

Peran Pendidikan Biologi Dalam Konservasi Keanekaragaman Hayati: Pelestari, Pengkaji dan Pemanfaat



Jatna Supriatna
Akademi Ilmu Pengetahuan Indonesia
Pusat Riset Perubahan Iklim UI

Bahan presentasi seminar di Universitas Ahmad Dahlan, Jogjakarta, 27 Agustus 2016

Indonesia: Geographically sits on “Ring of Fire”, more than 2000 earth quake from 1995-2005;

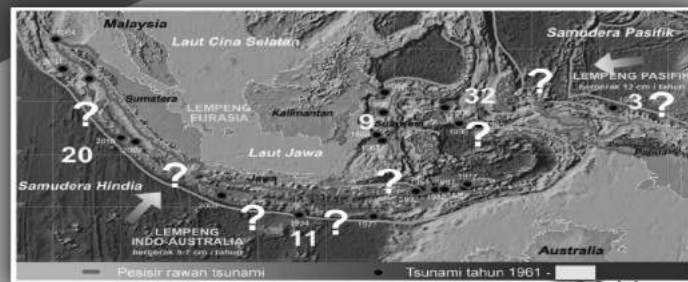
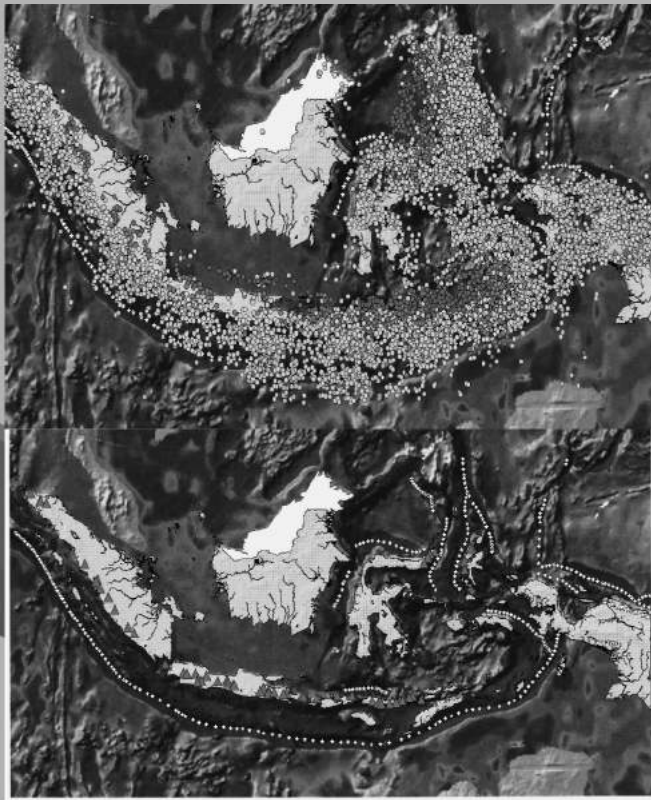
126 volcanoes active around Sumatra, Java, Nusatenggara and Sulawesi and Molucca

Red dot earthquake more than 6 in Reichter scale, Geologically unstable with Australian and Asian plates collided

“ 55 ecosystems, the highest marine and forest biodiversity in the world, more tsunamis than other countries, more than 500 languages, more moeslems (82% of 240 millions)

Indonesia - an island a day..17.000. at this rate it would take you , 49 years to 'Sea Indonesia...!'

110 tsunami in Indonesia recorded



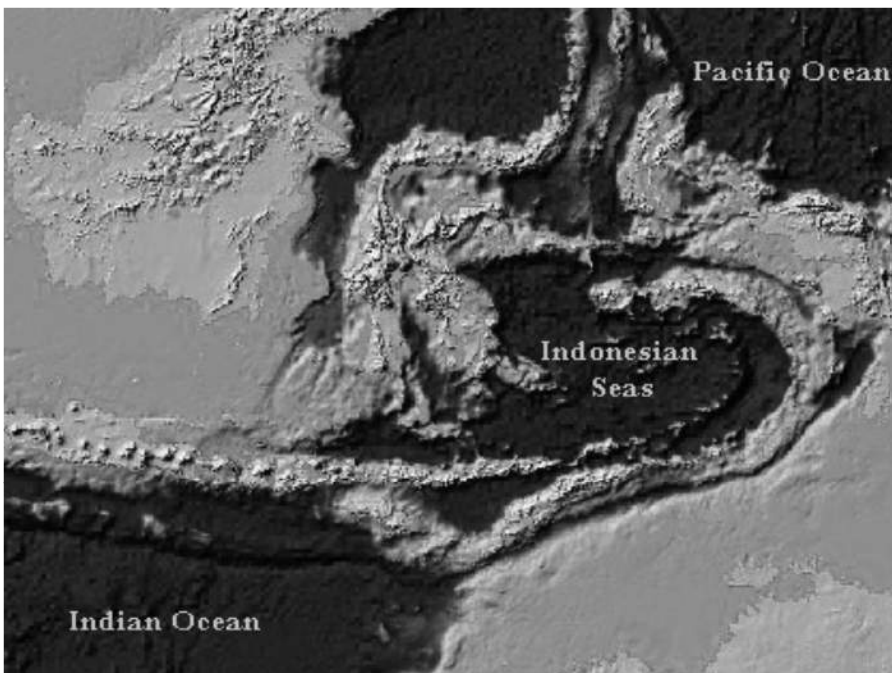
(Sea Level Rise)

2011

Laut Indonesia

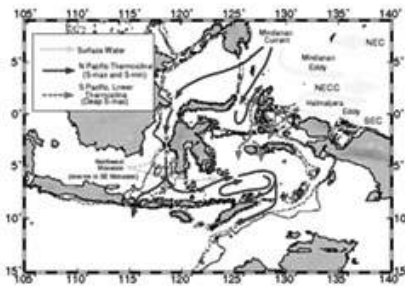
Keunggulan

- a) Pulau dan selat– archipelago terbesar di dunia
- b) Jumlah spesies laut terbanyak&keragaman habitat
- c) bathymetry rumit dan kaya dan
- c) Dynamic oceanography
- d) Data deficiency habitat laut khususnya laut dalam.
- e) Extreme depth gradients - coastal dan oceanic ecosystem berdekatan

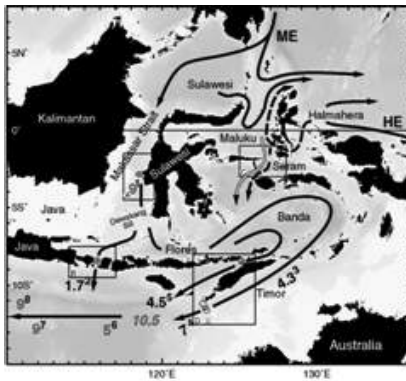


'Indonesia – setiap hari satu pulau...'

