



ALiSEA general assembly workshop “Towards an Agroecology Transition”



Crop Biodiversity: A Foundational Component of Resilient Farming Systems

Florent Tivet (CIRAD), Vira Leng (GDA), Rick Bates (Penn State), Rada Kong (CASC, RUA/Ecoland), Abram Bicksler (ECHO), Ouddom Chet (CASC), Sopheak Trang (CASC)



CASC's main activities



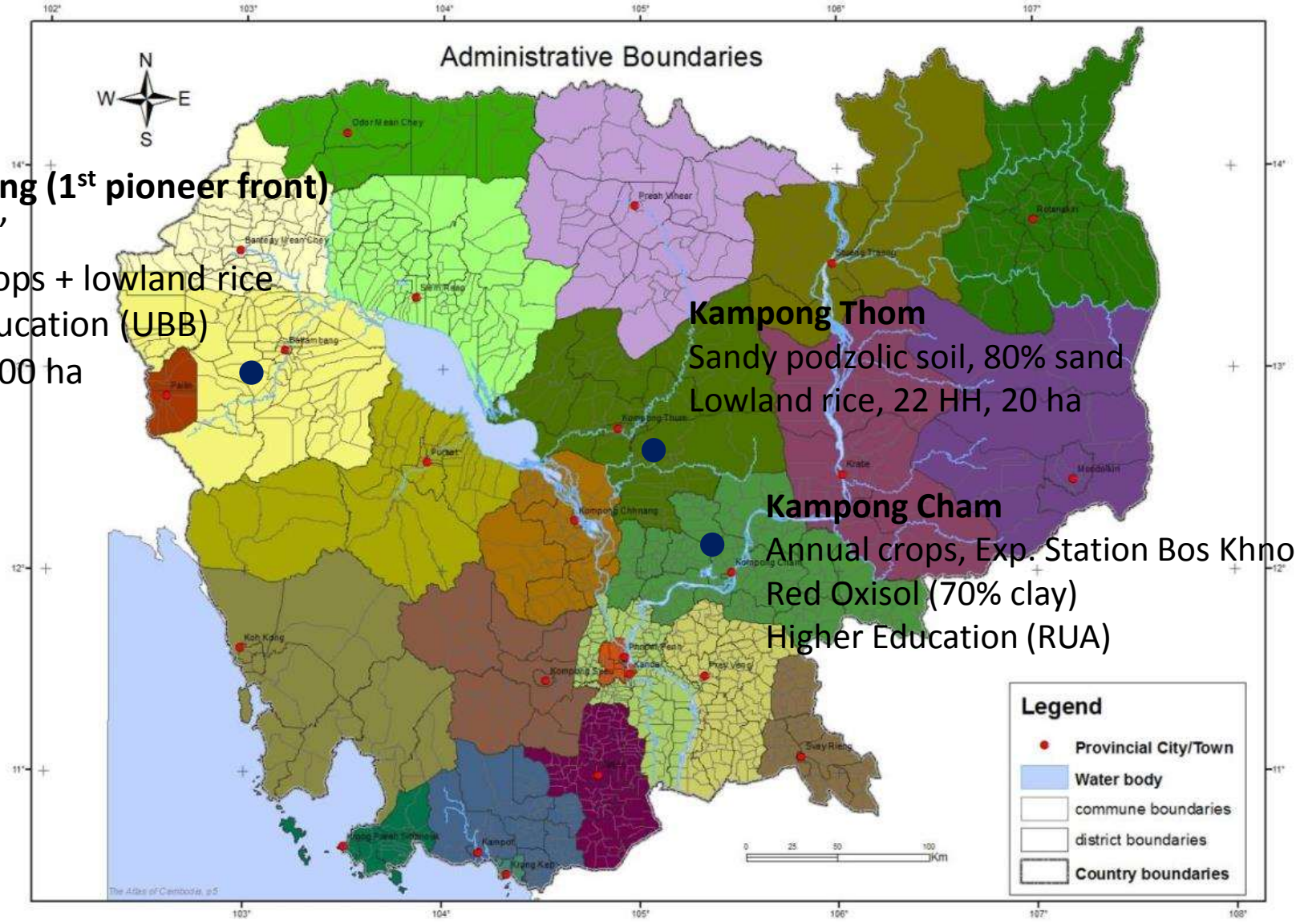
- Co-design and assess a diversity of conservation agriculture cropping systems
- Preserve a germplasm of staple, cash and cover crops
- Produce seeds of key species
- Test appropriate-scale machinery
- Disseminate the knowledge and know-how through technical support to farmer groups
- Develop educative materials
- Build capacity of students, agronomists and field technicians
- Provide consultancy to private operators/entrepreneurs

