Interdisciplinary approaches to the early history of plants and animals in Southeast Asia: beyond archaeobotany

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The study of the early history of plants and animals in Southeast Asia has focused on archaeobotany and archaeozoology and has thus been dominated by salient macro-remains, particularly rice. This repertoire is slowly expanding, but ethnographic studies of plant production show farmers growing and exploiting a wide range of crops, including vegetative crops such as bananas and taro, and tree-crops, particularly fruits and oil-plants. Weak archaeozoology means that we still have little idea of the domestication and spread of various animal species, although genetics has begun to make valuable contributions. The paper explores the different disciplines to hand to reconstruct their agrarian history and the subsistence matrices in which they are embedded.
What’s the issue?

- It suggests that the major types of additional information are:
  - Synchronic ethnography; detailed description of present agricultural systems
  - Historical data; written, archival and epigraphic sources
  - Iconography; representations of plants and animals in manuscripts, paintings and friezes
  - Lexicography; the compilation and analysis of vernacular names
  - Genetics; the analysis of DNA and consequent hypotheses about phylogenetic relationships
  - Phenotypic description; botanical description of the characters of plants and cultigens, zoological characters of livestock
  - Direct finds, for example, food offerings in Chinese tombs
What’s the issue?

- I argue we have to reach the present from the past, in order to explain the current patterns of exploitation of plants and animals by reference to hypotheses about the past.
- This paper looks at some examples of what materials are available and how we need to fit these into an enlarged narrative about subsistence.
SE Asia is famed for the rich variety of economic plants used in its agricultural systems.

One study of Javanese homegardens counted more than 500 species cultivated in these backyard farms.

New World crops brought by the Spanish and Portuguese from the sixteenth century onwards have substantially added to the repertoire.

Archaeobotany tends to privilege cereals and pulses, but vegetative crops, trees and green leaves constitute a major proportion of diet.

When reconstructing the agriculture and plant production in the past we need to build back from the present.
Synchronic ethnography II

- A ‘positivist’ approach, i.e. we can only make statements about what we find in the ground leads to extremely misleading results.

- The key tools are thus conspectuses of useful plants as well as accounts of agriculture.

- However, modern accounts of agriculture are dominated by rice cultivation and there is every reason to think this is misleading.
Reference books and field guides

A DICTIONARY OF THE ECONOMIC PRODUCTS OF THE MALAY PENINSULA

I. H. Burkill

VOLUME I (A-H)

TREES AND FRUITS OF SOUTHEAST ASIA
An Illustrated Field Guide

MICHAEL JENSEN

ORCHID GUIDES
Written resources for the SE Asian region are scarce and are typically contained in the records of outsiders, who provided overviews of the region for trade purposes.

Although in principle there could be Indian sources, in fact these contain almost no economic data.

However, the Geography of Ptolemy, which reaches as far as Java (150 AD though available recensions dated about 4th century)

Ptolemy is aware ‘aromatics’, ‘resins’ and camphor are brought from SE Asia.

And even Pliny (Natural History ca. 70 AD) refers to this trade more vaguely.
Ptolemy’s map
Al-Idrisi’s map
Historical data 2

Although there are indigenous epigraphic records in SE Asia, but almost all are concerned with politics, and there is little economic information to be gained from them.

Arab geographers and travellers begin to describe SE Asia from 1000 AD onwards, notably Al-Idrisi (ca. 1200 AD), and Ibn Battuta (1325 AD) but the mixture of fantastical information and actual reports means we learn disappointingly little.
Historical data 3

- From the opposite direction we have the diplomatic reports of Chinese ambassadors, which begin around 200 BC.
- These are summarised, for example in the Han Shu (漢書)
- These are recently summarised in Munoz (2006)
- However, these focus on local politics, with passing mentions of the trade in aromatics and resins
For the medieval period, most intriguing is the description of Angkor (1296-7) at its height by the Chinese trader Zhou Daguan, who specifically describes the domestic plants and animals in some detail as part of his account.
Historical data 5

- So the next major wave of documentation is with European contact from the sixteenth century onwards.
- Information is scattered and highly variable.
- What begins to be really useful are the conspectuses of useful and economic plants, starting with Rumphius (1627 - 1702) who worked in the Molucccas.
- And continues with Dutch and English guides to useful plants.
Iconography 1

- Iconography of plants and animals can be a very informative source when used with care.
- Some large and impressive monuments can contain almost nothing of economic interest for example Bagan or the Champa friezes.
- A little-exploited source are the Chinese picture bricks from Gansu from the 3rd century AD which depict early farming activities in great detail.
- Borobudur (9th century) has a wide range of daily activities mixed in with religious scenes.
- Unfortunately, most of the important representations are on the ‘inner friezes’ i.e. they cannot be seen, so we depend on images form the period when the monument was dismantled.
- The Bayon at Angkor (11th century) is also known for its domestic and agricultural scenes.
Han picture bricks: ploughing
Han picture bricks: sowing seed
Borobudur: plants and animals
The Bayon is not always accurate! Some plants depicted are impossible.

