

Orangutan Veterinary Advisory Group Workshop



2017

Photos provided by OC/OVAG participants
Orangutan Veterinary Advisory Group new logo courtesy of Ricko Jaya and Emma Wood

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Prepared with organizing committee of the Orangutan Conservancy: R. Commitante, S. Unwin, F. Sulisty, R. Jaya, Y. Saraswati, C. Nente, S. Sumita, A. Rosetyadewi, P.Nagalingam (Editors).
Orangutan Veterinary Advisory Group Workshop 2017 Report.

Copies of all the *Orangutan Veterinary Advisory Group (OVAG) Workshop Reports* can be found on the Orangutan Conservancy website, www.orangutan.com and coming soon: the official OVAG website: www.ovag.org

Participating Organizations:

Orangutan Conservancy, United States
Chester Zoo / NEZS, United Kingdom

ABAXIS Europe, Germany
Birmingham University (EDT)
Borneo Orangutan Survival Foundation, Nyaru Menteng, Palangkaraya, Central Kalimantan, Indonesia
Borneo Orangutan Survival Foundation, Samboja Lestari, Samboja, East Kalimantan, Indonesia
Borneo Orangutan Survival Foundation, HQ, Bogor, Indonesia
Borneo Orangutan Survival Foundation, Switzerland
Borneo Nature Foundation
Center for Orangutan Protection (COP) Indonesia
Children's Hospital Colorado
Cikananga Wildlife Center
Faculty of Veterinary Medicine, Gadjah Mada University, Jogjakarta, Indonesia
Frankfurt Zoological Society/Jambi - Sumatra, Indonesia
Hokkaido University
Hutan, Sabah, Malaysia
Indianapolis Zoo, Indiana USA
International Animal Rescue, Indonesia (IAR Kalimantan)
International Animal Rescue, Indonesia (IAR Bogor)
IUCN SSC Primate Specialist Group Section on Small Apes
Jejak Pulan (Vier Pfofen Indonesia)
Journal of Zoo and Wildlife Medicine
Liverpool Veterinary School, United Kingdom
National Jewish Health Organization (NJH)
Orangutan Foundation United Kingdom (OFUK) Central Kalimantan, Indonesia
Orangutan Foundation International (OFI)
Orangutan Information Center, Aceh, Sumatera, Indonesia
Orangutan Kutai Project, Kalimantan Timur, Indonesia
OVAID, United Kingdom
Pusat Studi Satwa Primata, LPPM, Insitut Petanian, Bogor, Indonesia
Royal Veterinary College, United Kingdom
Sabah Wildlife Department, Sabah, Malaysia
Sepilok Orangutan Center
Singapore Zoological Garden
Sintang Orangutan Center, West Kalimantan, Indonesia
Sumatran Orangutan Conservation Programme (SOCP), Medan, Indonesia
Sumatran Orangutan Conservation Programme, Jantho, Indonesia
Tasikoki Rehabilitation Center, Sulawesi, Indonesia
USAID One Health Workforce
Universiti Putra Malaysia, Selangor, Malaysia
Wildlife Rescue Centre, Jogkja, Indonesia

Supporting Organizations:



Orangutan Conservancy, United States

Chester Zoo/ NEZS, United Kingdom

The Orangutan Project (TOP) Australia

Fort Wayne Children's Zoo, United States

ABAXIS, Germany

Arcus Foundation

HOSTED BY:



Universitas Gadjah Mada Fakultas Kedokteran Herwan, Jogjakarta, Indonesia





July 23-27 Jogjakarta, Indonesia

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July 23-27 Jogjakarta, Indonesia