Our main locations

Battambang (1st pioneer front)
 'Mollisoils'
 Annual crops + lowland rice
 Higher Education (UBB)
 ~90 HH, 300 ha

Kampong Thom
 Sandy podzolic soil, 80% sand
 Lowland rice, 22 HH, 20 ha

Kampong Cham
 Annual crops, Exp. Station Bos Khnor
 Red Oxisol (70% clay)
 Higher Education (RUA)



Neglected and underutilized species (NUS)

Species with under-exploited potential for contributing to food security, health, income generation, and environmental services.

Important role in smallholder farmer livelihoods:

- Contribute substantially to food security
- Increase incomes among the poor
- Improve nutrition and health
- Sustain healthy ecosystems



From Rick Bates, Penn State

Neglected and underutilized species (NUS)

- Untapped potential for commercialization
- Very few crop species form the foundation of the world's agriculture system
- Less than 150 plant species are commercialized on a global scale - just 12 of these provide approx. 75% of the world's food (Padulosi and Frison, 1999)



Promoting neglected and underutilized species

- The need exists to expand the reach and impact of valuable underutilized cover crop and relay crop species
- Scale-up is critical to preserving biodiversity, ensuring food security and facilitating the sustainable development of rural agroecosystems



From Rick Bates, Penn State

Promoting neglected and underutilized species

Keys to success:

- Adoption of a holistic approach that empowers resource-poor households and communities (Thailand, seed production system)
- Better communication to raise awareness and build capacity among stakeholders and increase demand for these crops
- Promotion of seed system best practices
- Improved market development through practical interventions, entrepreneurship and fostering public-private partnerships

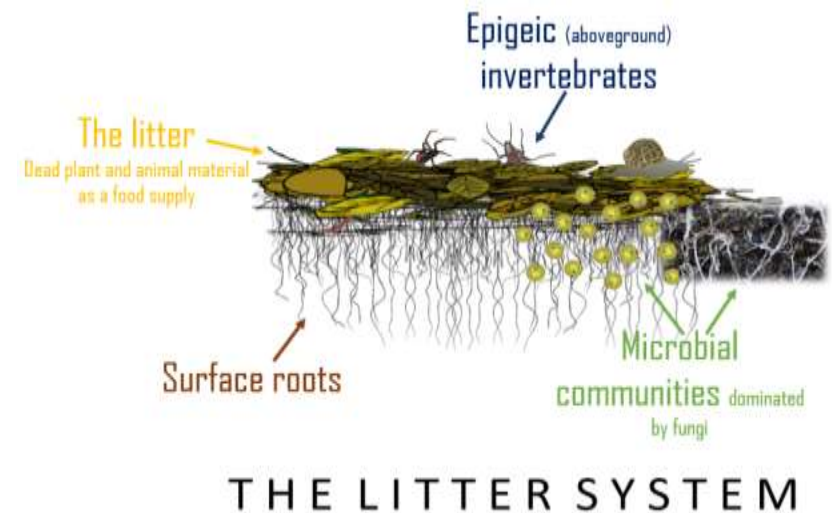
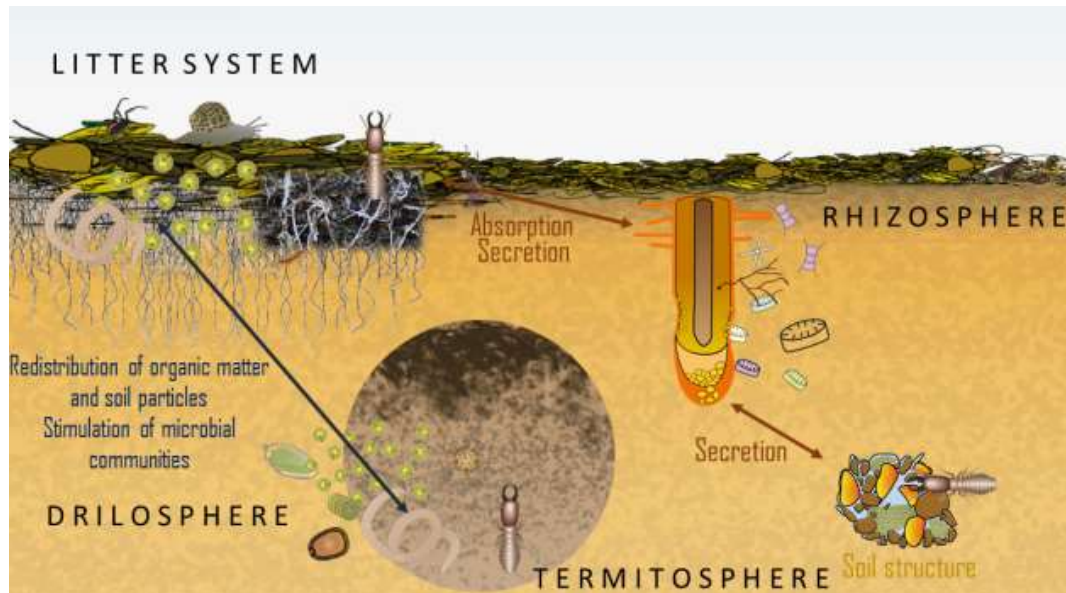


