

Traditional knowledge on “*Luchai*” [*Phragmites australis* (Cav.) Trin. ex Steud. and *Arundo donax* L.] and their dynamics through urbanization in Yangzhou area, East China

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As rural lifestyles have given way to more urbanized lifestyles, much traditional knowledge is lost. To investigate the dynamics of traditional knowledge on wetland plants during urbanization, *Phragmites australis* and *Arundo donax*, two important useful wetland plants in Yangtze River Delta were studied ethnobotanically in Yangzhou area, China. Our results revealed that, although the two plants both called “*Luchai*” in the study area, *P. australis* showed higher use value (UV), relative frequency of citation (RFC) and diversity of uses than *A. donax*. Presently, many traditional uses of *P. australis* are still practiced by local people, while *A. donax* is only used for constructing fence and supporters for climbing crops. There were significant correlations between the ages of informants and their traditional knowledge on the two plants, indicating that a growing number of young people had less and less folk knowledge on wetland plants. Traditional knowledge plays crucial roles in the sustainable development of economy and society, it is necessary to collect and document the traditional knowledge about other wetland plant species in the context of urbanization.

Keywords: *Phragmites australis*, *Arundo donax*, Traditional knowledge, Dynamics, Urbanization

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Urbanization all over the world has been growing rapidly since the middle of last century¹⁻³. According to the statistic data and forecast of UNPD, urbanization will continue at a high speed for next 30 yrs, especially in the developing countries^{4,5}. Although urbanization could drive economic development, accelerate information communication⁶, and provide more job opportunities⁷, it could also cause some serious issues such as environment pollution, growing the gap between richness and poverty, even social security^{3,8,9}. Urbanization also accelerates the disappearing of the traditional lifestyles which the rural people ever followed. Traditional knowledge on the use of natural resources plays an important role in solving the problems caused by urbanization^{3,10,11}. Firstly, as an important sector of urban economy, the informal sector which is related to traditional knowledge provide many job opportunities for these new city residents⁷. Secondly, traditional knowledge can contribute to the sustainable development of cities^{10,11}. For example, Hiemstra van der Horst & Hovorka reported that

traditional fuel could alleviate the energy crisis caused by urbanization in some African areas¹². Traditional medical knowledge still played an irreplaceable part in the health care of some countries during urbanization^{13,14}. However, the loss of traditional knowledge is inevitable in urbanization^{15,16}, it is necessary and urgent to collect and document the traditional knowledge before it disappears completely.

Wetlands are one of ecosystems that are susceptible to degradation through urbanization^{2,17,18}. Traditional knowledge about wetlands is disappearing along with wetland degradation and alteration^{19,20}. Yangtze River Delta is one of developed areas in China and well-known as “the country of fish and rice”. Wetlands were ever one source of local people getting their livelihood. However, the total area of wetlands in this region showed a trend of reduction in recent years²¹. Much traditional knowledge about wetland plants is also on the verge of loss along with degradation of wetlands and disappearing of traditional lifestyle. “*Luchai*”, the vernacular name of *P. australis* (Cav.) Trin. ex Steud. and *A. donax* L., is very useful for local people in this area. *P. australis*, a plant belonging to Poaceae, *Phragmites* genus, is a

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common dominant species of wetland plant communities. *A. donax* belongs to Poaceae, *Arundo* genus, was introduced to the Yangtze River Delta to meet the growing demand for the stems of *P. australis* in the 1950s. “Luchai” is a common element in the traditional culture, such as a famous folk song “Pulling a reed catkin” in Yangzhou area. In this paper, we try to answer the following two questions based on the information collected during the field work: what were or are they used for? What will happen to the traditional knowledge about them through urbanization?

Methodology

Study area

Field work was carried out in suburban areas of Yangzhou city, located at the plain of the lower reaches of Yangtze River, which is dotted with lakes and small water bodies (Fig. 1). Historically, Yangzhou has a long-history of inhabitation—one of its central waterways, the Beijing-Hangzhou Canal, was built nearly 2500 yrs ago—and today remains well-known for its bridges and ancient gardens. Wetlands and bio-resources across the region play important roles in traditional lives of local people, who are predominately Han Chinese. Despite large-scale urbanization, among traditional communities foraging, firewood and other living materials are often collected from the wetlands.

