (0) 7 68 74 94 22, **Email:** kongrada@gmail.com



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Collaborative Research on Sustainable Intensification

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Sar Veng

*SEARCA scholar,
Master of Science at
Kasetsart University,
research in
Conservation
agriculture*



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Vira Leng

Master of Science at
Tokyo University of
Science and Technology

Effect of short-term conservation agriculture on the changes of soil organic C, pool, total N, and nutrient availability in lowland rice agroecosystem of Cambodia



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5

Cambodia is the Leader in
Southeast Asian Countries on
Conservation Agriculture



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To See is

to Believe



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Cambodia has:



Programme countries



Partner country



Associated partners



IMPLEMENTING QUALITY OF EDUCATION & TRAINING OF THE YOUNG UNIVERSITIES IN RURAL AREA OF CAMBODIA

European contact: unicam@udg.edu
Cambodian contact: paosrean@gmail.com



Go-funded by the Erasmus+ Programme of the European Union



Implementing quality of education & training of the Young
UNIversities in rural area of **CAM**bodia

UNICAM

In the University of Battambang



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Cambodia has:

**Center of Excellence on Sustainable Agricultural
Intensification and Nutrition**

CE SAIN

Lyda Hok, Ph.D., Director



**In the
Royal University of
Agriculture**



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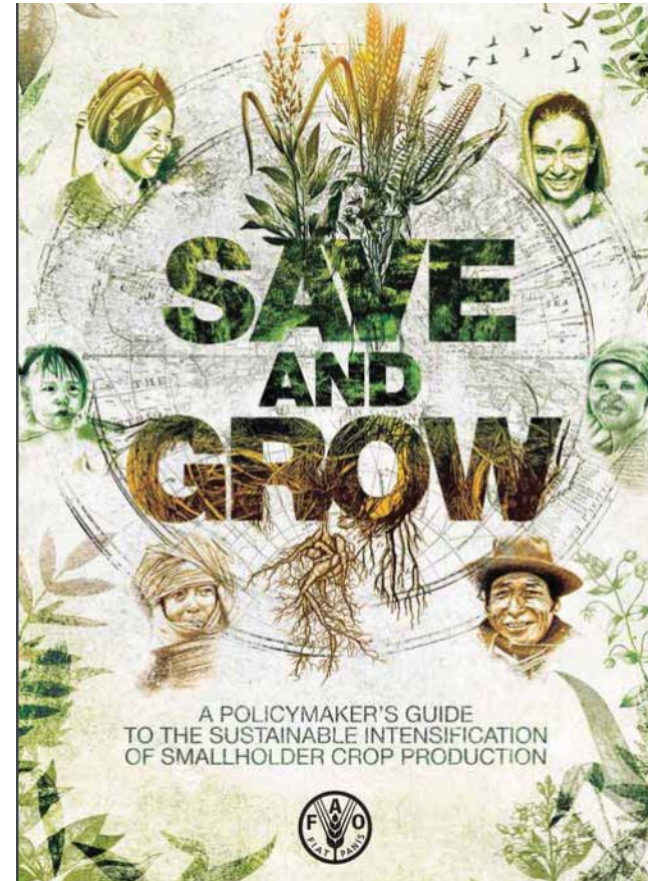
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'In order to grow, agriculture must learn to save'

FAO

Food and Agriculture
Organization



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Five Agricultural technology parks to showcase high-potential technologies and strategies to sustainably intensify smallholder farming systems



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Kampong Cham Tech Park Upland Production Systems