Following the period of European contact, naturalists such as Rumphius begin to illustrate plants with something like modern botanical accuracy.

These are not historical in themselves, but provide clues to current agricultural practice which help us interpret the past.
The Bayon
Rumphius
Iconography 3

- Pottery models of plants, animal and processing equipment, and sometimes agricultural tools are recovered, especially in China.
- For example, the dating of the earliest chicken bones are disputed but difficult to argue with a terracotta model of a chicken.
- Similarly, models of processing equipment or even fields and storehouses all help enrich the picture we can develop.
Terracotta models, Shijiahe culture

Ca. 4500 BP, Hubei
Terracotta models of processing equipment, Tang Dynasty

陶磨、碾、碓和井栏
唐（公元618－907年）
1954年山西长治王琛墓出土

Pottery Millstone, Roller, Grain Huller, and Wellhead
Tang Dynasty (618–907 AD)
Unearthed at Changzhi, Shanxi Province, 1954
Linguistics 1

- The basic tool is the compilation of vernacular names for plants and animals in the languages of the region.
- In some language phyla, for example Austroasiatic and Daic, agriculture appears to reconstruct back to the proto-family, and we can therefore attribute a specific repertoire of crops and domestic animals to that family, and even possibly attribute a date to it.
- The advantage is that it gives us a handle on all cultigens, including those hard to find in the archaeobotanical record.
- In some cases, individual crops, such as foxtail millet, were probably domesticated prior to the establishment of the current language phyla (according to archaeobotany).
- But we can track them as they spread from one area to another.
# Daic lexicon illustrative of subsistence

<table>
<thead>
<tr>
<th>Item</th>
<th>Quasi-reconstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>taro</td>
<td>#pγaak</td>
</tr>
<tr>
<td>cooked rice</td>
<td>#mpuŋ</td>
</tr>
<tr>
<td>husked rice</td>
<td>#saan</td>
</tr>
<tr>
<td>white rice</td>
<td>#rɔp</td>
</tr>
<tr>
<td>millet</td>
<td>#pfeeŋ</td>
</tr>
<tr>
<td>ginger</td>
<td>#kʰiŋ</td>
</tr>
<tr>
<td>buffalo</td>
<td>#kwaay</td>
</tr>
<tr>
<td>goose</td>
<td>#γaan</td>
</tr>
</tbody>
</table>
# Austroasiatic subsistence terms

<table>
<thead>
<tr>
<th>Gloss</th>
<th>Reconstruction</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>rice (general)</td>
<td>#ɓaːʔ</td>
<td>Found in seven branches</td>
</tr>
<tr>
<td>rice-grain</td>
<td>*sŋɛːʔ</td>
<td>Reconstructs only to Proto-Mon-Khmer</td>
</tr>
<tr>
<td>paddy rice</td>
<td>#srɔ</td>
<td>Found in three branches but includes Munda</td>
</tr>
<tr>
<td>husked rice</td>
<td>#rəkau</td>
<td>Found in seven branches</td>
</tr>
<tr>
<td>foxtail millet</td>
<td>#səŋkɔɔɔy</td>
<td>Found in seven branches</td>
</tr>
<tr>
<td>taro</td>
<td>#trawʔ</td>
<td>all branches except Aslian</td>
</tr>
<tr>
<td>sesame</td>
<td>#lɛŋa</td>
<td>Found in six branches</td>
</tr>
<tr>
<td>banana</td>
<td>#tVlVy</td>
<td>Found in six branches</td>
</tr>
<tr>
<td>betel pepper</td>
<td>#mpluːw</td>
<td>Found in six branches</td>
</tr>
</tbody>
</table>
# Austroasiatic livestock terms