Collection of ethnobotanical data

Field work was carried out during six field trips between the Spring of 2012 and the Spring of 2014. During the field investigation, interview and participatory observation were used to collect ethnobotanical information on the usage and perception of *P. australis* and *A. donax*. Informants for interviews (Total 271 villagers, 128 males and 143 females, aged 22 – 88 yrs) were selected using snow ball technique, and the objectives of this research were discussed with the villagers prior to obtaining their informed consent before interview. Generally, the informants were asked to list freely all uses, both past and present, of the two species they knew. And then, information about the useful organs (root, stem, leaf, inflorescence, whole plant) and use pattern were collected for the data analysis.

Data analysis

The use value (UV), relative frequency of citation (RFC), Shannon diversity index (H') and evenness (E)

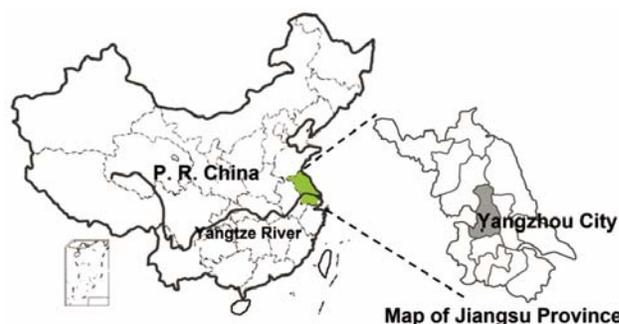


Fig. 1—Location of Yangzhou City (the study area of this paper) in China

were determined to analyze the diversity of uses of the two species. The use value was calculated as:

$$UV = \sum U_i / N$$

Where, U_i is the number of different use-categories mentioned by each informant and N is the total number of informants interviewed during the field work²².

Relative frequency of citation was calculated as:

$$RFC = FC / N$$

Where, FC is the frequency of citation and N is the total number of informants interviewed²².

Shannon diversity index (H') and evenness (E) were calculated according to Andabo and Gamo as²³: $H' = -\sum p_i \ln p_i$ and $E = H' / \ln S$, where p_i is the frequency of use category i , S is the number of use categories. The independent-samples t -test and χ^2 test were applied to analyze the difference in the use diversity of the two species and difference in the knowledge between different informant groups. The difference was considered to be statistically significant when $P < 0.05$.

Results

Characteristics of knowledge owners

All the informants were classified into the following age groups: ≤ 20 , 21 to 30, 31 to 40, 41 to 50, 51 to 60, 61 to 70, and ≥ 71 yrs old. The distribution of the 271 informants in different age groups was showed as follows: 13 (4.8%) in aged 21-30, 13 (4.8%) in aged 31-40, 59 (21.8%) in aged 41-50, 62 (22.9%) in aged 51-60, 71 (26.2%) in aged 61-70, and 53 (19.6%) in aged over 70. The number of informants in the younger age group (21-40) was markedly lower compared with the older age groups, because most young people went to study or work outside. The demographic breakdown of the interviewed knowledge owners showed a significant

difference in knowledge about the uses of the two plant species ($\chi^2=105.65$, $df=1$, $P<0.05$). Among the informants, over 98.5% of them (267) reported *P. australis* as a useful plant, while only 64.9% (176) considered *A. donax* useful. Nearly all the informants who mentioned *A. donax* also mentioned *P. australis* except for 4 people. Our results did not show a significant difference for knowledge of the two species in either gender ($\chi^2=0.293$, $df=1$, $P=0.628$). Male and female informants had similar knowledge on the use of *P. australis* and *A. donax*.

The ethnobotanical information of vernacular name of the two species

“*Luchai*” consists two parts, “*lu*” and “*chai*”. “*lu*” means all plants like reed and “*chai*” means firewood. So “*Luchai*” is used traditionally as firewood. “*Luchai*” was classified into two groups, “*Shui Luchai*” (*P. australis*) and “*Yang Luchai*” (*A. donax*), according to their habitats by folk people. “*Shui*” and “*Yang*” are two extremely different environments. “*Shui*” refers to water or wetland environment, “*Yang*” is typical terrestrial environment. “*Shui Luchai*” means *P. australis* grows in or near by water environments and “*Yang Luchai*” means *A. donax* grows in dry or terrestrial sites. So the use, morphological characteristics and habitats are important in the folk nomenclature of the two plant species. This phenomenon is also similar to many other wetland plants in the study area.

