Sus scrofa - Wild Boar

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Picture 1: A wild boar. Credits to Frank Vincentz.

Distribution
The original distribution of wild boar (green) covers a large part of Eurasia, which ranges from tip of western Europe to Japan, and from Manchuria (North China/ Far East Russia) to Java in south. Its limited by Sahara and Arabian deserts in Middle East, colder climate in higher latitude (and altitude) and the sea between Sunda islands (Malayan peninsular, Sumatra and Java) and Borneo plus the rest of eastern Indonesia (Meijaard et al., 2011; Oliver & Leus, 2008).

Historically, wild boar also lived in Egypt, Libya, British isles and Scandinavia which they went extinct (red). However, in British isles and Scandinavia, wild boar were reintroduced by human action (light blue) (Meijaard et al., 2011; Oliver & Leus, 2008).

Besides that, wild boar were also introduced through human action to region beyond original range (dark blue) such as Americas (North, South and Caribbean), sub-Saharan region and Australasian region (east Indonesia, Australia, New Zealand and Polynesian islands) (Meijaard et al., 2011; Oliver & Leus, 2008; IUCN SSC Invasive Species Specialist Group).

**Diet**

Wild boar are omnivorous and known to have diverse diet which includes mostly vegetable materials (roots, seeds, fruits) and also, in small proportion, other organisms, from accidental ingestion of soil organisms (mostly invertebrates) to active predation on turtle eggs and young animals (reported on rare occasion) and scavenging (displacing other predators). Their characteristic feeding strategy involves sniffing for food below ground level with specialised snout disk and digging it up with their canines. The omnivorous diet are related to their inefficient digestive system that only utilises rudimentary fermentation without specialised stomach or caecum (Meijaard et al., 2011).

**Habitat and Behaviour**
Wild boars, known to be ecologically adaptable, occupy a variety of habitats ranging from semi deserts to tropical rainforest. They can also be found up to 2400m above sea level. They generally avoid open areas, preferring areas with water supply and tree cover (Meijaard et al., 2011; Oliver & Leus, 2008).

The usual period of greatest activity occurs during crepuscular hours such as early morning or late afternoon. However, wild boars are also reported to be active throughout the night in disturbed areas. Most of the time are spent feeding and travelling. Besides that, they also wallow in muddy waters regularly to cool down body temperature and also removing parasites. Wallowing puddles are strategic territories for wild boars, they usually marks their territory through rubbing against vegetations around the puddles (Meijaard et al., 2011; Oliver & Leus, 2008).

Wild boars tend form herds of 6 to 20 individuals that are made up of females and their litters, which communicates with each other using sound and tactile contacts. The organisation of the herds are flexible as individual come and goes. Different herds may aggregate to group of up to 100 individual during feeding, which social interaction such as display and aggression also takes place at the same time. On contrary, adult male are solitary except during breeding season and feeding aggregation. In contrast with herding females, the males also uses odour signal for communication. (Meijaard et al., 2011; Oliver & Leus, 2008).

Wild boar are known to display aggressive anti-predation behaviour and are known to kill their predators with their canines which are sharpened by constant friction against opposite canines. They may also attack in groups, displaying mobbing behaviour. The ferocity of wild boar are increased when protecting their young (Meijaard et al., 2011; Oliver & Leus, 2008).

Reproduction

Wild boars displays facultative seasonality in breeding activity at higher latitudes, due to influence of food availability and climatic factors. In tropics, the abundance of food supply and relatively constant climate allows them to breed throughout the year and potentially two litters in the same year. This results in highest rates of reproduction among ungulates. They usually (but not limited to) give birth to litters of 5-9. When its time to give birth, females will leave the herd temporarily to construct a nest. The newborn litter will stay at the nest for 4-6 days before rejoining the herd. A wild boar herd shares responsibility in feeding the litters, which means piglets can suckle from unrelated lactating females within the herd even if they are not related. The suckling last for 3-4 months and the piglets will reach full maturity at 18 months. Wild boars are highly protective of their litters, they will fight with intense vigour when cornered, especially the females with piglets (Meijaard et al., 2011; Oliver & Leus, 2008).

Relation With Humans

Domesticated pig, notice the lost of colouration, fur and canine compared to wild boar in other video.

Domestication

Wild boars/pigs had been domesticated since the early times of human civilisation. It is valuable in agriculture due to large litter size, fast maturity and flexible diets which makes it suitable as food species (Meijaard et al., 2011). Historically, the domestication of wild boar into domestic pigs are speculated to originate from Near East around 9000 BC. However, molecular works on mitochondrial DNA revealed multiple, independent origin of domesticated wild boar across the world, which can be roughly grouped into domestic pig of European, East Asian, Indian and South-East Asian origin (Larson et al, 2005).

Impacts due to domestication

One of the side effects of human domestication is the establishment of feral population. The ease of rearing allows pigs to brought along during migration. Once settled, domesticated pigs might escape into wild and will turn feral easily after several generations and breeds readily with native conspecifics. The relation between human migration and domestication of wild boar causes the species to be present in all continents of the world except Antarctica (Meijaard et al., 2011; Oliver & Leus, 2008; IUCN SSC Invasive Species Specialist Group, 2010).