A diversity of plants provides options, adaptation (market, climate)



Sustain healthy ecosystems

Plant diversity is the engine that drives soil-crop interactions and enhances ecosystem services (regulation and provision)



A diversity of plants: a diversity of functions and services

Soybean



0.6 to 1.2m

Rice



Maize



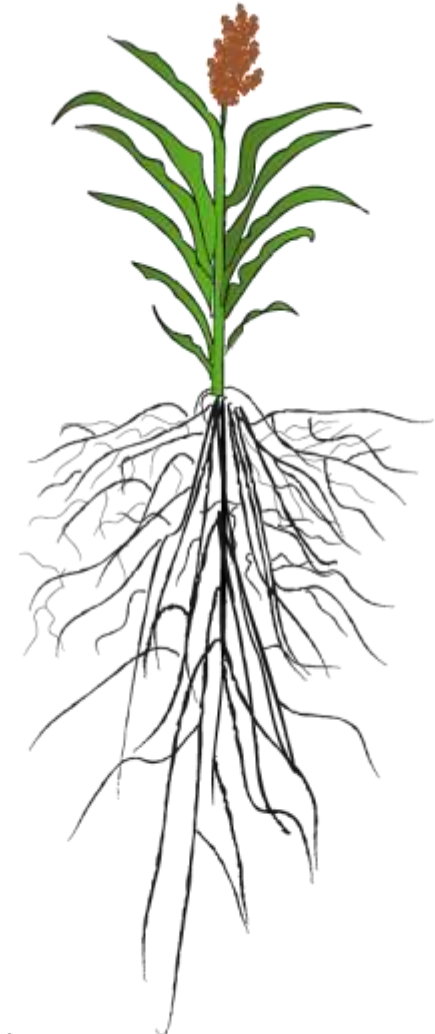
1.6 to 2.0m

Pigeon pea



Deep water, nutrients cycling,
C deposition ...

Sorghum



> 2.5m

A diversity of roots, a diversity of functions and services

Finger millet

Fibrous root

Biological tillage

Free living N fixing bacteria

Mycorrhizal symbiosis

Pigeon pea

Up to 120 kg N/ha

Tap root, ability to solubilize Fe-bound P ...

Wide diversity of species for different functions. Improved soil structure, carbon trading network (mycorrhizae). Deep roots capture leached nutrients.

Plants bring nutrients into an organic form



Replace fertilizers through N fixing
(plants and microbial)



Nutrients into an
organic form they
don't leach!

A diversity of functions, a question of adaptation (markets, climate...)