Section One

Executive Summary

For our ninth year, the 2017 Orangutan Veterinary Advisory Group (OVAG) workshop was held in our home base of Jogjakarta, Indonesia in collaboration with our longtime partner, Universitas Gadjah Mada (UGM), Fakultas Kedokteran Hewan (Veterinary Faculty), Indonesia. This year we were pleased to invite Orangutan Center managers once again – and nearly every manager working in Indonesia and Malaysia attended. Our ninth workshop continued to solidify our ever growing network of individuals and organizations committed to orangutan conservation. Though we focus mainly on One Health *Viaveterinary* and public health issues, we continue to expand our network to include wild orangutan researchers, orangutan behaviorists, exhibit design experts, MDs, and individuals/organizations working with other primates. For the first time we had presentations on gibbons, slow loris and Sulawesi macaques. Our work continues to be as critical as ever as the problems contributing to the decline of primate populations have not lessened. In fact, our work has become even more acute as there is now a new species of orangutan that has been identified in Batang Toru, South Tapanuli Regency, in Northern Sumatra, Indonesia. The name given to this group of about 800 genetically distinct orangutans is *Pongo tapanuliensis*. One of our OVAG vets, Yenny Saraswati played an important part in the discovery of this new species. The future of their habitat is currently in jeopardy. By creating a united and informed group, we may be able to stand together to prevent further decline.

As occurred in 2015, another of our OVAG vets (Yenny Saraswati Jaya) traveled to England for continuing professional development with Chester Zoo and Liverpool University. Ricko Jaya will be heading to India for a short course there on Intervention in Wild Animal Health. Another of our OVAG vets, Anta Rosetyadewi, is in the final year of her PhD study at Murdoch University, Perth, Australia! We also had several of our group members present their work at regional conferences. We hope to be able to get more of our vets traveling for extra training as well as presenting at international conferences throughout the rest of 2017 and into 2018. As our network increases, so do the opportunities for our OVAG participants.

The clinical work this year focused primarily on respiratory ailments and anesthesia (continued from last year and a follow up from several onsite training sessions at BOSF centers with U.S. long time zoo vet Nancy Lung), as many orangutans both in zoos and *in situ* centers suffer from respiratory issues. We also had two emergency medicine sessions (for both orangutans and humans), more work on bone traumas (also continued from last year), continued discussions on the One Health paradigm, a wonderful and thorough overview of orangutan reintroduction by Dr. Anne Russon, orangutan behavior, and many other important and interesting presentations and case studies (see herein).

An exciting new development is the first of courses specifically designed for wildlife and wildlife medicine at UGM. This is something we have been working on with UGM for several years. This was a summer course held before the start of the 2017 OVAG workshop. This course in wildlife is being added to the vet schools' curriculum in Indonesia. UGM sponsored this Wildlife Summer Course through collaboration between the Veterinary Faculty and the Biology Faculty. It was an 8 day intensive course featuring lecturers from both inside and outside Indonesia. Several OVAG members were included in the list of lecturers. The course was held for the most part in the new Biology Department building. Our hope is that the course (and others like it) will continue and that OVAG can be instrumental in building a Master's Program in Wildlife Medicine (the first of its kind in Indonesia), working towards increasing the knowledge of both veterinarians and researchers being trained.

Another exciting event in 2017 was that Chester Zoo received a BIAZA (British and Irish Association of Zoos and Aquariums) Conservation Gold Award for their support of OVAG!

Looking toward the future, we are planning to build our own OVAG website (which should be operational soon, through Chester Zoo) where people will be able to search for us, find out more about us, as well as providing an internet home for OVAG members to access important information from each and every OVAG meeting since 2009. OVAG participating vets have also built their own contact system in WhatsApp where they can be in constant contact. This is a very active social media outlet where they can continue to share information and support each other. We are also working on our evaluation for efficacy as a network to see if we are truly making a difference with the work we have been doing. This evaluation and self-analysis will be the basis of an article co-authored by the OVAG committee which we hope to submit for publication in the coming months.

Also, as a network and in order to operate more efficiently, we are setting up some new rules for attendance:

- a) participants must commit to attending at least 4 days of the workshop
- b) all presenters must submit an abstract of their talks
- c) participants must have a roundtrip ticket in hand before attending.