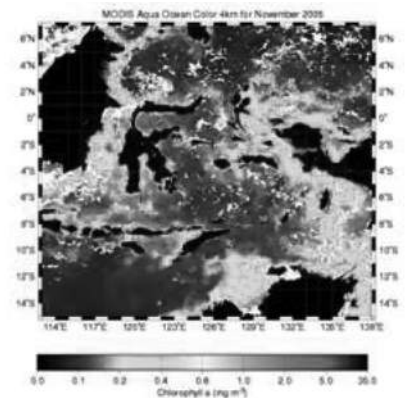
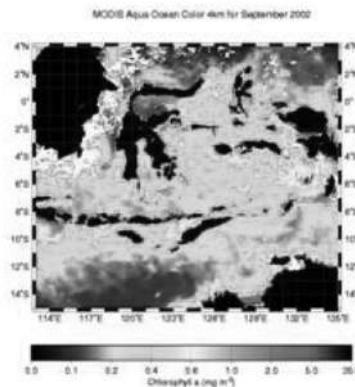
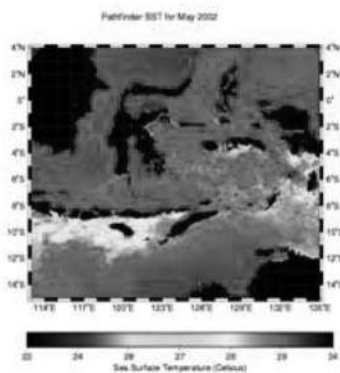
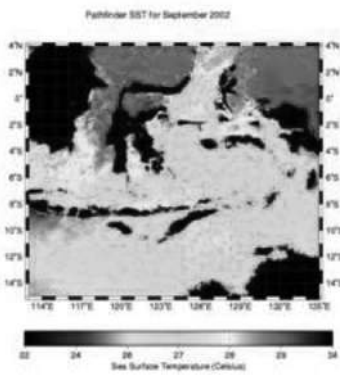
***Anda memerlukan
49 tahun untuk mengunjungi
pulau
'Indonesia...!'***



• **Unik karena simpangan dari 2 laut tropis besar Indonesia --Flow-Through-- kombinasi dan pengaruh iklim kuat (monsoon). Menyebabkan**

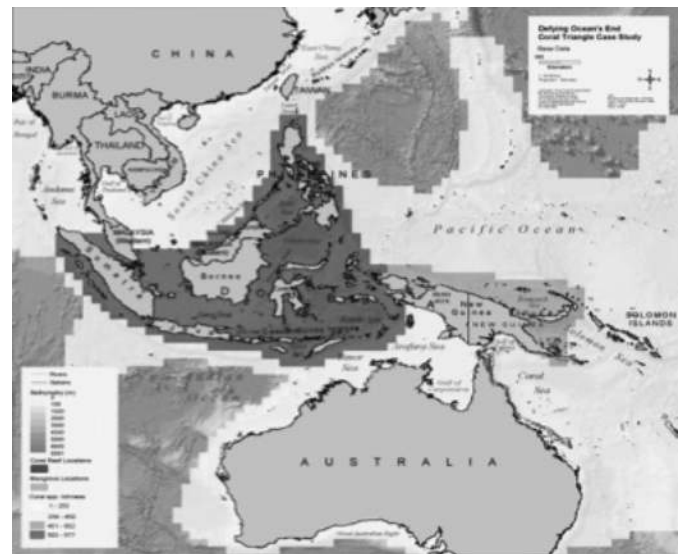


• **upwelling lokal Retention zones and eddies Tempat pelagic sangat besar di dekat pantai, laut near-shore, laut dalam di Indonesia timur (sea mount)**