Stylosanthes

Brachiaria

Finger millet

Radish

Sunnhemp

Amaranth

Nutrients uptake, biological tillage, mycorrhiza symbiosis, decomposition rate, physical barriers, pests regulations, weeds control, biomass input and nutritive values

Overall objectives



- Build capacity (Laos and Cambodia)
- Strengthen germplasm production sites
- Disseminate the knowledge and know-how on the use of underutilized species and cover/relay crops
- Connect seed sources with development workers across the region
- Explore connection with markets and identify opportunities within cover/relay crops value chains

ECHO[®]

Asia Impact Center



2015 Seed Catalog

Strengthening production sites in Laos/Cambodia + genetic bank

- Preserving some species at ECHO seed center
- Sharing germplasm between partners and development workers/operators
- Upgrading tools and storage facilities

In Cambodia: large diversity of crops and cover/relay crops, 54 species, 335 cv.



Large diversity of crops and cover/relay crops

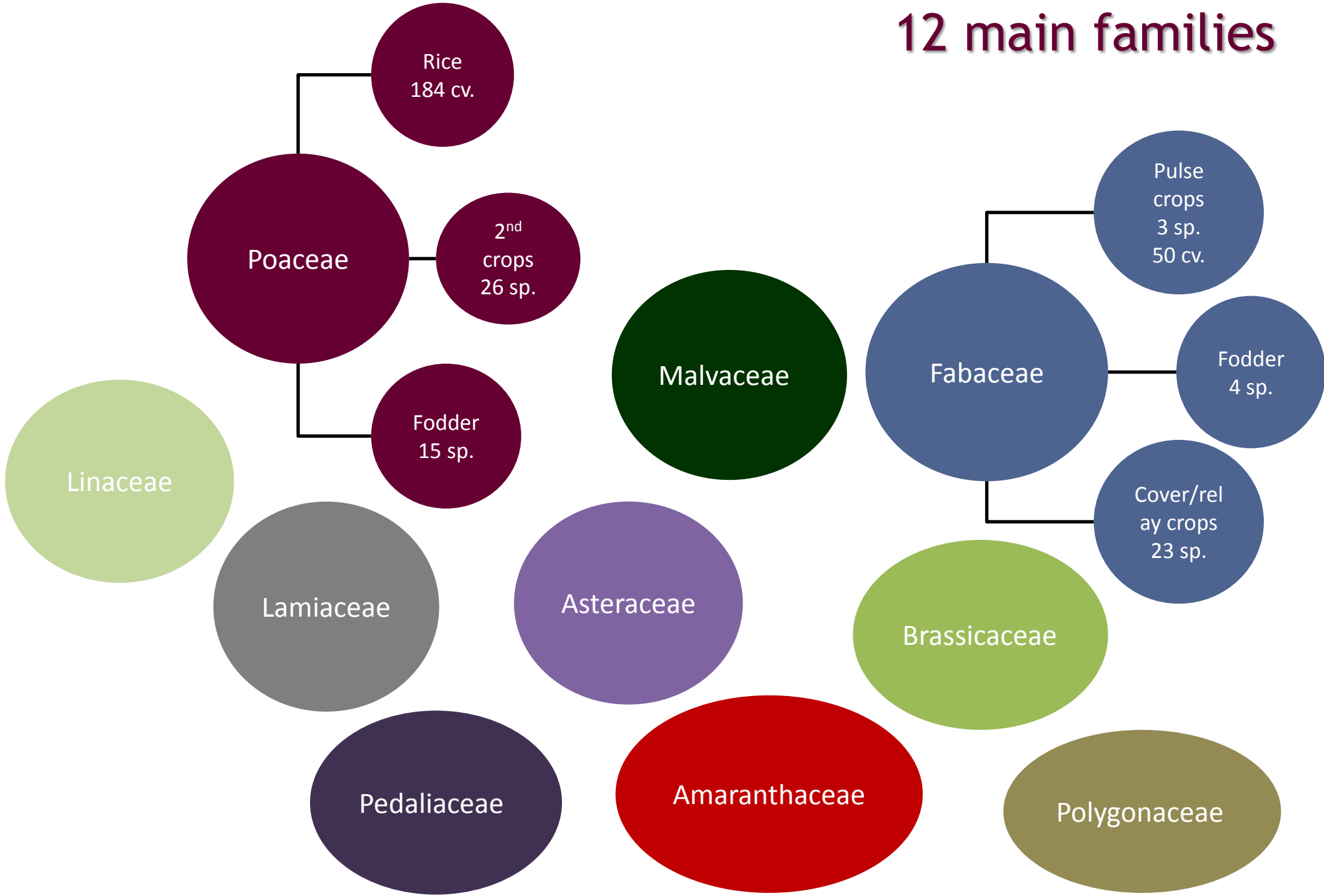
54 species, 335 cv.