We have also added a new committee member, Pakeeyaraj Nagalingam of the Sabah Wildlife Department, Malaysia. We know his addition will provide a stronger link between Indonesian and Malaysian orangutan stakeholders.

The 2017 OVAG Workshop was co-sponsored by the Orangutan Conservancy (USA), and Chester Zoo/ NEZS (United Kingdom) and the Veterinary faculty of UGM. OVAG received additional funding support from The Orangutan Project (TOP – Australia), Fort Wayne Children’s Zoo (USA), the Arcus Foundation (A USA based nonprofit organization), and Abaxis (Europe).

Next year, for our 10 year anniversary, we have been invited by Syiah Kuala University in Aceh, Northern Sumatra to hold our workshop there! Steve, Citra, Ricko, and I went to Banda Aceh after the OVAG workshop to meet with the Dean and to visit the SOCP Orangutan release site of Jantho which is a few hours away. OVAG 2018 will be held July 21 – July 26 (with arrival on the 20th and departure on the 27).

We hope to see you all there!

With warm regards and respect,

Raffaella Commitante, B.F.A., M.A., Ph.D.
 Steve Unwin, B.Sc., B.V.Sc., Dipl ECZM, MRCVS
 Ricko Laino Jaya, drh.
 Yenny Saraswati, drh.
 CitraKasih Nente, drh., MVS (Conservation Medicine)
 Fransiska Sulisty, drh., MVS (Conservation Medicine)
 Sumita Sugnaseelan, DVM (UPM), PhD (Cantab)
 Pakeeyaraj Nagalingam, DVM, SWD
 Anta Rosetyadewi, drh., MVS
 Gavo





July 23-27 Jogjakarta, Indonesia

OVAG 2017 Budget (US Dollar after approximate conversion from pounds and rupiah)

International air fares	11,263
Local airfares	6,073
Ground transportation	130
Hotel accommodation	18,230
Office expenses/T-shirts	882
Ground support (food etc.)	929
Miscellaneous	300
Aceh trip (prep for 2018)	673
 Workshop Total	 38,480

Supplementary budget for Continuing education:

Yenny Saraswati Jaya for UK training	4,731
Panung presenting at ASEAN conference	625
Ricko Jaya to Jakarta for Ministry Meeting with Pak Indar	160
Anta Rosetyadewi for PhD, Murdoch University (2017, 2018)	7,000
Ricko Jaya to India (Continuing Professional Development)	1,500

FULL TOTAL..... 52, 496

(Some funds in rupiah were left in an account in Indonesia for expenses needed for local conferences, meetings, and preparation for OVAG 2018. Some additional rupiah is with Raffaella Commitante for OVAG 2018.)



July 23-27 Jogjakarta, Indonesia



Section Two

Letter of Invitation

Three different letters typically are sent: one for full funding, one for partial funding, and one for self-funding participants.

Sample:



Honorary Patrons:

Dr. Jane Goodall
Dr. Edward O. Wilson
Dr. Suwanna Gauntlett
Djameludin Suryohadiku

OVAG 2017

May 24, 2017

RE: **Orangutan Veterinary Advisory Group Workshop 2017**

Advisers:

Dr. Tim Laman
Dr. Mark Leighton
Dr. Amory B. Lovins
Dr. Cheryl Knott
Lori Perkins
Dr. Herman Rijksen
Dr. Anne Russon
Dr. Robert Shumaker
Dr. Willie Smits
Dr. Carel Van Schaik

To Whom It May Concern:

This letter shall serve as an invitation to attend the Orangutan Veterinary Advisory Group (OVAG) Workshop 2017 sponsored by the Orangutan Conservancy (OC), a United States not-for-profit organization, Chester Zoo (a zoological park in The United Kingdom) and in collaboration with the Universitas Gadjah Mada (UGM)..