<table>
<thead>
<tr>
<th>Gloss</th>
<th>Reconstruction</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>bovid</td>
<td>$^{1}ywV$</td>
<td>widespread but does not necessarily apply to domestic species</td>
</tr>
<tr>
<td>cow</td>
<td>$^[rə]mɔɔk$</td>
<td>Found in six branches including Munda</td>
</tr>
<tr>
<td>buffalo</td>
<td>$^{k}rəpəaa$</td>
<td>Found in all branches excluding Munda</td>
</tr>
<tr>
<td>buffalo</td>
<td>$^{k}t\text{riik}$</td>
<td>Found in six branches with possible Munḍā cognate</td>
</tr>
<tr>
<td>pig</td>
<td>$^{k}kliik$</td>
<td>Found in six branches</td>
</tr>
<tr>
<td>pig</td>
<td>$^{k}kruul$</td>
<td>Found in six branches</td>
</tr>
<tr>
<td>goat</td>
<td>$^{b}ɛɛŋ$</td>
<td>Found in ten branches with doubtful Munḍā cognate</td>
</tr>
<tr>
<td>dog</td>
<td>$^{a}tʃɔ:k$</td>
<td>all branches</td>
</tr>
<tr>
<td>cat</td>
<td>$^{m}iaw$</td>
<td>Found in eight branches</td>
</tr>
<tr>
<td>chicken</td>
<td>$^{s}yiar$</td>
<td>Found in six branches</td>
</tr>
<tr>
<td>goose/duck</td>
<td>$^{tʃaa[k]}$</td>
<td>Found in nine branches but referent varies</td>
</tr>
<tr>
<td>duck</td>
<td>$^{tʃaa[k]}$</td>
<td>Found in nine branches</td>
</tr>
</tbody>
</table>
There is an extremely widespread root which can be reconstructed as #tfɔk, which resembles Old Chinese *sok closely.

It appears as an early borrowing into proto-Mienic (*tsyəiA), with the loss of the final velar, but also into Austronesian (Atayal basag).

This is consistent with an early domestication in the region of North-Central China and an eastward spread into the Austronesian world.
Foxtail millet II

- However, Austroasiatic languages have a quite distinctive root, #səŋkɔɔɔy, spread across the phylum and not showing borrowing from Sino-Tibetan.
- This argues either for a second domestication in the Austroasiatic area, or else a very early borrowing of the crop without a transfer of the name.
- This name is then borrowed into late Austronesian languages, such as Malay, which had ceased growing foxtail millet of Taiwanese origin.
- Another term in Austroasiatic for millet is #sapiʔ which has probably shifted from the original term for Job’s tears.
### Reflexes of \#tfɔk for ‘foxtail millet’ in SE Asian languages

<table>
<thead>
<tr>
<th>Language Family</th>
<th>Language Type</th>
<th>Language</th>
<th>Form</th>
<th>Phylum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sino-Tibetan</td>
<td>Sinitic</td>
<td>Chinese</td>
<td>sù (粟)</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Sinitic</td>
<td>Chinese</td>
<td>shǔ (黍)</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Sinitic</td>
<td>MC</td>
<td>syowk</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Sinitic</td>
<td>OCM</td>
<td>*sok</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Tujia</td>
<td>Tujia</td>
<td>wu¹ suo¹</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Nungish</td>
<td>T’rung</td>
<td>tɛa⁵⁵</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Loloish</td>
<td>Lisu</td>
<td>tʃø²¹</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Burmic</td>
<td>Burmese</td>
<td>ḟa⁵</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Tibetic</td>
<td>Lhokpu</td>
<td>cək</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Tibetic</td>
<td>Tshangla</td>
<td>ja⁵⁵ ra¹³</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Luish</td>
<td>Cak</td>
<td>jwari</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Tani</td>
<td>Bokar</td>
<td>ta-jak</td>
<td></td>
</tr>
<tr>
<td>Hmong-Mien</td>
<td>Mien</td>
<td>P-Mienic</td>
<td>tšyəi⁵⁵</td>
<td></td>
</tr>
<tr>
<td>Austronesian</td>
<td>Formosan</td>
<td>Atayal</td>
<td>basag</td>
<td></td>
</tr>
<tr>
<td>Austronesian</td>
<td>Philippines</td>
<td>Bontok</td>
<td>sabog</td>
<td></td>
</tr>
</tbody>
</table>
### Reflexes of #səŋkɔɔy, ‘foxtail millet’