| Genus specie | Number of species | Number of cultivars |
|--|-------------------|---------------------|
| Forage species | 15 | 15 |
| Brachiaria ruziziensis, B. decumbens, B. brizantha (3), B. humidicola, B. mullato (3), B. mutica | 10 | 10 |
| Panicum maximum (3) | 3 | 3 |
| Tripsacum | 1 | 1 |
| Pennisetum purpureum | 1 | 1 |

| Genus specie | Number of species | Number of cultivars |
|--|-------------------|---------------------|
| Rice | 1 | 184 |
| Rice | 1 | 184 |
| Pulse crops | 3 | 50 |
| Soja | 1 | 40 |
| Vigna unguiculata, Vigna umbellata | 2 | 10 |
| Others 2nd crops | 7 | 11 |
| Amaranths (Amaranthus cruentus) | 1 | 3 |
| Chia (Salvia hispanica) | 1 | 2 |
| Buckwheat (Fagopyrum esculentum) | 1 | 1 |
| Niger (Guizotia abyssinnica) | 1 | 1 |
| Radish (Raphanus sativus) | 1 | 1 |
| Echinochloa esculenta & E. frumentacea | 2 | 3 |

| Genus specie | Number of species | Number of cultivars |
|---|-------------------|---------------------|
| Cover/relay crops | 27 | 53 |
| Pearl millet (Pennisetum typhoides) | 1 | 2 |
| Sorghum (Sorghum bicolor) | 1 | 15 |
| Finger millet (Eleusine coracana) | 1 | 4 |
| Adlai (Coix lacryma Jobi) | 1 | 5 |
| Canavalia ensiformis | 1 | 1 |
| Aeschynomene histrix | 1 | 1 |
| Calopogonium mucunoides | 1 | 1 |
| Cajanus cajan | 1 | 4 |
| Cassia rotundifolia | 1 | 1 |
| Centrosema pascuorum | 1 | 1 |
| Crotalaria juncea, C. ochroleuca, C. retusa, C. spectabilis, C. zanzibarica, C. artrorubens | 6 | 6 |
| Dolichos lablab | 1 | 1 |
| Indigofera | 1 | 1 |
| Macrotyloma axillare | 1 | 1 |
| Macroptilium artropurpureum, M. latyroides | 2 | 2 |
| Mucuna atterinum | 1 | 1 |
| Pueraria phaseolides | 1 | 1 |
| Sesbania rostrata, S. pakistan | 2 | 2 |
| Stylosanthes guianensis | 2 | 2 |
| Tephrosia | 1 | 1 |
| Tuber | 1 | 22 |
| Cassava | 1 | 22 |

12 main families



Seed production for key cover crops



Stylosanthes guianensis: 1000 kg; *Dolichos lablab*: 100 kg

Capacity building

- National ECHO conference Oct. 2017, participation of Lao and Cambodian partners
- Training of Cambodian and Lao partners Dec. 2017
- National events germplasm sharing:
 - Laos under DALaM/CIRAD partnership
 - Cambodia (Aug. 2018) organized with ECHO and regional participants → seed swap, training on different topics (natural resources mngt, animal integration, seed bank, soil mngt...)

Explore value-chain (Penn State)

- Three main species will be targeted: sunnhemp, pigeon pea, rice-bean, amaranth, buckwheat
- Involvement of students (start in July 2017)

Disseminating knowledge and know-how

- Technical booklet with 3 main components
 - Integration of cover/relay crops into cropping systems (practical)
 - Elements from the value-chain analysis
 - Description of the main species (including nutrients contents/ITC)

Introduction to the ECHO Asia Regional Impact Center and Seed Banking



By Abram J. Bicksler, Ph.D.
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www.echocommunity.org

A Few Areas in Which ECHO Works

- Sustainable Agriculture
- Community Development
- Water and sanitation
- Urban and Community Gardening
- Alternative and Renewable Energy
- Appropriate Technology
- Participatory Approaches
- Seed Saving and Banking
- Creation Care and the Environment
- Coffee


ECHO Asia Services

The screenshot shows the ECHO community website interface. At the top, the URL is www.echocommunity.org. The search bar contains the text "cabbage root maggot organic control". The navigation menu includes "Resources:", "By Region", "Plants & Seeds", "By Technology or Technique", "By Publication", "Education & Events", and "Research". A language selector shows "English | Change Language".