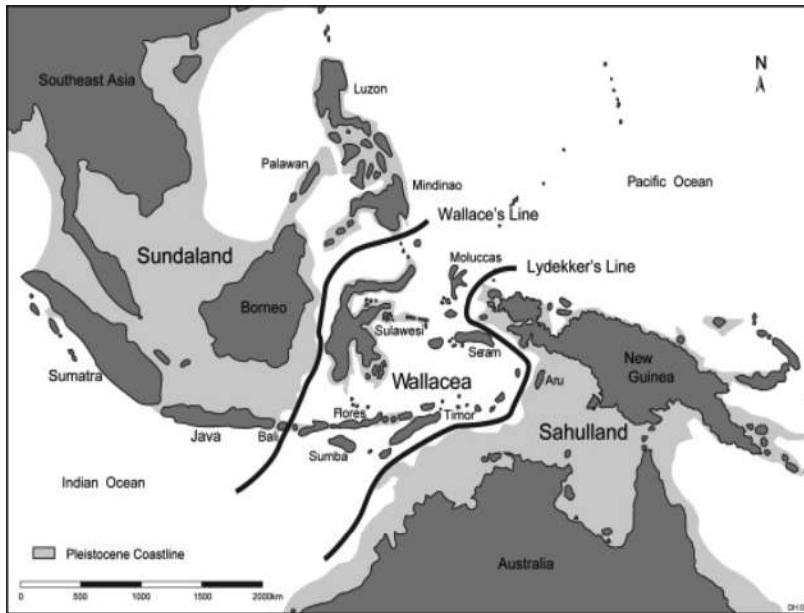
Coral Triangle

Keragaman ikan



Keragaman Terumbu Karang

Biogeografi dan Keragaman Satwa Nusantara

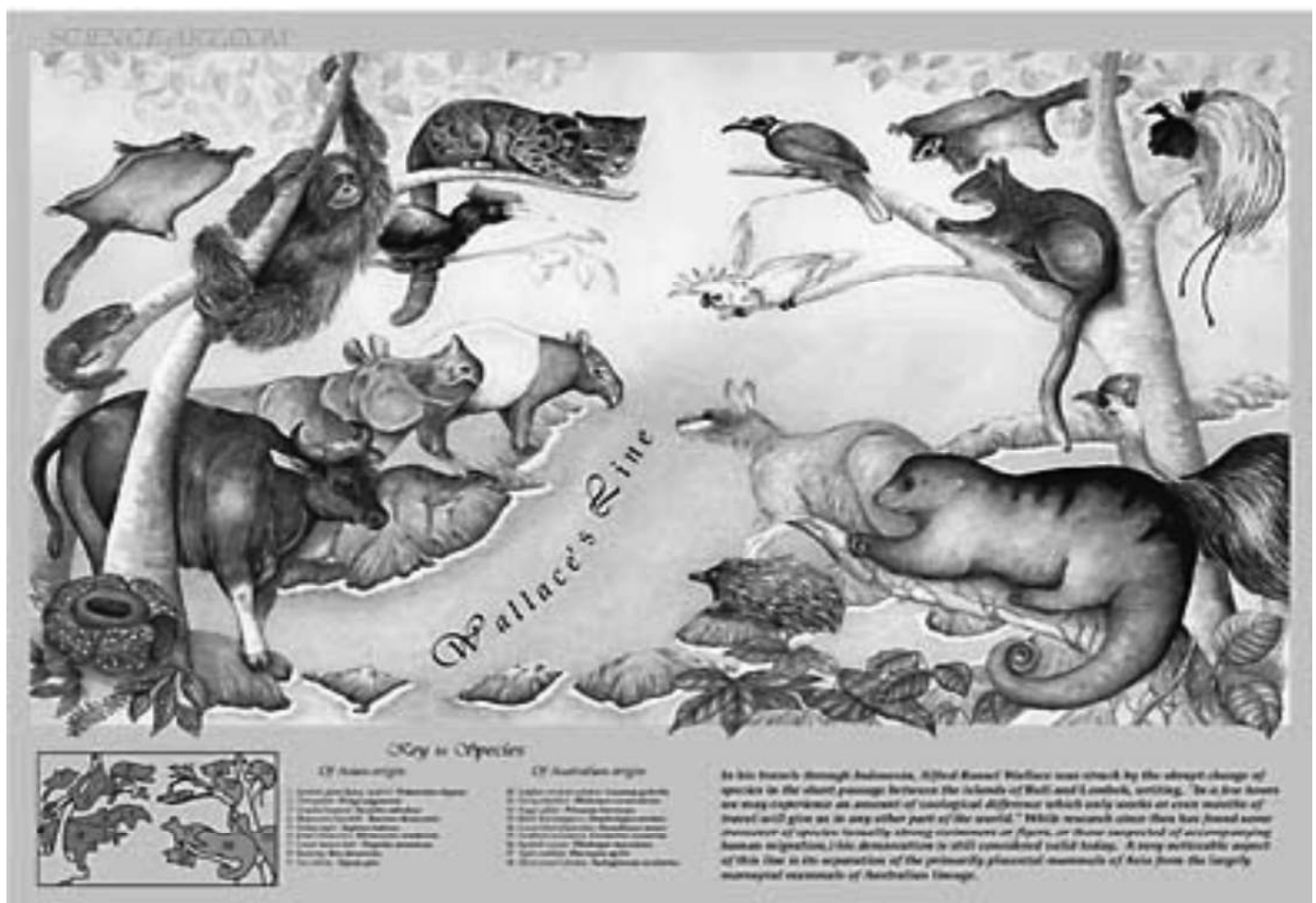


- Berada di antara 2 kawasan biogeografi dunia: Oriental dan Australasia
- Dinamika Pleistosen
- Proses geologi kompleks
- Kepulauan



Isolasi dan spesiasi

Biogeografi dan Keragaman biodiversitas Nusantara



Keanekaragaman Biodiversitas Nusantara



- Rumah bagi megafauna karismatik (harimau, badak, orangutan, komodo).

- Pusat keragaman burung paruh bengkok (Psittacidae)

- Terkaya di dunia Tumbuhan Dipterocarpaceae, durian, Manggis, mangga, pisang, dan sayuran.

- Rumah Teori Evolusi (Alfred R. Wallace)



Keanekaragaman satwa Nusantara



- Urutan kedua terkaya untuk mamalia (515 spesies).
- Keempat terbanyak untuk keragaman burung (>1500 spesies).
- Menyimpan sekitar 1400 spesies ikan air tawar, setengahnya endemik.



Mamalia Besar di Indonesia: Turisme Handal



Kucing Liar di Indonesia



Indonesia:

1. Harimau Sumatra (*Panthera tigris sumatrae*)
2. Macan tutul (*Panthera pardus*)
3. Macan dahan (*Neofelis diardi*)
4. Kucing emas (*Catopuma temmincki*)
5. Kucing merah (*Catopuma badia*)
6. Kucing bakau (*Prionailurus viverrinus*)

Jawa (3 species)

: Macan tutul, kucing congkok, kucing bakau

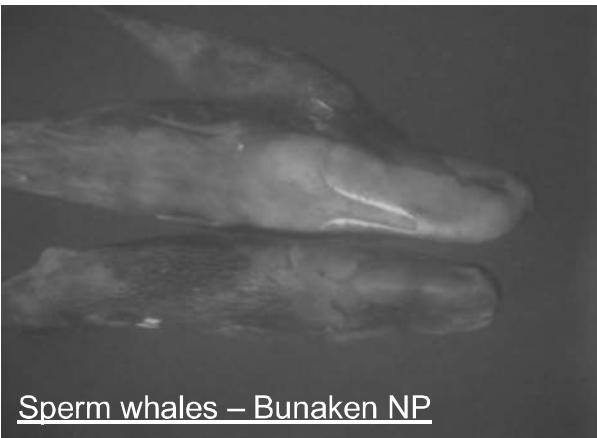
Sumatra (7 species)

: Harimau sumatra, kucing emas, macan dahan, kucing bulu, kucing congkok, [*kucing bakau*], kucing dampak

Kalimantan (5

: Macan dahan, kucing merah, kucing

Contoh Satwa Mamalia laut



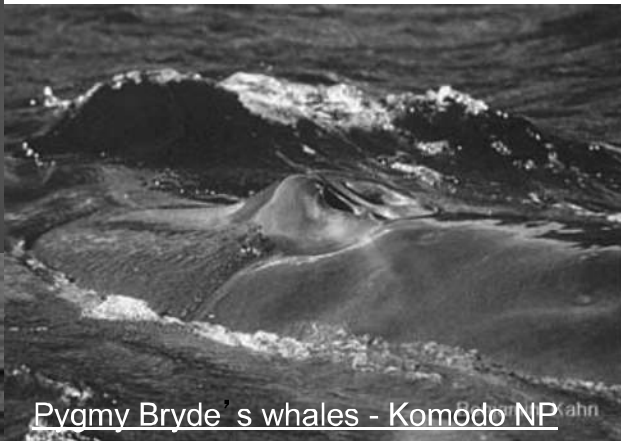
Sperm whales – Bunaken NP



Killer whales/Orca – Solor Alor (MPA planned)