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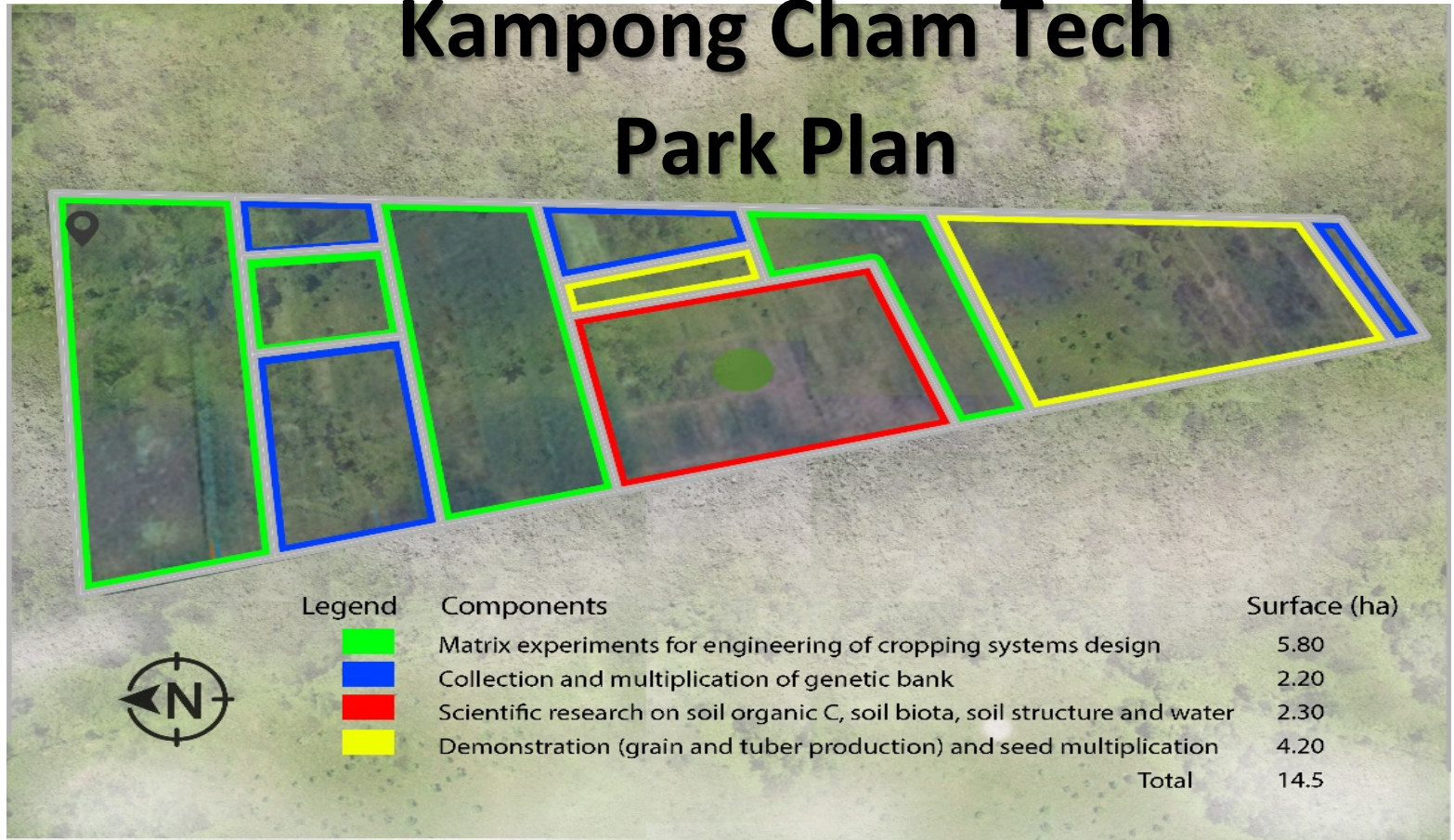
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Kampong Cham Tech Park Plan



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Legacy Conservation
Agriculture Systems not
tilled since 2005



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Conservation Agriculture Machinery Hub



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CE SAIN

Objective 3: Establish technology parks to showcase high-potential technologies and strategies to sustainably intensify smallholder farming systems