Blog Update: ECHO Research
The ECHO Research blog highlights ongoing research done by ECHO and network members around the world. Subscribe to the blog to stay up-to-date on new and interesting discoveries. This week, Dr. Motis writes about lessons learned in: Weed Suppression Options—Legumes and Guinea Hogs
[More information](#)

ECHOcommunity Updates

ECHO Development Notes #126 Now Available 2015-02-04



Excerpt: Bicycle Pump Vacuum Sealer for Seed Storage

Storing seeds in the tropics can often be difficult; with high temperatures and humid conditions, seeds lose their ability to germinate quickly. Many techniques for seed storage exist, from the high-tech standards of gene banks to simple methods used by villagers for saving their own seeds. All have their strengths and weaknesses, but when balancing costs and resources, which methods are really the most effective? This article highlights research conducted by ECHO Asia regarding the use of vacuum sealing, using a simple bicycle tire pump, for tropical seed storage under resource-constrained settings.

The three key factors that determine the rate of seed deterioration in storage are: oxygen pressure (amount of oxygen with the seeds in storage), seed moisture content, and temperature (Roberts, 1973). An increase in any of these factors will lower the storage life of the seeds, and as a general rule any increase of 1% moisture content or 1.0°F (5.6°C) in storage will halve the storage life of the seeds.

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CALENDAR [MORE]

- 2015-03-03 » 2015-03-06
ECHO Asia Indonesia Sustainable Agriculture Workshop
- 2015-03-08 » 2015-03-14
Training Seminar in Natural Medicine
- 2015-03-23 » 2015-03-27
ECHO West Africa Anglophone Forum 2015
- 2015-04-19 » 2015-05-02
Permaculture Design Certification Course

www.ECHOcommunity.org

ECHO Asia Services

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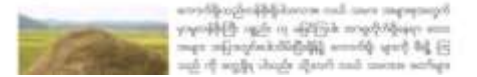


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Thai

Burmese

Bahasa Indonesian

Mandarin

Khmer

English

Hindi?