Pygmy blue whale – Solor Alor (MPA planned)



Pygmy Bryde's whales - Komodo NP



Bryde's whale (regionally distinct, note white jaw on right side only) – Uluwatu, Bali



Spinner dolphin – Bali (target species of US\$5M/yr dolphin watch industry)



Cuvier's beaked whale – Komodo NP



Pygmy killer whales – Bunaken NP

Keanekaragaman Satwa Nusantara



- Rumah bagi megafauna karismatik (harimau, badak, orangutan, komodo).
- Pusat keragaman burung paruh bengkok (Psittacidae)
- Banyak satwa yang unik dan endemik
- Memuat satwa Oriental dan Australia



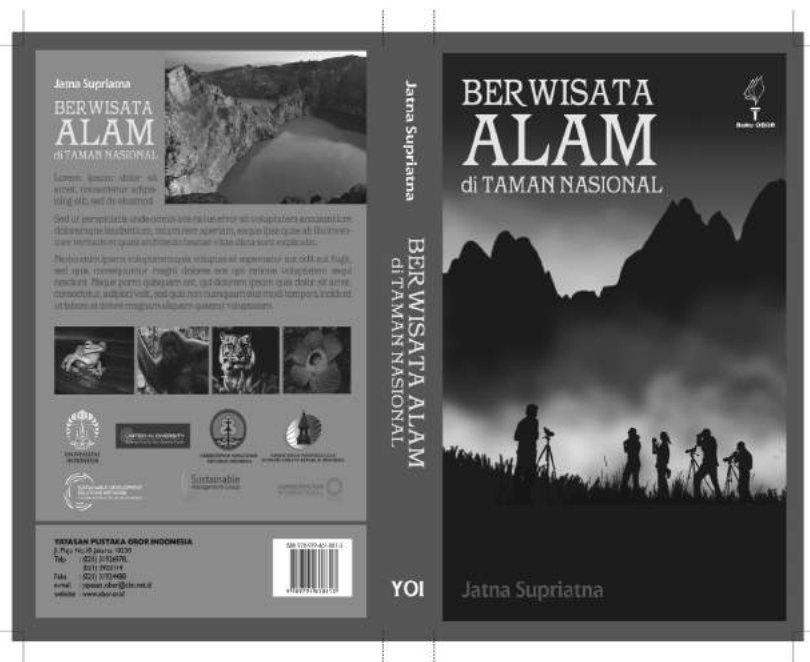
Pemanfaatan satwa secara langsung



- Pangan
- Serat
- Obat
- Produk industri (lemak, minyak)
- Sumber energi alternatif

Pemanfaatan satwa secara tidak langsung

- ▣ Penyerbukan dan pemencar biji
- ▣ Kontrol biologis bagi hama pertanian
- ▣ Pustaka genetik
- ▣ Sumber inspirasi
- ▣ Bahan kajian sains dan pendidikan
- ▣ Wisata dan rekreasi alam
- ▣ Budaya dan spiritual
- ▣ Ketahanan masyarakat



Ekowisata

\$34 milyar global (harga seekor singa mati \$5000 tetapi singa hidup nilainya \$28.000 bila dilihat turis)

Sulawesi and Wallacea islands: Natural Laboratory

Evolution of Sulawesi Macaques (Sulawesi Macaques Differentiation (Evans, B, J. Supriatna2003 dan Distribution of Bufo celebensis (Evans, B., J. Supriatna...2003, Evolution...))

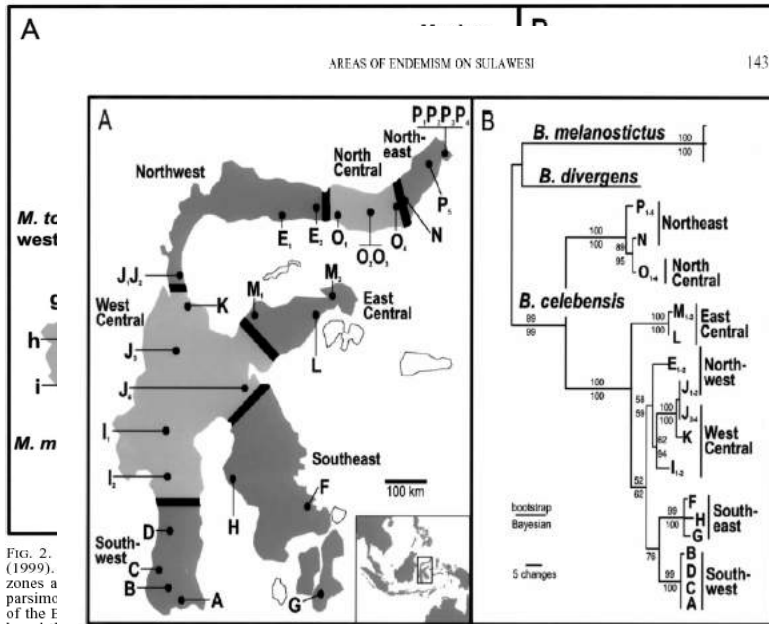


FIG. 1. Toad mitochondrial DNA (mtDNA) phylogeography and monkey areas of endemism on Sulawesi. Uppercase letters signify unique toad mtDNA sequences; for sequences present in more than one toad, individual toads are denoted with numbered subscripts after the letter. (A) Locations of *Bufo celebensis* mtDNA sequences and macaque areas of endemism. Shaded areas of endemism are each occupied by an endemic macaque species as depicted in Figure 2. Macaque contact zones are indicated with a thick line. (B) Intraspecific phylogeny of *B. celebensis*. Branch lengths are proportional to the number of evolutionary changes. Percentages of 2000 bootstrap replicates greater than 50 are above branches and Bayesian posterior probabilities (shown as percentages) are below branches. Labels on the right refer to areas of endemism on Sulawesi.