The workshop will be held in Jogjakarta, Indonesia at the:

**Grand Mercure Yogyakarta
Jl. Laksda Adisucipto no 80**

Sleman 55281 Yogyakarta Indonesia Ph. +62 274 2924000

Directors

Norm Rosen, Chair
Dr. Anne Russon
Dr. Rob Shumaker
Dr. Raffaella Commitante
Barbara Shaw
Juanita Kemp
Betty Dunbar

Contact information for OVAG:

Orangutan Conservancy/OVAG: Raffaella Commitante (rcommitante@gmail.com) / Chester Zoo/OVAG: Steve Unwin (s.unwin@chesterzoo.org) Jogjakarta /OVAG: Fransiska Sulisty (siska@orangutan.or.id) / Aceh/OVAG: Ricko Jaya (rickojaya@gmail.com)

Director of Marketing / Development

Thomas Mills

Our ninth workshop will continue work begun in 2009 to improve the work we collectively do to ensure orangutan conservation and health. It will be held

July 23-27

(Arrival: July 22 / Departure: July 28)

OVAG and UGM would like to extend an invitation to the person/s listed below to attend this international workshop.

Steve Unwin (OVAG Committee)

We thank you for your participation in allowing your staff to attend. All travel and accommodation expenses will be paid for by **OVAG**.

Respectfully,

A handwritten signature in black ink that reads 'Raffaella Commitante'.

Orangutan Conservancy / P.O. Box 513 / 5001 Wilshire Blvd. / #112

Los Angeles, CA 90036/USA / www.orangutan.com / info@orangutan.com

Agenda

OVAG 2017 AGENDA

TIME/ DATE	21-Jul	22-Jul	at Hotel 23-Jul	at Hotel 24-Jul	at UGM 25-Jul	at Hotel Half Day 26-Jul	at Hotel 27-Jul	28-Jul	
7:00			Breakfast	Breakfast	Breakfast - transport to UGM	Breakfast	Breakfast		
7:30			Opening Ceremony UGM & OVAG (Ricko Jaya: MC)	Field Sampling Methods (Steve Unwin)	Respiratory Disease - Update from BOSF Samboja: Air Sacculitis (Agnes Pratamiutami, Jennifer Taylor-Coursar)	Orthopedy Season 2 (Matthew Pead)	BlAZA Welfare Assessment Procedure and Malaysia Welfare Update (Nick Davis, Sumita Sugnaseelan)		
8:00			Ice breaker on 8th Floor (outside) and introduction of Delegates in Meeting room (6th floor) (GAVO - Steve Unwin)	Recommended Rehabilitation Practices in Orangutans Behaviour Perspective (Anne Russon)	Case studies: 1. Rosalie Dench 2. Meuthya SOCP 3. Fiet Hayu Patispathika NM	Case studies 1. Andhani Widya Hartanti FZS 2. Lia Kristina NM 3. Pakeeyaraj Nagalingam SWD, 4. Citrakasih Nente SOCP	Management of Gastrointestinal Problem (Steve Unwin)		
8:30		Evaluation Session - (Steve Unwin, OVAG Committee)							
9:00			Break	Break	Break	Break	Break		
9:30			Orangutan Behaviour (Raffaella Commitante)	Release Management (Group and discussion) 2	Anesthesia (Nancy Lung's Session given by Javier Lopez, Ghislaine Sayers)	Orthopedy Season 2 (Matthew Pead) continued	Reintroduction Program (Wendi Prameswari) IAR Ciapus		
10:00			Enclosure Design Tools (Jackie Chappell)	reintroduction sites (BOSF and SOCP) (Jamartin Sihite, Mukhlisin)			Reintroduction Program - (Simon)Tasikoki		
10:30			Wildlife Disease Risk Analysis for Dummies (Steve Unwin)				Gibbon Project (Susan Cheyne)		
11:00			Lunch - 8th floor Purple	Lunch - 8th floor Purple	Lunch - 8th floor Purple	Lunch - 8th floor Purple	Lunch - 8th floor Purple		
11:30			Pathology and sampling (Silvia Arin Prabandari)	OVAG Strategic Meeting - OVAG, UGM and Tufts University Where are we now? Where are we going? Review questionnaire results Introduction to Theory of Change (Steve Unwin, Fransiska Sulisty lead)	Anesthesia Continued		Public Health Engagement (Isabelle Lackman, Felicity Oram)		
12:00	Participant early arrival for those who wish to attend UGM seminar (Please note that seminar fee and accommodation for this event will NOT be covered by OVAG)		First Aid / Emergency Care for Field staff (Chris Cousar)				Ecotoxicology in SE Asia (Lesa Thompson)		
12:30			Break	Break	Break		OVAG Strategic Meeting Committee only		
13:00			Health screening for staff/visitors orangutan centers/release sites DRA (Steve Unwin & Yenny Saraswati)	GROUP PHOTO Outside 8th Floor WEAR YOUR OVAG T-SHIRTS	Anesthesia Continued	Explore Jogja Dinner at your own pleasure	Evaluation and wrap up		
13:30			Medical Supply Auction	OVAG Strategic Meeting continued					
14:00			Break	Break	Transport back to hotel		Certificate Distribution		
14:30			Dinner at hotel - Purple	Dinner at hotel-Purple	Dinner at hotel-Purple		Break		
15:00							Conference Dinner - Purple		
15:30									
16:00									
16:30									
17:00									
17:30									
18:00									
18:30									
19:00									
20:00									