Vietnamese

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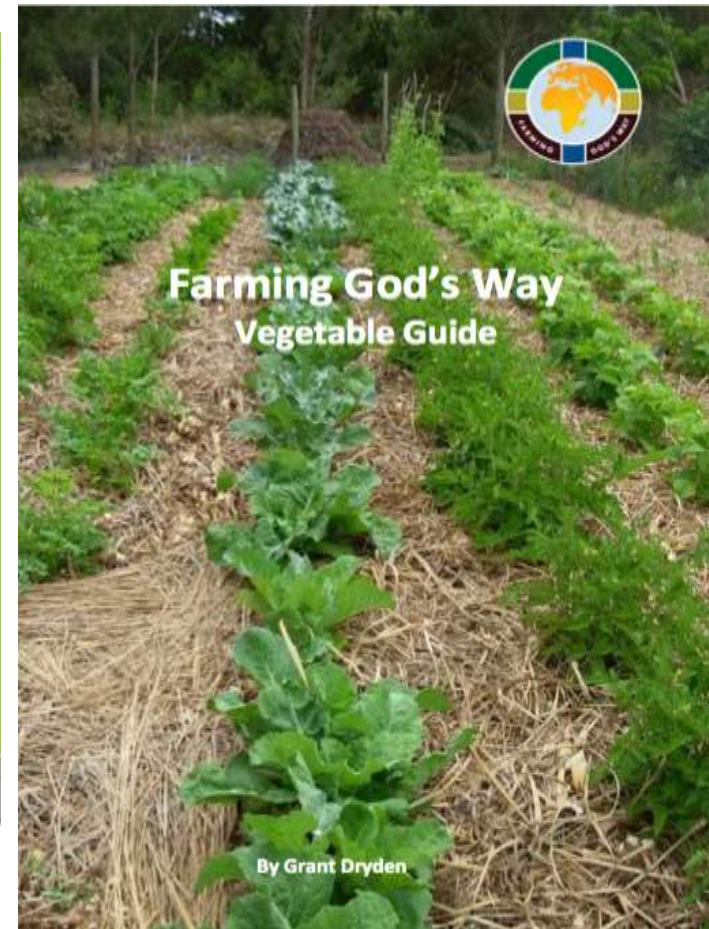
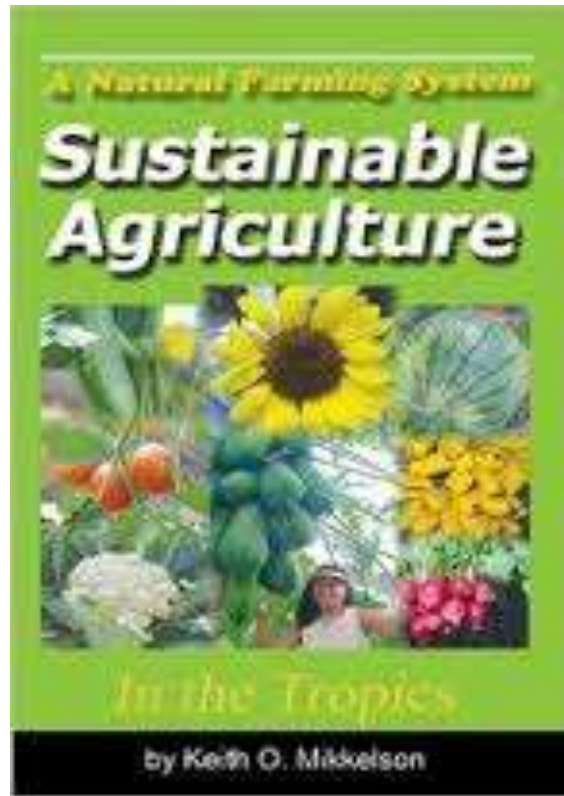
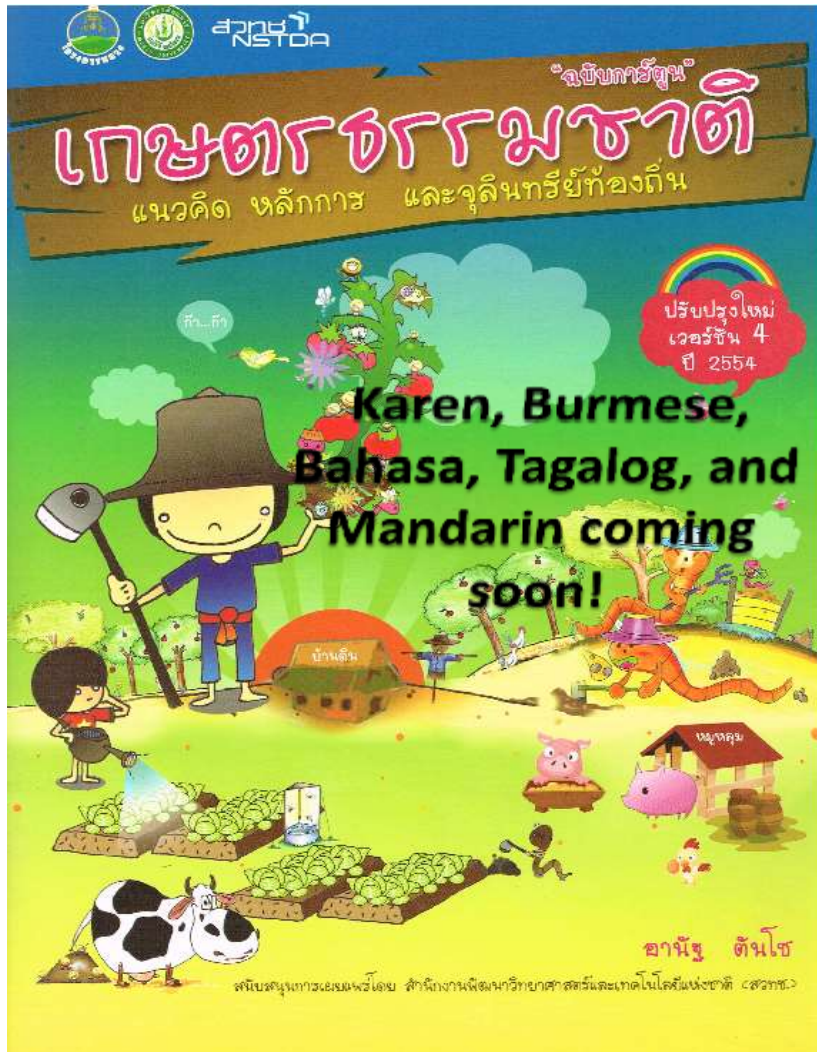
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ECHO Asia Notes Currently in Seven Languages