The feral population is often considered a pest animal for feeding on crops and disrupting field. However, the greatest damage caused by the feral pigs happens in non-native region through disruption of local ecology. High breeding rate and flexible adaptability enables them to establish themselves quickly in non-native regions, causing serious issue as invasive species by causing damages through habitat alteration (due to their feeding habit of digging up soils and also habit of wallowing), competition/predation of local species and disruption of local vegetation (IUCN SSC Invasive Species Specialist Group, 2010; Massel & Genov, 2004).

Wild Boar in Singapore

Wild boar spotted at Upper Pierce Reservoir in main island of Singapore. Notice the travelling herd of female with piglets.
In Singapore, wild boars are known to thrive in nearby islands but not the main island. There were records of previous existence of wild boar on main island up to 1960's but presumably extinct in the main island due to lack of reported observation (Medway, 1978; Harrison, 1974; Yong et al., 2010). However, as recent as 2010, wild boar are found to be repopulating the main island. They were speculated to be originating from either the nearby islands or from Peninsular Malaysia. This is possible due to wild boars being capable of swimming across the narrow strait separating the islands (and the peninsular) (Yong et al., 2010).

While Singapore is not a foreign region for wild boars, which also arrives through natural means, the wild boars are considered risk to local ecology. This is because the main island does not have predators such as tigers, that are large enough to predate on wild boars nor do the island have large herbivores that could compete with the wild boars. The lack of control on wild boar population is damaging local ecosystem as they damages local habitat by wallowing and uprooting plants as they feed. Besides that, there were also instances of aggression against people near the edge of forest (Yong et al., 2010; Nature Society Singapore, 2012; Singapore National Parks Board, 2009). The local authorities employed methods such as culling to attempt to control the wild boar populations (Kok, 2013).

### Taxonomy

#### Name

*Sus scrofa* Linnaeus, 1758

#### Etymology

*Sus* means pig in latin while *scrofa* means female pig for breeding in latin.

#### Type information

Type - stored in Muséum National d'Histoire Naturelle, Paris

Type locality - Germany, exact location unknown

(Handjasasmita, 1987)

### Description

Figure 1 Common characteristics of wild boar.
Common characters (Harjasasmita, 1987; Groves & Grubb, 1993; Meijaard et al., 2011):

- Long and pointed head, face with short snout, characteristic snout discs (a).
- Upper canines form tusks that curved up and outward (b).
- Male generally have larger canines.
- Rounded back (c) and relatively long legs (d).
- Generally brown to black in body colour.
- Young are coloured brown with longitudinal blackish stripes at torso (losing it between 2-6 month of age).
- Morphology may vary significantly among different subspecies, such as fur colour and size.
- Generally obeys Bergmann's rule, with larger subspecies found towards higher latitude while smaller subspecies at lower attitude.

**Diagnosis**

Figure 2: Sus scrofa skull, notice the upward curving canine. (Hardjasasmita, 1987)
Figure 3: Skull of typical peccary, notice the downward pointing canine.

Distinction from close relatives (Hardjasasmila, 1987; Groves & Grubb, 1993; Groves, 2007; Groves & Grubb, 2011):

- Can be easily differentiated from Tayyasuidae (peccaries) as the upper canine is curved upward.
- Recognised from other genus within Suidae due to lack of special features on face and facial warts (common among Suidae, *Sus scrofa* is an exception).
- Exception found on the genus *Porcula*, pygmy hog but it has different number of pairs of mammary gland and only found in Assam, India.
- Male lower canine is of scrofic type with posterior side broader than buccal (cheek, as contrast to lingual, the tongue) side, and lack of facial features such as ring of thick hair (seen on *Sus barbatus*, the bearded pig) or warts which differentiates from other species within genus *Sus*. 
Figure 4: The bearded pig, Sus barbatus which can be found in Peninsular Malaysia, Sumatra and Borneo. Note the thick hair (the beard) around the snout which gave this species the common name.
Figure 5: Desert warthog, Phacochoerus africanus. Notice the facial wart which is a common feature of Suids except Sus scrofa.

Figure 6: Morphology of scrofic & verrucosic male lower canine, note the difference in length of posterior side (blue) and buccal side (green) of the canine. (Hardjasasmita, 1987)

Phylogeny
Sus scrofa belongs within the genus of Sus which is within Suidae. Suidae is nested within the Artiodactyla (usually referred as even-toed ungulate), which is one of the major clade of Mammalia. The last major change in relationship among clades within Artiodactyla is the inclusion of Cetacea within Artiodactyla as closest relative to Hippopotamidae and recognition of Tylopoda as the basal branch of Artiodactyla. While the relationship among ruminants (such as Bovidae, Cervidae etc.) are difficult to resolve, Tayassuidae (peccaries, or new world pigs) remains the closest relative of Suidae within Artiodactyla and both recognised as the more basal branches of Artiodactyla due to their primitive digestive system, hence they are sometimes groups together as Suina. The difference between the two families lies in morphology of upper canines which in Suids are turned upward while in Tayassuids are pointed downward (Groves & Grubb, 2011; Groves, 2007; Asher & Helgen, 2010).