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Participant Contact List for OVAG 2017

	Name	Email	ORG
1	Adi Irawan	adi@internationalanimalrescue.org	IAR vet/mgr
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July 23-27 Jogjakarta, Indonesia



Section Three

Proceedings

Day One - 23 July 2017

Welcome from **Ricko Jaya** (OVAG, OIC) – MC (English and Javanese)

Dear respected OVAG friends that we love and invited guests. First of all I would like to say Welcome to the delegates and thank you for spending the time participating in the workshop. I hope this will be a good experience from beginning to end

Ricko introduced the Vice Dean of Academic Affairs, **Dr. Agung Budiarto** representing UGM. His speech summary:

He thanked everyone for the cooperation and the hard work done by OVAG to assist in medical skills as well as the love and passion they show. Without this love, it would be impossible to do the hard work needed. It is important to have skills as well as love to do the work OVAG does. Individual orangutans display unique characteristics and learning more about them is important. It is important work that vets do – they care about other creatures in the world – what do we need moving forward? Improve the skills needed for the increasing challenges as the orangutan problem will get more complicated. We need to share information and work together to face the orangutan problem in the future. We have to increase awareness about orangutans to the government as well as to the people. As part of the committee for TGLS, we are on the orangutan's side, we need to increase the participation of not only the forestry department, but have a wider reach. OVAG has taken many positive steps toward increasing skills, collaboration and thank you for all the structure and to all the committee that created such a workshop and I know it will run well from beginning to end. In future, we hope to increase the support from our faculty.

Welcome by **Raffaella Commitante** (OVAG, Orangutan Conservancy (OC), California State University Fullerton (CSUF))

Welcome by **Steve Unwin** (OVAG, Chester Zoo, IUCN)

Film of OVAG overview – Steve Unwin.

Introduction of the committee: Steve Unwin (Chester Zoo), Ricko Jaya (OIC), Fransiska Sulisty (BOSF), Raffaella Commitante (OC), Citrakasih Nente (SOCP), Sumita Sugnaseelan (UPM), , Yenny Jaya (SOCP), Anta Rosetyadewi (UGM, Murdoch), and from UGM veterinary faculty collaborators and OVAG members, Pak Indarjulianto Soedarmanto, Pak Hery Wijayanto.

Review of the OVAG working agreement (follows IUCN CPSG):

All ideas are valid, discussions are recorded, no one dominates everyone participates; we listen, treat each other with respect and observe time frames.