<table>
<thead>
<tr>
<th>Phylum</th>
<th>Language</th>
<th>Language Name</th>
<th>Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austroasiatic</td>
<td>Monic</td>
<td>Nyah Kur S.</td>
<td>phəyóok</td>
</tr>
<tr>
<td>Austroasiatic</td>
<td>Khmeric</td>
<td>Khmer</td>
<td>skuːŋy</td>
</tr>
<tr>
<td>Austroasiatic</td>
<td>Vietic</td>
<td>PV</td>
<td>*s-koː j</td>
</tr>
<tr>
<td>Austroasiatic</td>
<td>Vietic</td>
<td>Vietnamese</td>
<td>kê</td>
</tr>
<tr>
<td>Austroasiatic</td>
<td>Vietic</td>
<td>Malieng</td>
<td>səkoː j</td>
</tr>
<tr>
<td>Austroasiatic</td>
<td>Pearic</td>
<td>Chong [Chantaburi]</td>
<td>ha : j kəno : ?j</td>
</tr>
<tr>
<td>Austroasiatic</td>
<td>Palaungic</td>
<td>Rianglang</td>
<td>¯khuay</td>
</tr>
<tr>
<td>Austroasiatic</td>
<td>Katuic</td>
<td>Pacoh</td>
<td>?ayuəʔ</td>
</tr>
<tr>
<td>Austroasiatic</td>
<td>Khmuic</td>
<td>Kammu Yuan</td>
<td>həŋkə:y</td>
</tr>
<tr>
<td>Austroasiatic</td>
<td>Khasian</td>
<td>Khasi</td>
<td>kra : y</td>
</tr>
<tr>
<td>Austronesian</td>
<td>Malayic</td>
<td>Malay</td>
<td>sēkoī</td>
</tr>
<tr>
<td>Austronesian</td>
<td>Chamic</td>
<td>Cham</td>
<td>hakoːy</td>
</tr>
<tr>
<td>Daic</td>
<td>Tai</td>
<td>Shan</td>
<td>kʰaw³ kɔy¹</td>
</tr>
</tbody>
</table>
Genetics

- The genetics of domestic plants and animals in SE Asia is in its infancy
- The focus has been, as usual, on rice, with a small amount of work on other crops, such as foxtail millet, buckwheat etc.

Molecular Evidence on the Origin and Evolution of Glutinous Rice

Kenneth M. Olsen¹ and Michael D. Purugganan
Department of Genetics, North Carolina State University, Raleigh, North Carolina 27695
Manuscript received June 19, 2002
Accepted for publication July 26, 2002

Genetic Structure and Diversity in *Oryza sativa* L.

Amanda J. Garris,*,¹ Thomas H. Tai,†,² Jason Coburn,* Steve Kresovich* and Susan McCouch*³

⁻¹ Plant Breeding Department, Cornell University, Ithaca, New York 14853-1901 and ¹ U.S. Department of Agriculture-Agricultural Research Service Dale Bumpers National Rice Research Center, Stuttgart, Arizona 72160
Genetics 2

- There has been more work on domestic animals, notably pigs, dogs and chickens
- Especially for pigs, the results have caused a major rethink of the routes by which pigs reached ISEA

Rethinking dog domestication by integrating genetics, archeology, and biogeography


Patterns of East Asian pig domestication, migration, and turnover revealed by modern and ancient DNA

Greger Larson, Ranran Liu, Xingbo Zhao, Jing Yuan, Dorian Fuller, Loukas Barton, Keith Dobney, Qipeng Fan, Zhiliang Gu, Xiao-Hui Liu, Yunbing Luo, Peng Lv, Leif Andersson, and Ning Li
Pig genetics SE Asia
Dated finds

- Apart from classic archaeobotany, there are claims, for China at least, that some finds go back to the early Palaeolithic.
- However, tombs in China, in particular, have good preservation and are sometimes dated precisely.
- Specific offerings in the tombs focus on fruits and other food plants with hard kernels.
Palaeolithic hackberry seeds

Hackberry Seeds
Lower Palaeolithic (c. 2 million–200,000 years ago)
Unearthed at Locality 1, Zhoukoudian, Beijing, 1958

Hackberry seeds gathered for food and a large cache of animal remains were discovered at the Peking Man site. The fossils of over 2,000 individual thick-jawed deer and over 1,000 individual *Pseudaxis grayi* deer indicate that these two species were primary hunting targets for Peking Man. The *Pseudaxis grayi* were hunted in late summer/early autumn, while the thick-jawed deer were hunted in late autumn/early winter.
Tomb offerings in Hubei Province

Ginger

Warring States period
From Wangshan Tomb 2, Jiangling, Hubei Province
The concept of integrated prehistory

- Human interaction with plants and animals is clearly a major element of prehistory.
- Yet for SE Asia our understanding remains extremely weak for a variety of reasons.
- Beyond a positivist archaeobotany we need to begin to bring in a wide variety of other sources of information in order to being the construction of integrated prehistory.
- Which might look like this;
Integrated prehistory: a model

Prehistory

- Documentary records
- Oral traditions
- Comparative ethnography
- Comparative and historical linguistics
- Genetics
- Palaeoclimatology
- Archaeology, Ethnoarchaeology, Archaeoscience
- Paleobiogeography
Above all..

- Reconstructing the history of interaction with plants and animals is *not* a scientific experiment.
- The archaeobotanical record will always be extremely patchy.
- We need to approach the topic with a broad range of reference and some imagination to do justice to the past.
THANKS

To the many individuals and museums who have contributed to this talk