Use diversity of the two species

According to the folk uses of the two species, we classified the uses into eight categories (Table 1). *P. australis* was employed in all the use-categories, but *A. donax* had been mentioned only in six types of use. *A. donax* was never used as medicine or fodder. For both species, the most frequently mentioned use was being used as construction materials, especially

for *A. donax* (nearly half of informants mentioned this use) (Table 2). They were main materials for constructing traditional houses in the study region. The second important use for *P. australis* was being employed as vegetable or used for processing foods. Its shoots were edible and leaves were mainly employed to process rice dumpling, a traditional Chinese food for the Dragon Boat Festival. Providing fiber, being used as firewood and materials for making domestic articles were the other important uses after food for *P. australis*. For example, “*Woji*”, a columned container made from the stems of *P. australis*, is commonly used for storage of grains due to its excellent ventilation that allows for long-term storage Fig. 2A. Besides providing construction materials, the next important use for *A. donax* was being used as firewood. Compared with *P. australis*, it was rarely used as food, fiber, and other use (Table 2). Comparatively, *P. australis* had far more cultural or medicinal uses than *A. donax*. For instance, some folk songs from the area are related to *P. australis* and this plant is very important in local religious ceremonies. The Shannon diversity of use for *P. australis* was significantly higher than that of *A. donax* ($df=393$, $t=9.8826$, $P<0.05$), as well as UV and RFC (Table 3). The evenness of *P. australis* was also higher than that of *A. donax*, indicating that most of *P. australis*' diverse uses were quite common in the study area. Although *A. donax* had many uses, some were unevenly or rarely practiced by most of the local people, and few people had the requisite knowledge of its capabilities. Similarly, folk knowledge on *P. australis* was much richer than for *A. donax* and more constituent parts of *P. australis* were widely used. The stem, leaf, inflorescence and root of *P. australis* were all reported to be useful, but for *A. donax*, the stem seemed to be the only valuable part in the study area.

Table 1—Traditional use categories of the two species based on their folk use information in the study area

Use category	Usage (species with the usage)
Construction material	Used for constructing house, fence, trellis for supporting climbing plants, hogcote, and fishing vessel, etc. (<i>P. australis</i> and <i>A. donax</i>).
Fodder	Used as animal foods (<i>P. australis</i>).
Fuel	Used for cooking and heating (<i>P. australis</i> and <i>A. donax</i>).
Fiber	Used as the materials for making baskets, mat, rope, and shoes (<i>P. australis</i> and <i>A. donax</i>).
Daily necessity	Used for making domestic articles, such as granary, door curtain, raincoat, pillow, etc. (<i>P. australis</i> and <i>A. donax</i>).
Food	Edible or used for processing foods (<i>P. australis</i> and <i>A. donax</i>).
Medicine	Used to treat human or animals' diseases (<i>P. australis</i>).
Other	For religious and cultural purposes (<i>P. australis</i> and <i>A. donax</i>).

Table 2—The citation frequencies of different use categories for *P. australis* and *A. donax*

Categories	<i>P. australis</i>		<i>A. donax</i>	
	Number of UR*	%	Number of UR	%
Construction material	248	23.5	152	48.3
Food	231	21.9	21	6.7
Fiber	173	16.4	18	5.7
Firewood	169	16.0	99	31.4
Daily necessity	151	14.3	12	3.8
Medicine	17	1.6	0	0
Fodder	13	1.2	0	0
Other	53	5.0	13	4.1
Total	1055	100	315	100

*UR=use-report(s)

Remaining usages of the two species

As rural lifestyles have given way to more urbanized lifestyles, it seems likely that many uses of “Luchai” have been lost. Our results showed that a great deal of knowledge on the folk uses of the two plants was only reported as a memory and not practiced any more. However, there are some uses still practiced even now (Table 4). For *P. australis*, five kinds of traditional usages are still widely practiced. For example, the stems are not only used to build supporters and fences, but also for weaving mats Fig. 2B, and making sacrificial offerings for religious activities Fig. 2C. The leaves of *P. australis* are an important raw material in traditional Chinese rice-pudding, which remains quite popular in mainland China; these leaves can be found in local markets throughout the region at a price of roughly 1.5 US\$ per kilogram Fig. 2D. Similarly, the roots are still used in modern practices of traditional Chinese medicine. For *A. donax*, the stems are still used to build support structures for climbing crops (e.g., beans, cucumber, and tomatoes) Fig. 2E. Sometimes, these stems are also used to make fences to prevent animal incursions Fig. 2F.