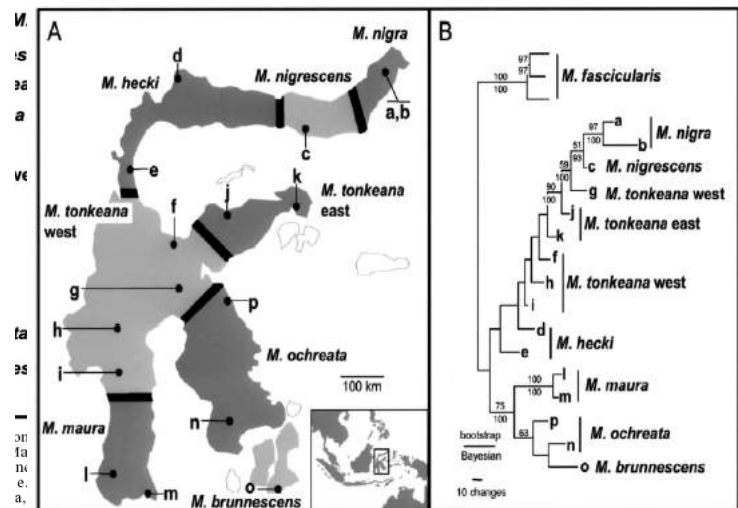


FIG. 2. Macaque mitochondrial DNA (mtDNA) phylogeography on Sulawesi; reanalysis of a subset of sequences from Evans et al. (1999). (A) Locations of *Macaca* mtDNA sequences, areas of endemism, and contact zones labeled as in Figure 1. Macaque contact zones are indicated with a thick line. (B) Mitochondrial DNA parsimony phylogeny of Sulawesi macaques. This is one of two most parsimonious trees that differ in the placement of the root; the other tree is rooted on the branch between sequences d and e. The topology of the Bayesian tree differs from the parsimony analysis in that sequence e instead of sequence f is sister to sequences a, b, c, g, j, and k and that sequences l, m, n, o, and p have the following topology: ((o(n(p(l,m))))).

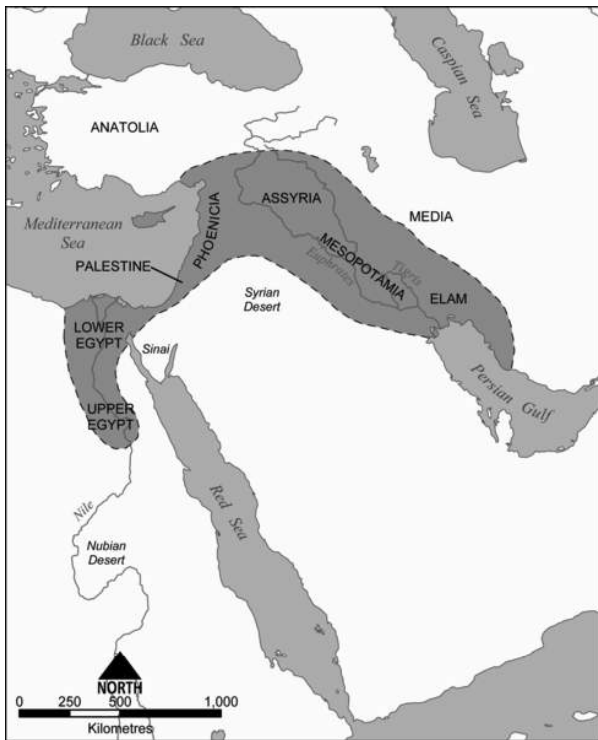
Sumber inspirasi dan informasi

- Biomimikri
- Biologi terapan
- Model biomedik



Source: Brumbaugh © AMNH-CBC

Mamalia: Sumber Peradaban Fertile Crescent



- ▣ Lembah Tigris dan Euphrates
 - Iraq
- ▣ Delta dan Lembah Nile
 - Egypt
- ▣ Levant
 - Jordan
 - Palestine