Chart 1: Simplified cladogram of relationship among major clades of Artiodactyla. Notice the basal position of Suidae. (Asher & Helgen 2010; Groves 2007)

Within Suidae, the six genus can be roughly divided into Babyrousa, Eurasian Suids and African Suids. The African Suids is made up of Phacochoerus, Hyl ochoerus and Potamochoerus which are all restricted to African continent, separated by the Sahara desert from Eurasia. The Eurasian Suids are previously made up of only Sus, but recently the pygmy hog, Porcyla salvanius is considered as new genus and taken out from Sus. While showing close affinity with Sus, the position of Porcyla in relation with other genera are still unclear (Funk et al., 2007; Gongora et al., 2011).
Within \textit{Sus}, \textit{Sus scrofa} is traditionally differentiated from other \textit{Sus} species by morphological features of lower canine. This creates two groups, one is the scrofic group (also known as non-warty pig) which consists of \textit{Sus scrofa}, while the other group, the verrucosic group consist of other \textit{Sus} species. However, further analysis based on morphology and molecular data each yielded different results, leaving the overall relationship unclear. The morphological study suggested that \textit{S.barbatus} (Beraded pig) and \textit{S. verrucosus} (Javan warty pig) form distinct lineage from \textit{S. scrofa} and pigs from Sulawesi (\textit{S.celebensis}) and Philippines (\textit{S.phillipensis} etc.) (Groves, 1997). The molecular studies, however, grouped \textit{S.scrofa} with \textit{S.barbatus} & \textit{S. verrucosa} (Lucchini et al., 2006). Further molecular work shows “basal comb” structure among \textit{S. scrofa} in Southeast Asia which even includes other \textit{Sus} species (Larson et al., 2005). The inspired an ongoing revision which suggested elevation of \textit{S.scrofa} subspecies into new species (Groves & Grubb, 2011).
As shown in the first cladogram, A, morphological data grouped Sus scrofa together with various species of Philippine Sus (circled in A) while S. barbatus & S. verrucosus formed another lineage (Groves, 1997). The next cladogram, B, shows molecular data, which groups S. scrofa (Eurasian wild pigs) with S. vermiculatus (Bearded wild pigs) while S. cebifrons (Visayan wild pigs, one of Philippines Sus species) forms another lineage (Lucchini et al., 2006). The third cladogram, C, shows the "basal comb" structure among various Sus in Southeast Asia where only S. celebensis (Sulawesi wild pig, all nodes in pink and brown square) shows distinct lineage while relationship between S. scrofa (all other nodes unless labelled), S. barbatus (labelled "sb") and S. verrucosus (labelled "sv") are unresolved in a "basal comb" (Larson et al., 2005). This suggested that the speciation of Sus happened among islands of Southeast Asia very recently and some of the subspecies of S. scrofa might be justified as new species.

Subspecies
There are large number subspecies of *Sus scrofa* due to its widespread range, which can informally grouped into 4 groups based on geographic location. However, recent reviews disputed the status of certain subspecies as synonyms while suggesting some highly distinct subspecies as different species. The summary presented is based on older but more organized classification (Groves & Grubb, 1993) with notes on latest review which is still ongoing and incomplete (Groves & Grubb, 2011).

Western races:
*S.s scrofa* - occurs in mainland Europe, might be more widespread as more subspecies are recognized as synonyms
*S.s. algira* - Coastal side of Atlas Mountains (N.Africa), synonyms of *S.s.scrofa*
*S.s. attila* - occurs in Eastern Europe, synonym of *S.s.scrofa*
*S.s. lybicus* - occurs in Caucasian, Asia Minor and Middle East, synonyms of *S.s.scrofa*
*S.s. nigripes* - occurs in Central Asia, only single specimen known, questionable status
*S.s. meridionalis* - occurs in Andalusia (Spain/Portugal), indeterminate

Indian races:
*S.s.davidii* - occurs in northwest India, Pakistan to southeastern Iran, suggested to be different species.
*S.s.cristatus* - occurs from most of northern India to Western Thailand down to Isthmus of Kra, suggested as different species.
*S.s. affinis* - occurs in southern India and Sri Lanka, synonyms of *S.s.cristatus*.

Eastern races:
*S.s. sibiricus* - occurs in Mongolia, obscure information, close affinity with *S.s.nigripes*, questionable status
*S.s. ussuricus* - occurs in Manchuria, suggested as different species.
*S.s. leucomystax* - occurs in Japan main islands, suggested as different species
*S.s. riukiuanus* - occurs in Ryukyu islands, distinct yet needs comparison with *S.s.taivanus*, indeterminate
*S.s. taivanus* - occurs in Taiwan, suggested as different species.
*S.s. moupinensis* - occurs from Burma and Indochina to China and Korea, suggested as different species.
*S.s. chirodontus* - newly found from South-Central China, suggested as new species.

Indonesian race:
*S.s vittatus* - occurs in peninsular Malaysia, Sumatra and Java. Suggested as new species.

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**Literature and References**