The correlation between the informants’ ages and their knowledge on the two species

The four people who did not mention any use of *P. australis* were all female and aged 50 – 59 yrs. The result of independent-samples *t*-test showed that the mean age (59.2 yrs old) of informants who mentioned at least one use of *A. donax* was significantly older than that (56.9 yrs old) of informants who did not report any use of this plant ($t=1.245$, $df=269$, $P<0.05$). A simple linear regression analysis was used to analyze the correlation between the mean ages of



Fig. 2—Some folk uses of *P. australis* and *A. donax* in the study area; (A) “Woji” made from the stems of *P. australis*, a common container used for storage of grains; (B) Mats woven with the stems of *P. australis*, which can be used for constructing houses and other household purposes; (C) Sacrificial offerings used in religious activities, the stems of *P. australis* are used as the skeletons of them; (D) Rice dumplings, they are wrapped with the leaves of *P. australis* as the special odor of these leaves can make this food more delicious; (E) Support structures for climbing crops made of the stems of *A. donax*; (F) Fences made of the stems of *A. donax*, they are used to protect crops or homegardens against the incursions of animals.

informants and their knowledge on the uses of the two species. A significant correlation between the ages and the number of uses as well as the number of use-categories the informants mentioned was obtained for *P. australis* Figs. 3A&B. For *A. donax*, a significant correlation was found between the ages and the number of use-categories ($R^2=0.6972$, $P<0.05$), and there was no correlation between the ages and the number of use mentioned ($R^2=0.4938$, $P>0.05$) Figs. 3C&D. The informants aged 51-60 were more knowledgeable about the folk use of *A. donax* than other age groups.

Discussion

P. australis has a cosmopolitan distribution²⁴ and is often considered as a useful plant in many of its distribution areas, both within and outside of China²⁵. For example, the stems of *P. australis* are widely used to plait mats, which can be used for constructing houses and other household purposes²⁶⁻²⁹. These stems are also key materials for weaving baskets^{30,31}, constructing musical instruments^{32,33} and curing sicknesses³⁴. The leaves are added to the foddors to treat the stomach flatulence of horses³⁰. In some parts of Lesotho, *P. australis* is used in the construction of courtyard screens³⁵, while the Chumash Indians of southern California collect aphid honeydew from the stems of *P. australis* for use as sugar. In South eastern Spain, the plant has a long cultural and historical legacy for its use in the capture and feeding of song

birds³⁶. In this study, we found that *P. australis* is or has been used for many other purposes besides those mentioned in the existing literatures. Likely, this is due to the lack of timber and widespread distribution of *P. australis* in the study area, which makes this plant important for its uses in construction. Similarly, the rich fiber in *P. australis* is suitable to make daily necessities and handicrafts. Culturally, this plant also carries cultural meaning that is represented in folk songs and religious activities. Indeed, the species is among most important wild plants in the study area.

A. donax can grow very well in lots of different habitats, and is regarded as one of important plants in the agricultural production in some areas^{33,37}. During the 1950s to the 1960s, the local people in the study area began cultivating *A. donax* to meet the growing demand for the stems of *P. australis*. So, it is easy to understand why the informants aged 50-61 yrs have much more knowledge on the use of *A. donax* than other age groups (Figs. 3C&D). Although the higher production per acre of *A. donax* satisfied the demand for *P. australis* as raw material of paper-making, it did not replace *P. australis* completely in terms of traditional practices. Even when the two species are used for the same purpose, the local people often

prefer *P. australis*. For example, though both species can be used to build traditional houses, local people seemed to prefer *P. australis* to *A. donax* if both species are available. Similarly, the leaves of

Table 3—Use value (UV), relative frequency of citation (RFC), Shannon diversity index (H') and evenness (E) of the two species.

Index	<i>P. australis</i>	<i>A. donax</i>
UV	3.82	1.14
RFC	0.98	0.65
H'	1.81	1.32
E	0.87	0.63

Table 4—Uses of the two species still practiced presently.

Usescategories	<i>P. australis</i>	<i>A. donax</i>
Construction material	+	+
Fodder	-	-
Fuel	-	-
Fiber	+	-
Daily necessity	-	-
Food	+	-
Medicine	+	-
Other	+	-

Note: '+' means the corresponding use being practiced presently and '-' means the corresponding use no longer being used.