Kampong Thom Tech Park

**Upland and Lowland
Production Systems**



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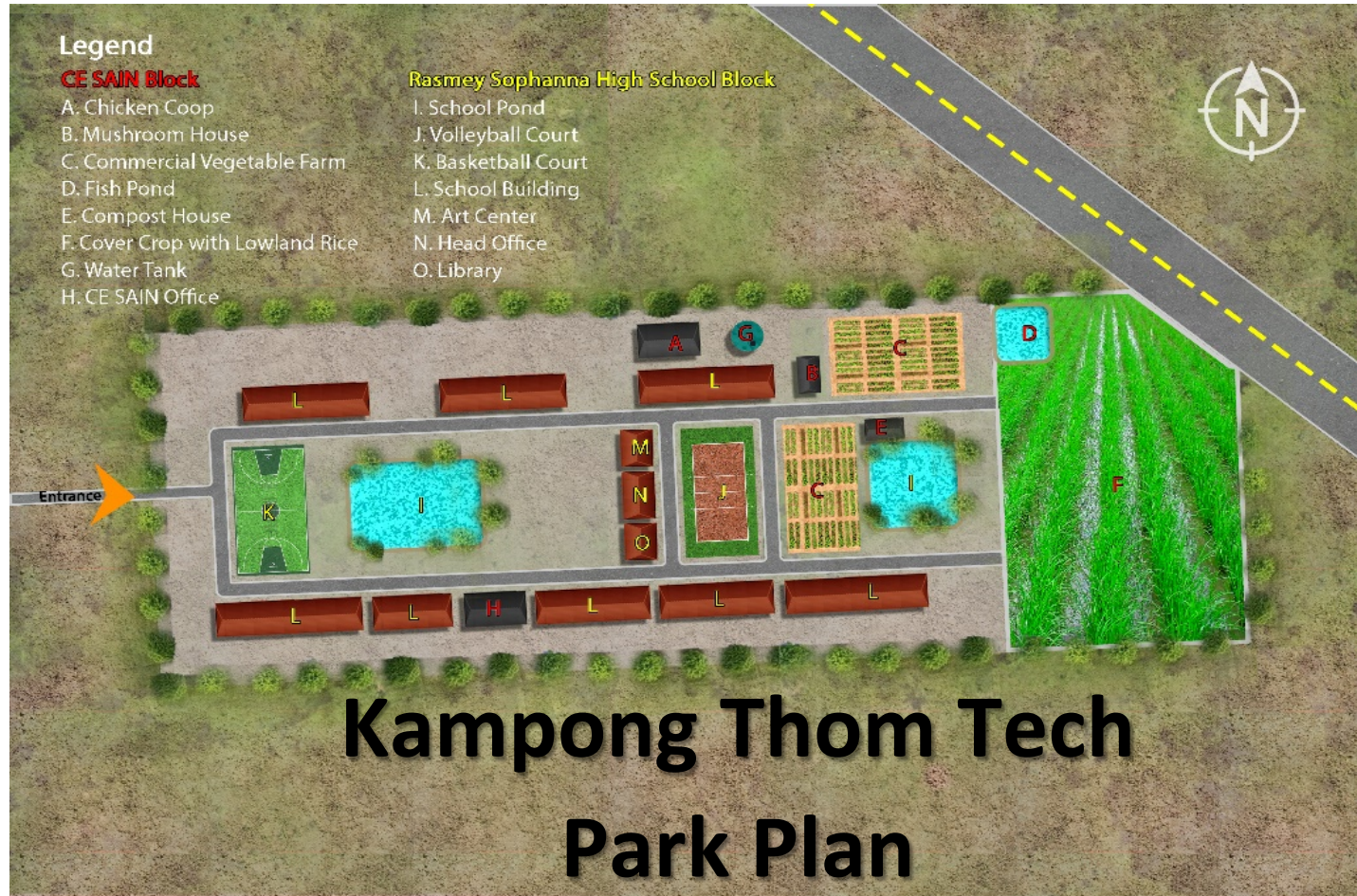


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Located in a High School Campus



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Happy and Passionate



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High School students in a field trip learning conservation agriculture machinery



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Cambodia has the Conservation Agriculture Service Center (CASC)



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Conservation Agriculture Service Center is part of the **Ministry of Agriculture, Forestry and Fisheries (MAFF)**