Beginning Sessions:

Workshop Overview:

Steve Unwin (OVAG, Chester Zoo, IUCN)

Husbandry and welfare aspects of animals under your care

Health and biosecurity aspects of reintroduction

Your colleagues' clinical and practical issues and hopefully ways to assist them

Protocols for CPR

Knowledge of the OIE/ CPSG Disease Risk Analysis toolkit, how to access it and utilize it to minimize disease risk

Primate pathogens

Orthopedic principles

Anaesthesia and the respiratory systems

Management of gastrointestinal issues

Health and biosecurity clinical issues

Protocols for PCR

Reintroduction review

Orangutan behavior

The main thing is that the workshop is useful to you; not only at the workshop but useful as strategies moving forward over the next 2, 3 and 5 years.

Post it board for questions, issues, concerns, etc. is available. All presentations and notes will be available to all participants through a dedicated Google drive.

It will be expected that most OVAG participants have basic training and demonstrate skills in:

Theory:

- Understanding of One Health, disease ecology and disease risk analysis principles
- Understand the basics of Primate reintroduction health and biology
- Diagnosis development and to be able to recognize good welfare and husbandry

Practical:

- First aid and emergency care
- Anesthesia (clinical vets only)
- Orthopedics (clinical vets only)
- Provide sanctuary management with advice on pathogen control
- Create a contingency plan for a disease outbreak

Our hope as a network group is that we will continue to increase links between OVAG and Universities. That we be as inclusive as possible to help all to improve the health, wellbeing and conservation of orangutans and other wildlife – in zoos, in rehabilitation centres, and in the wild.

And ultimately, our goal is to be useful to you!!!

Gavo travel videos parts 1 and 2

Group Ice breaker – led by **Steve Unwin**

Pre Workshop Quiz – tailored mostly for both vets and managers (with the last part specific to vets) covering both past information and new information.

Thank you to donors

Raffaella Commitante

Orangutan Conservancy, Chester Zoo, Arcus, Fort Wayne Children's Zoo, The Orangutan Project and Abaxis and the hard work done by the OVAG committee in the year- long preparation for this workshop.

Orangutan Behavior Part 2 (continued from 2016)

Raffaella Commitante (OVAG, OC, CSUF)

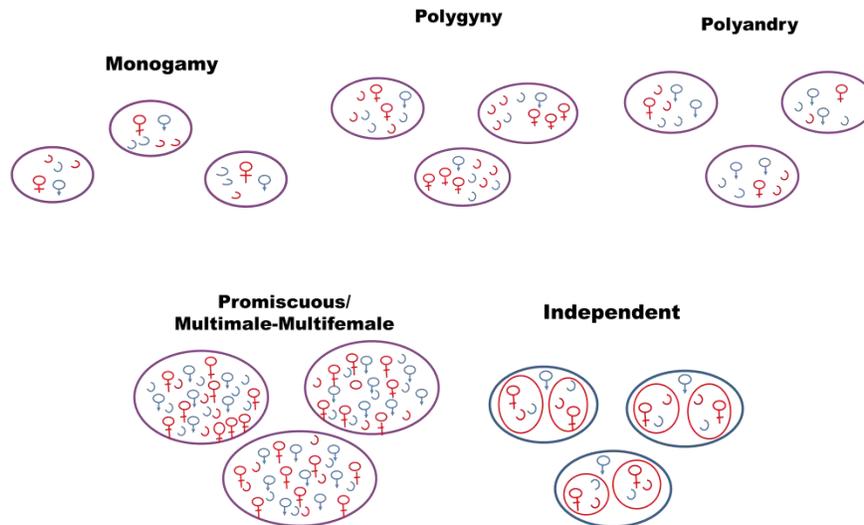
Abstract

Understanding orangutan behavior can be a difficult challenge. Orangutans are very complex individuals in many aspects of their behavior. They are complex thinkers and they spend much of their infancy and adolescence learning how to negotiate their environment and how to survive within it. Their sociality falls outside of the typical primate structure, being for the most part independent, yet very adaptable as to be able to live in various social settings. Though known to be frugivores, they are (as are most primates) omnivores, though they have (as do most primates) food preferences. They are very long-lived and have strong mother-infant bonds. Their similarities to human primates have both helped and hurt their chances at survival. As they continue to move closer to possible extinction, understanding the intricacies of their live ways becomes an important and necessary tool to prevent it.