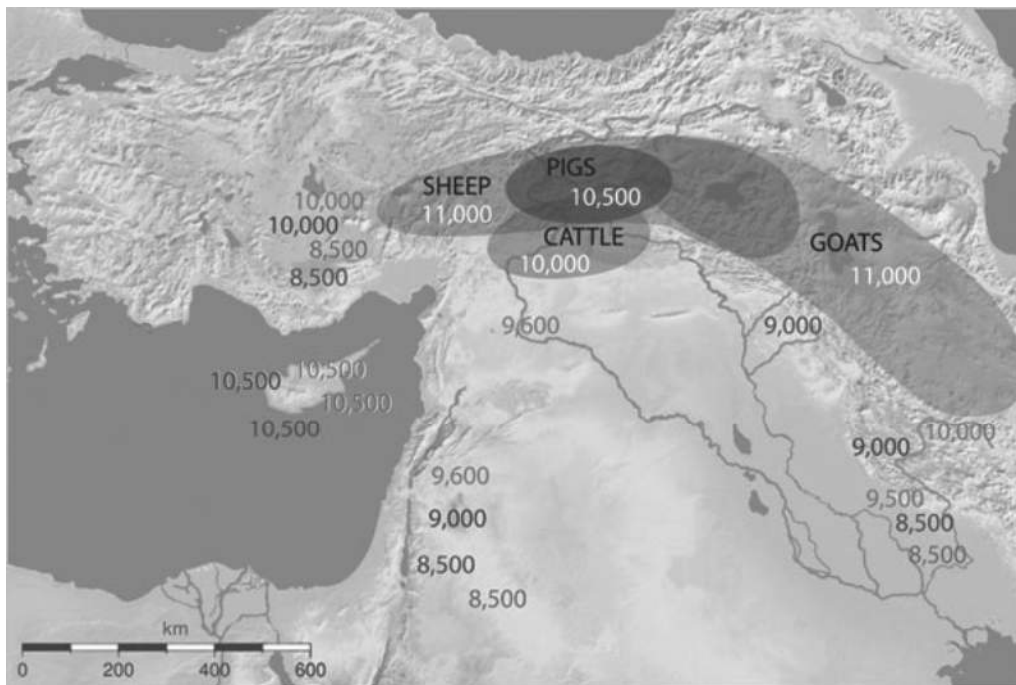
Fertile Crescent



<http://www.mrdowling.com>

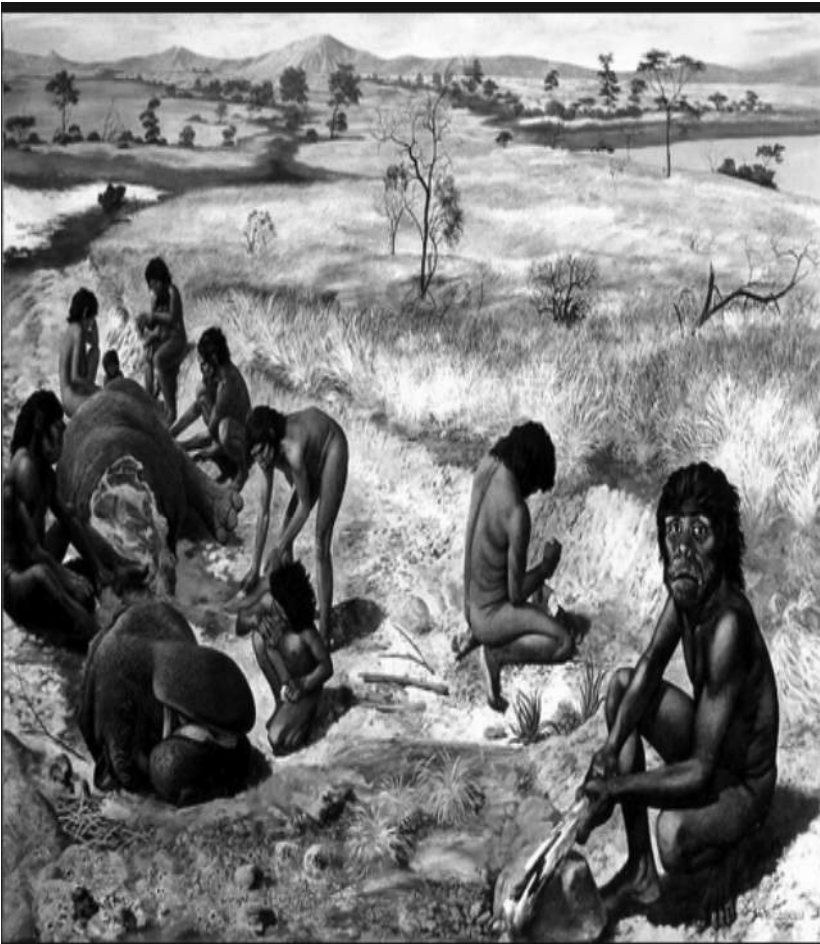
- ▣ Iklim Mediterranean
- ▣ Keragaman kelompok gandum/serelia (32 dari 56 spesies dunia)
- ▣ Hunter/gatherers
 - Mulai menetap
 - memanfaatkan serelia
- ▣ Kekayaan jenis tumbuhan dengan sistem penyerbukan sendiri
 - mudah didomestikasi.
- ▣ Satwa besar untuk domestikasi:
 - Kambing, domba, sapi, babi

Domestikasi satwa di Eurasia



http://mathildasanthropologyblog.files.wordpress.com/2008/09/wadc_graphic_600.jpg

Eksplorasi hewan dan tumbuhan terjadi sejak awal keberadaan manusia (zaman prasejarah)



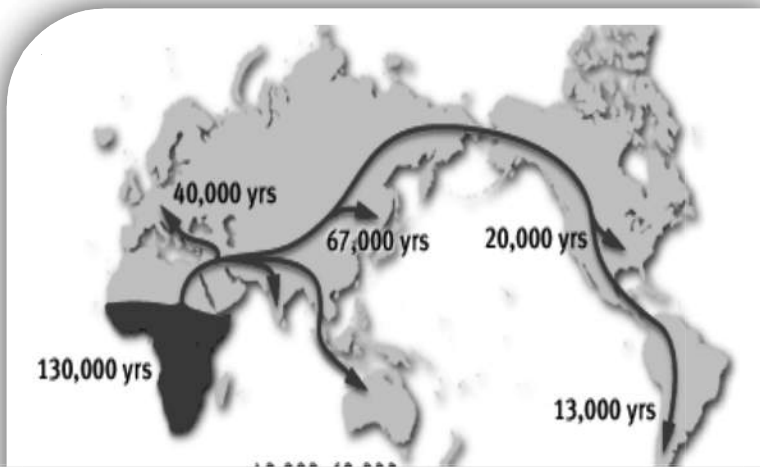
berburu (2 juta – 10.000 tahun yl)



- Masa bercocok tanam/berhuma (9.000 tahun yl)



- Populasi meningkat dan ekspansi manusia---Kehilangan Satwa



Mengapa Eurasia?



- Dari 148 spesies herbivora atau omnivora besar dunia
 - Eurasia 72
 - Africa 51
 - Americas 24
 - Australia 1
- Sebagian besar tidak bisa didomestikasi

Mengapa hanya sedikit satwa yang bisa didomestikasi?



<http://www.australian-wildlife.com/images/Free-koala-picture3.jpg>

- Sumber pangan tertentu dan terbatas
 - koala
- Kecepatan pertumbuhan terlalu lambat
 - gajah, gorila
- Tidak bisa ditangkarkan



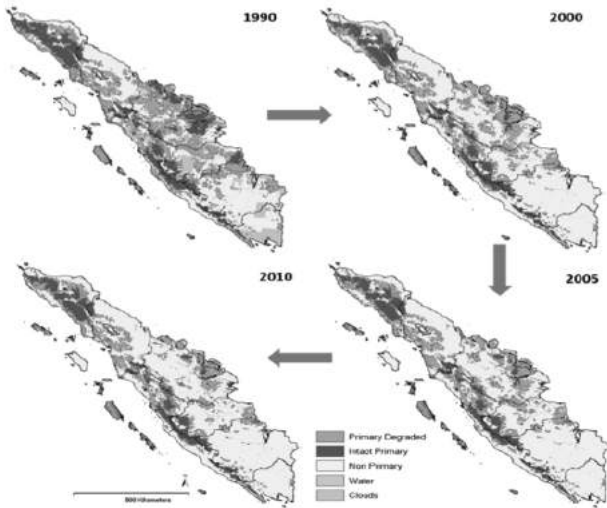
<http://www.texasbeyondhistory.net/st-plains/nature/images/Deer-tpwd-sm.jpg>

- ▣ Sulit digembala
(tidak ada struktur
dominan)
 - rusa, antelope
- ▣ Kecenderungan
panik
 - rusa, antelope, gazelles
- ▣ Soliter
 - Hanya kucing dan *ferrets*
yang bisa didomestikasi
- ▣ Teritorial
 - badak

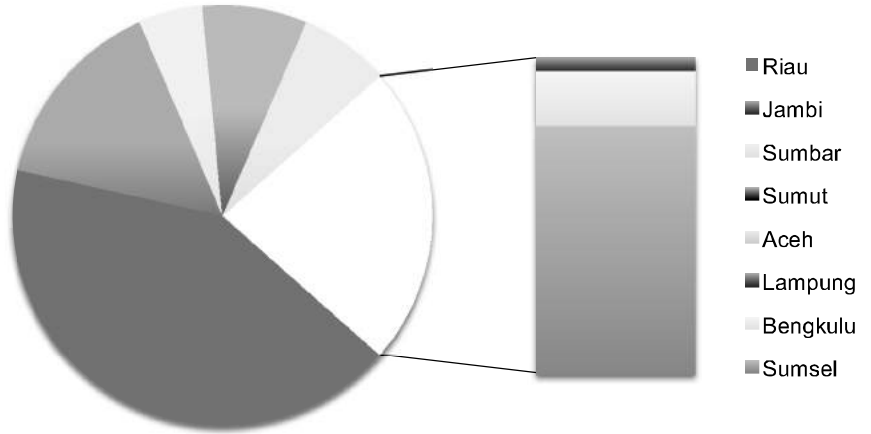
Satwa yang sudah dan potensial untuk domestikasi di Indonesia