ECHO Asia Services



**Assistance in Finding and Accessing Needed
Technical Resources**

ECHO Asia Services



2009, 2011, 2013, 2015 ECHO
Asia

Agriculture and Community
Development Conference
Next Conference: October 3-6, 2017, Chiang
Mai
~\$200 with meals and lodging

Educational and Networking Events

198 Participants from 20 Countries



ECHO Asia Services



Northern Thailand - 2011



Southeast Cambodia - 2011



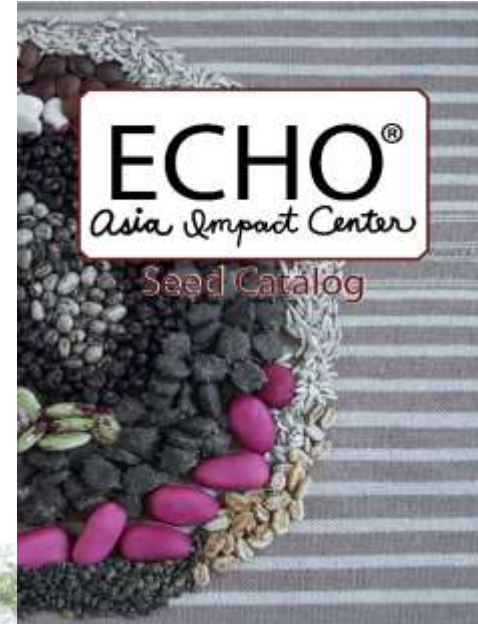
Indonesia - 2015



Pyin oo Lwin - 2016

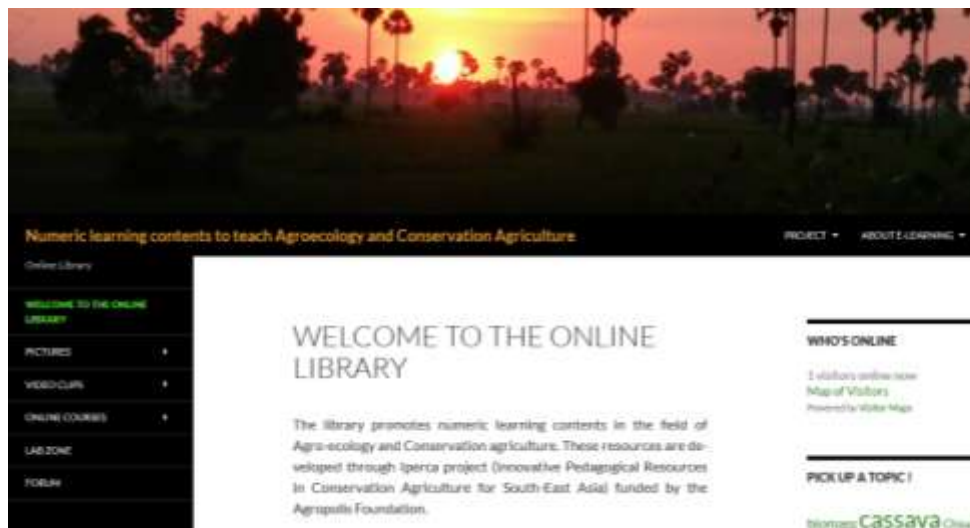
Regional Seed Exchange Events

ECHO Asia Services



**Seed Bank-
Now
Offering
145
Varieties**





<http://www.iperca.org/>

<http://casc.cirad.fr/>

**Thank you for your
attention!**

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