When thinking about primate food choices, ranging patterns play a huge part. Typically, females and their young live in ranges that overlap with other females (that they may be related to). These ranges are usually in an adult male's range (their preferred mate) (te Boekhorstal. 1990; Rodman 1993; Singleton & van Schaik 2002). Males typically range alone and are quite independent – meeting only with females for reproduction and leaving all care of offspring to the females. Males range farther once they are independent from their mothers. Sometimes they are nomadic, sometimes displacing a dominant male once they find an area in which to reside (Delgado & van Schaik 2000).

A typical orangutan day Starts at sun up (about 06.00) when they leave their nest and eat, rest and travel for most of the day – usually alone or a mother with her offspring. They spend about 3 hours in the morning feeding, rest in the middle of the day, and then are on the move searching for more food. Their day ends at about 18.00 when they make a sleeping nest.

Primate mating patterns also play an important role in ranging and feeding behaviors. Primates are quite unique in that they employ multiple mating patterns and strategies.



Orangutans appear to prefer the independent system, though they are capable of functioning in both polygynous and promiscuous systems. Young orangutans stay with their mothers between 6 and 8 years. During this time they are being very social as they are learning from her. This is very much a primate advantage for survival – as primates, we all learn by watching others. In the primate (and animal) world this is typically referred to as social learning (Coussi-Korbel & Fragaszy 1995). Different social situations and conditions can affect an individual’s ability to learn as well as what it is they are trying to learn. Orangutan infants learn everything they need to know about the forest and surviving from their mothers (and sometimes their older siblings) (Jaeggi et al 2010, Munn & Fernandez 1997).

Males compete for females and can get quite aggressive because females can be hard to find... especially in increasingly fragmented areas (Mitani 1989; Rodman 1993). While males are adapted to finding females, females are adapted to finding food...Why? Because they are the baby makers!

Some Orangutan Facts – All are approximate !!!

	Orangutan	Humans
Gestation	260 days	270 days
Age at first reproduction	13-15 (earlier in captivity)	19-21
Weaning age	5-8 years old	6 months – 2 years old
Interbirth interval (IBI)	8 years	2-4 years
Births Per Lifetime	3 – 4 infants	1-6 +
Reproductive Lifespan	25 + years	20-24 years
Lifespan	40 – 60 years	70-89 +

Orangutan Developmental Stages

- Infant.....0 – 4/5 yrs
- Juvenile.....4/5 – 7/8 yrs
- Adolescent.....7/8 – 15 yrs
- Reproductive.....15 – 48
- Post Reproductive.....+ 48 yrs

Orangutan females begin cycling between 5.8 and 11.1 years (occurring earlier if there is more body fat) (Kaplan & Rogers 1994; Knott 2001). While there is no defined season for breeding, there does appear to be some seasonal impact on ovarian function in females coinciding with either more or less food resources (Muller & Wrangham 2001). For orangutan males, maturity occurs between 8 and 15 years of age. The secondary sexual characteristics (larger size, large throat sac, cheek pads, long-calls, long hair) occur at about 15 to 20 years, though young males are capable of reproducing (Rijksen 1978). The large males do not see the smaller males as a threat and they are able to move within the male’s territory easily. This allows the sub adult male to have access to the larger male’s females that live within the male’s territory. Sex with females is sometimes forced as females prefer their larger fully adult male (Utami et al. 2002;

Setchell 2003). Females submit to sub-adult males in order to avoid injury – both for themselves and for their infant (if they have one).

Orangutans are large bodied primates (as are most great apes). Even though they are large bodied – they are still able to move quite easily through the tree tops. They do this by distributing their weight throughout their four very flexible limbs. This mode of locomotion is referred to as clamouring or being quadrumanous. Moving in the forest canopy, orangutans can be a bit destructive if the forest is not composed of healthy tall trees (primary forest). However, they can survive in secondary or regenerating forests because of their unique clamouring ability and the ability to find fallback foods.