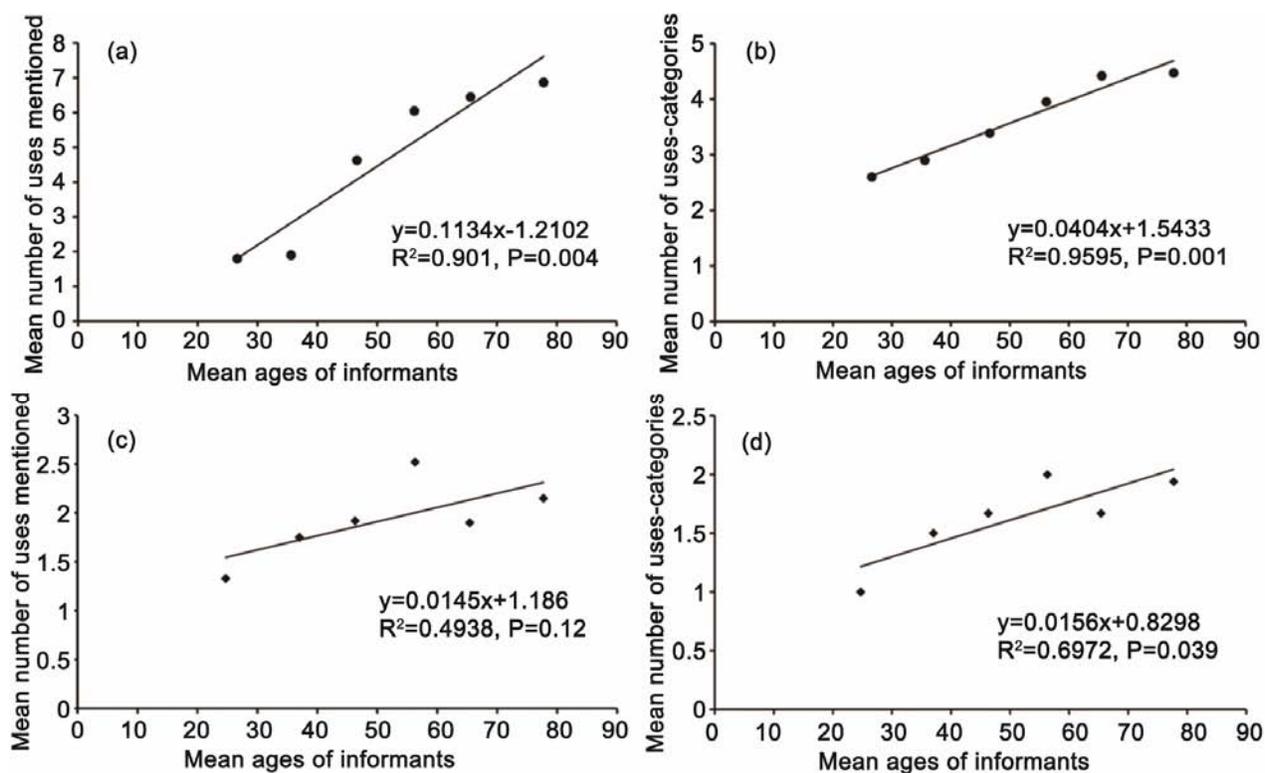


Fig. 3—Correlation between the informants' ages and their knowledge on *P. australis* (A&B) and *A. donax* (C&D).

P. australis are essential materials in rice dumplings, the leaves of *A. donax* are hardly for this purpose, because they lack the special odor of *P. australis*.

Much of the knowledge on *P. Australis* mentioned in this paper is general knowledge among the populace and not specialized. Only some uses, such as medicinal, religious uses are possessed by few professional persons. Alongside these applied practices, there was some evidence that certain people only knew of the uses but did not practice them. Presumably, along with the disappearance of traditional lifestyles, a great deal of folk knowledge on the use of the two species has been lost. This loss is not necessarily surprising, since during our field work we found it is difficult to find informants under 40 yrs. Likely, changing demographics in China as well as rapid urbanization has pushed many young people into the cities to find jobs. It then stands to reason that in this environment, young people have no chance to touch and practice such traditional knowledge. Additionally, the traditional knowledge on cultivation and management of these two species is also facing being lost because their roles are decreasing in local people's life. It is necessary to collect and document the traditional knowledge about other wetland plant species.

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