MAFF provided it with a headquarters of two buildings and a 15 ha experimental station in Kampong Cham



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**I can go on and on
like an energizer
battery but I made
my point**





**Cambodia is the Leader in
Southeast Asian Countries on
Conservation Agriculture
therefore**





Cambodia is the Center of Conservation Agriculture in Southeast Asia





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Stephane 'macho' Boulakia - CIRAD Scientist, former host country coordinator, Cambodia, started CA in Cambodia 2004



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Development history of no tillage and CA in the World

CA and No-tillage in the World

Extension of CA in Brazil

> Today 25 millions ha

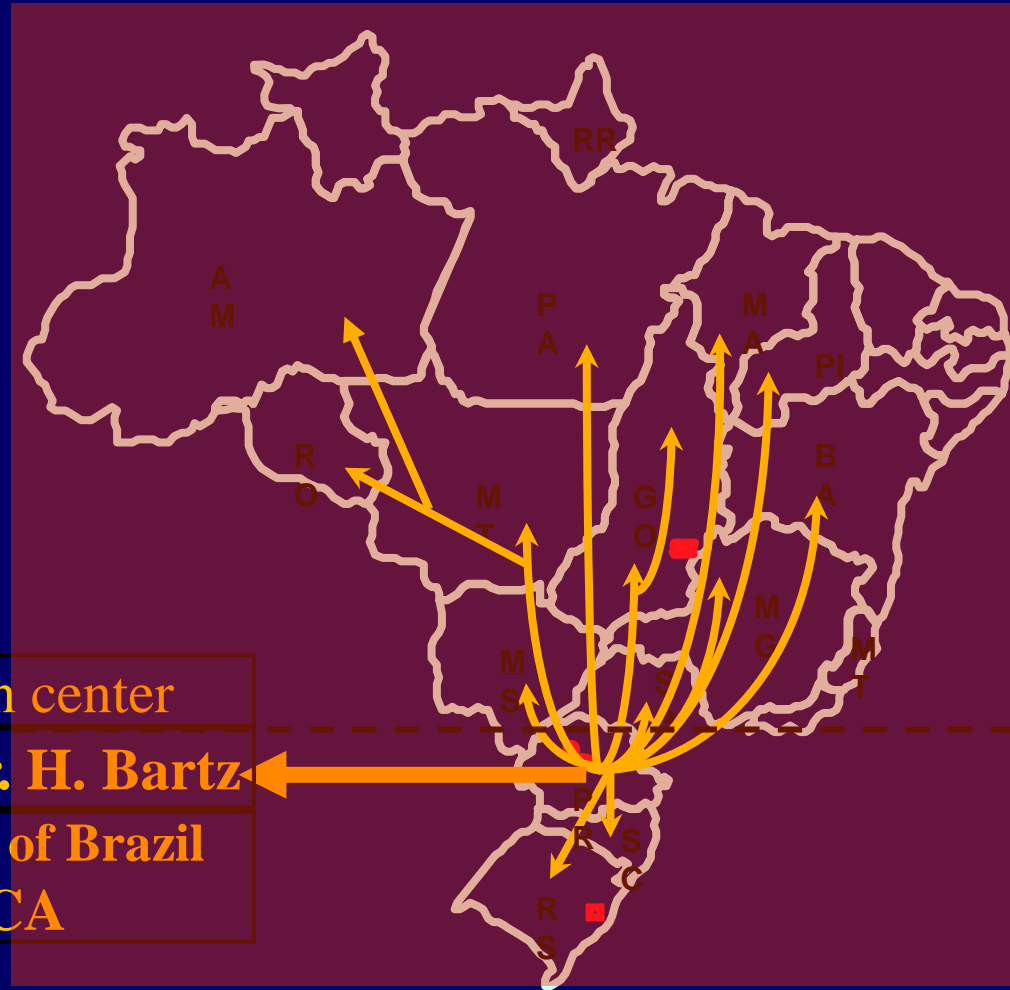


PARANA state = diffusion center

1972 ... one pioneer farmer, Mr. H. Bartz

2005 ... 1st agricultural state of Brazil

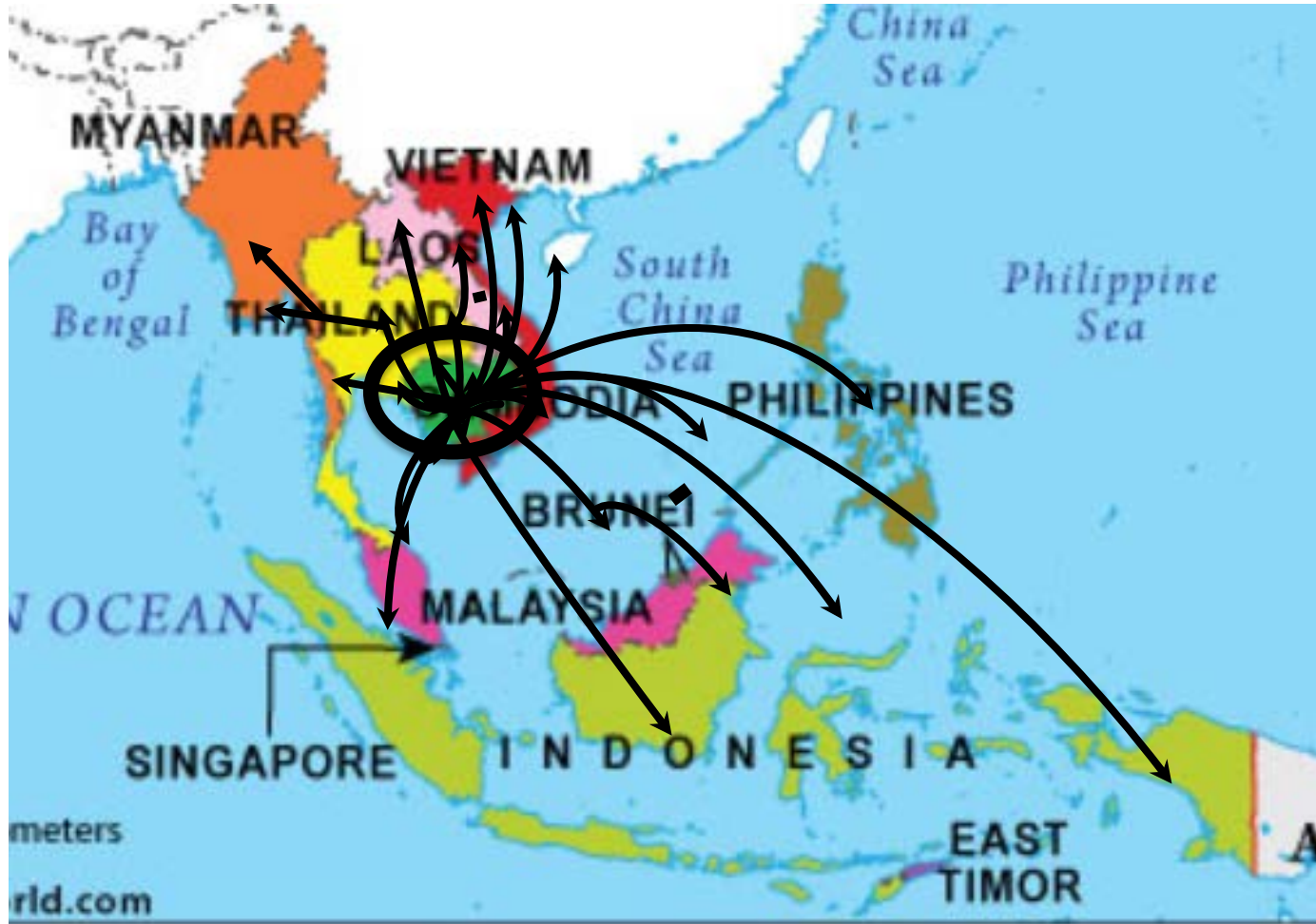
90% surface under CA





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Thank you, any questions!!!



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