Existing	Species	Area of Origin	When
Bali Cattle	<i>Bos sondaicus</i>	Southeast Asia	Not sure
Chicken		Southeast Asia	Not sure
Milkfish	<i>Chanos chanos</i>		Majapahit era
Candidates	Species	Area of Origins	When and Ref
Deer	<i>Cervus spp</i>	Southeast Asia	
Muntjak	<i>Muntiacus muntjak</i>	Sundaland	
Anoa	<i>Anoa Depresicornis</i>	Sulawesi	
Ducks			
Reptiles	<i>Clamydosaurus</i>	Wallacea	
Frogs	<i>Rana macrodon</i> and <i>R. blythii</i>	Sundaland	
Fishes	Many catfish	Sundaland	

Keserakahan dan Eksploitasi Berlebih



Deforestation 1990-2010



Biodiversity in Danger!



Mamalia Terancam di Dunia

mammals

COUNTRY	TOTAL NUMBER OF THREATENED MAMMAL SPECIES
Indonesia	128
China	75
India	75
Brazil	71
Mexico	64
Australia	58
PNG	57
Philippines	49
Peru	46
Madagascar	46
Kenya**	43
Malaysia	42
Dem. Rep. Of Congo~	38
Vietnam**	38
USA	35
Colombia	35
Ethiopia**	35
Thailand**	34
South Africa	33
Tanzania**	33

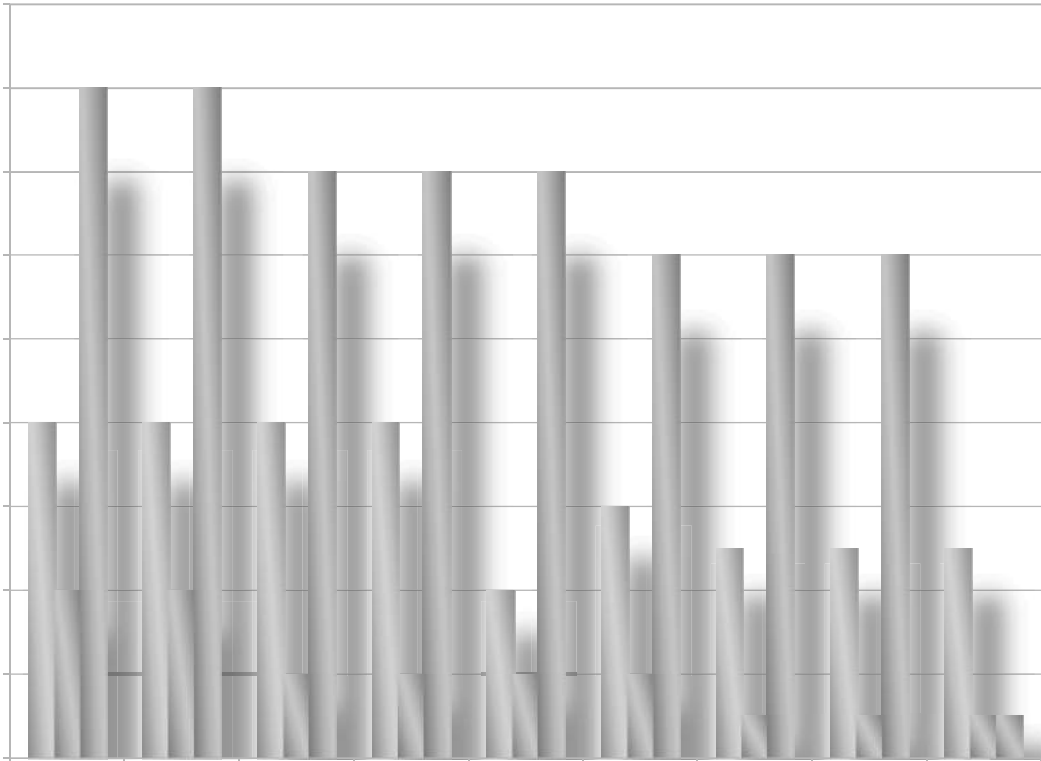


** Not a Megadiversity Country

- ✓ Total of Critically Endangered, Endangered, and Vulnerable Identified in 1996 IUCN Red List = 1,096
 - ✓ Total Number of Species in Megadiversity Countries (15) on this list = 852
 - ✓ Percent of All Threatened Species that Exist in Megadiversity Countries (852/1,096)=77.7%
- ~ Formerly Zaire

NILAI ILEGAL EKSPOR, IMPOR, DAN DOMESTIK SATWA LIAR DI INDONESIA

Milyar



Tahun

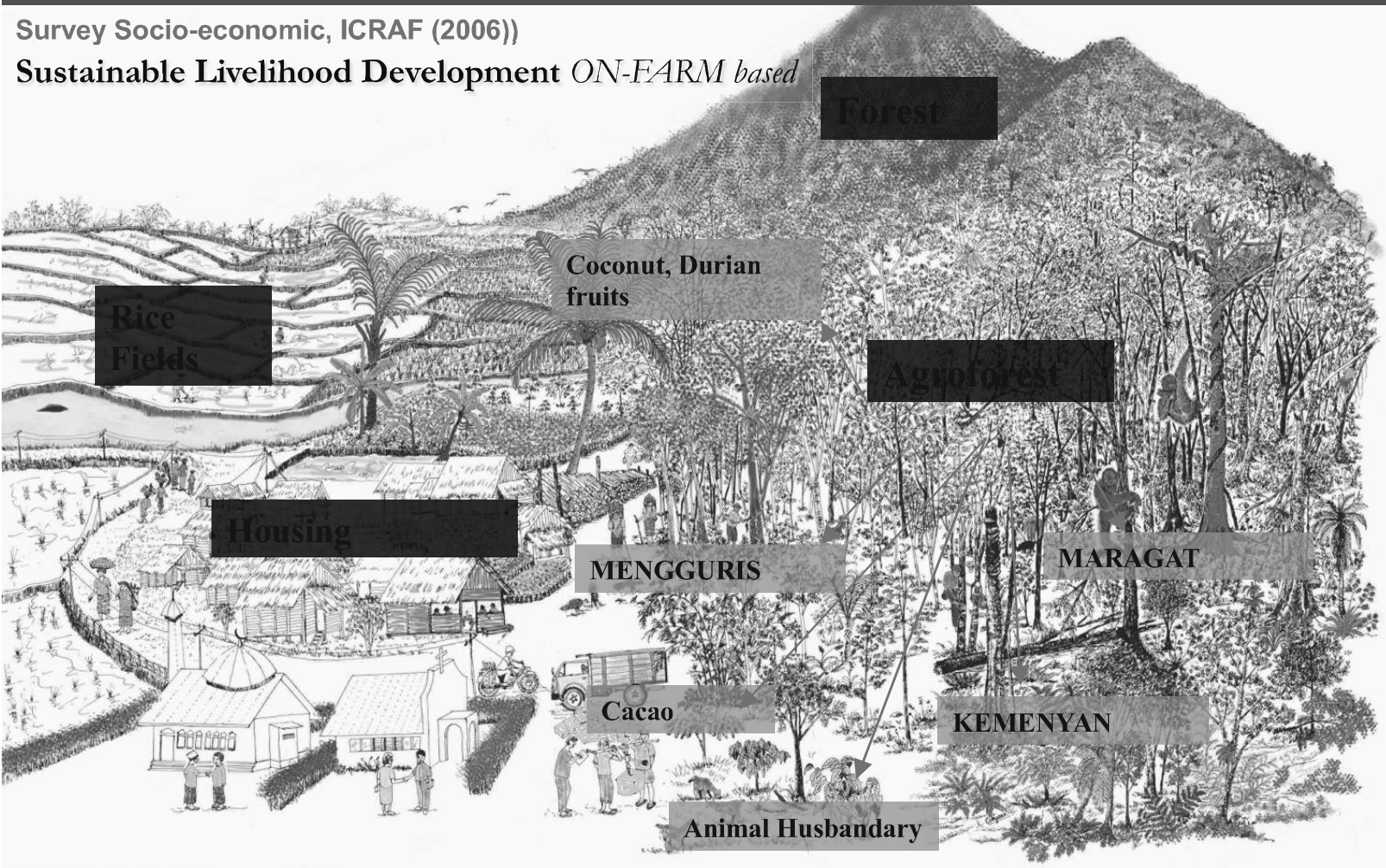
SATWA-SATWA DAN BAGIANNYA YANG SERING DIPERDAGANGKAN



Agroforestri dan Ekowisata di hutan alam bersama orangutan (Sumatra Utara)

Survey Socio-economic, ICRAF (2006))

Sustainable Livelihood Development *ON-FARM based*





Masyarakat Mentawai: berburu satwa dilindungi, hasil riset Tenaza dkk (1978) mereka adalah pemburu tradisi masih dalam ambang sustainable hunting bila masih memakai busur dan panah tradisional

Sumber inspirasi dan informasi

- Biomimikri
- Biologi terapan
- Model biomedik



Source: Brumbaugh © AMNH-CBC

Pemanfaatan KH secara langsung



- Pangan
- Serat
- Obat
- Produk industri (lemak, minyak)
- Sumber energi alternatif

BIOMIMIKRI: Belajar dari Alam



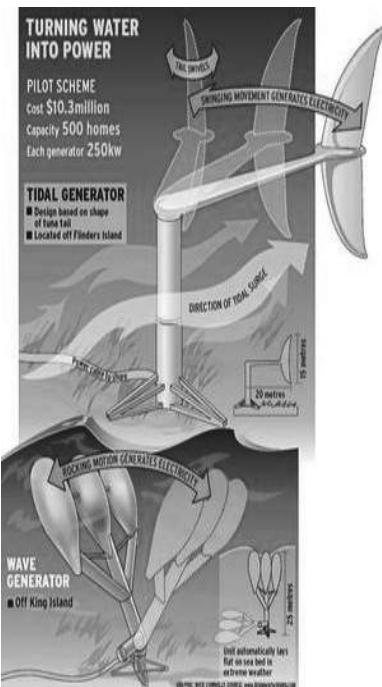
Burung kolibri melintasi Teluk Mexico dengan menghabiskan kurang dari 3 gram (sepersepuluh *ounce*) bahan bakar,

Capung mampu bermanuver melebihi helikopter tercanggih kita,

Sistem pemanas dan pengatur udara di dalam sarang rayap jauh lebih baik dari segi perangkat dan penggunaan energi dibandingkan buatan manusia,

Pemancar frekuensi tinggi kelelawar bekerja lebih baik dan lebih peka daripada sistem radar kita sendiri,

LIPI 2013



Penegakan hukum yang konsisten!



Gorilla Wisata di Afrika

National Park	Mgahinga	Volcanoes²	Virunga¹	Bwindi¹	Kahuzi¹	Total
Country	Uganda	Rwanda	DRC	Uganda	DRC	-
Area (km²)	34	160	240 ²	330	600 ³	1364
Human population density around park (/ km²)	400	400	400	300	300	-
Year Gorilla tourism began	1994	1979	1985	1993	1973	-
No. gorillas in area	12 ⁴	129 ⁴	181 ⁴	300	247 ⁵	869
No. gorilla groups habituated for tourism	1	3-6 ⁶	4	3-4	4	16-19
No. gorilla groups for research	0	3	0	1	2	6
No. tourists per group	6	8	6	6	8	-
Daily viewing fee for non resident tourists (US\$)	120	126	125	150-180	120	-

¹Also designated a World Heritage Site.

²Portion of the 7800 km² Virunga National Park that lies within the Virunga Conservation Area

³Portion of the 6000 km² Kahuzi-Biega National Park occupied by the gorilla population that is visited by tourists.

⁴Gorillas in these three parks are all within the Virunga Conservation Area (c. 324 gorillas). Most of them move between at least two of the three parks. The number within each of the three parks, therefore, varies considerably and frequently.

⁵Gorilla tourism in the Kahuzi-National Park is confined to a mountain population of about 247 gorillas (Vedder 1996).

⁶The one gorilla group visited by tourists in Mgahinga Gorilla National Park moves between this park and the Virunga National Park.

Peran Pendidik



- **Pelestari:** Terlibat dalam melestarikan kekayaan biologi kita agar dapat dilihat, dinikmati dan dimanfaatkan secara sinambung: jangan sampai
- **Pengkaji:** Terlibat dalam penelitian dan pengkajian biologi yang sedang kritis, riset Sains dan teknologi mumpuni, serta menggali sistem pelayan ekosistem
- **Pemanfaat:** Memanfaatkan biota secara lestari, alternative protein atau pangan dan pengembang ekowisata dengan network global.

Terima Kasih