Fallback foods are food items that may be difficult to find, difficult to open or not their first choice. These include items such as tree bark, gingers, pith, seeds, nuts, small animals, insects etc.

Fruit and vegetation (leaves) are a regular part of their diet with these fallback foods added in. Orangutans also contribute to forest growth as they are known to be seed dispersers, eating forest fruits and defecating the seeds as they move through the forest. The warmth of the feces is a perfect environment for seeds to germinate –thus regenerating the forest!

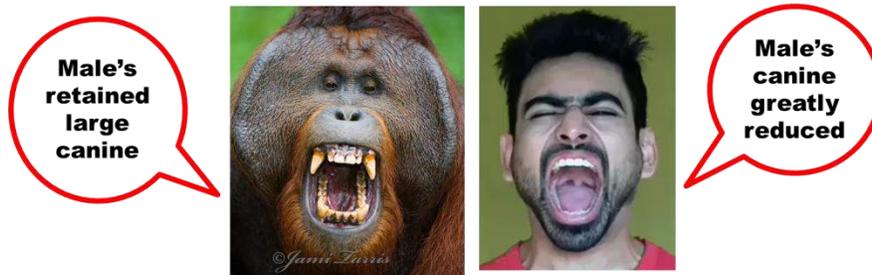
The life style and biology of orangutans (and all living things), along with reproduction and many other behaviors are tied to food resources. That is why it is important to understand both behavior and food consumption. Orangutan food choices are plentiful. While orangutans do eat lots of fruits, their forest fruits are very different from fruits human eat. Remember, they also eat leaves, flowers, honey, shoots, stems, seeds, fungus, pith, bark, small insects, eggs, and even small mammals. Orangutan stomachs are designed to take in a lot of vegetation – along with a lot of fruit. It is important, when considering behavior to also consider biology.

Biology influences Behavior and Behavior influences Biology

They are ALWAYS connected. The problem? Primates are usually categorized in what are known as Primate Food Categories: Insectivores / Frugivores / Herbivores / Gumivores/ /Omnivores. But in reality - all primates are in a sense omnivores – they eat from all food categories, though they definitely have preferences and even adaptations for their preferred food. For example, insectivores have high cusps to pierce insect bodies; frugivores have wide molars for crushing; herbivores have sacculated stomachs holding bacteria; gumivores have gouging incisor teeth.

Primates as a large group have many unique characteristics. One of them being un-specified dentition. This un-specified dentition allows them to use their teeth for a variety of foods. The typical primate tooth formula is 2.1.2.3 (per jaw quadrant meaning 2 incisors, 1 canine, 2 premolars, 3 molars)

This formula applies to Old World monkeys, Apes, Great Apes, and Humans. Though there is variation in tooth size and form.



Orangutans are adapted to eating multiple food types not only because of their teeth but also because of their gut design. When looking at the digestive system, there are also categories and as in food categories, there is also room to belong to more than one.

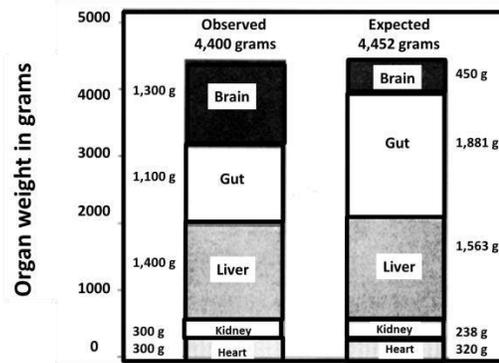
Types of herbivores:

- 1 - Ruminants (cattle, sheep, goats) with bacteria in special compartments in a large stomach.
- 2 - Those having an enlarged large intestine and caecum, containing cellulose digesting micro-organisms.
- 3 - Those having a cecum which includes great apes and humans

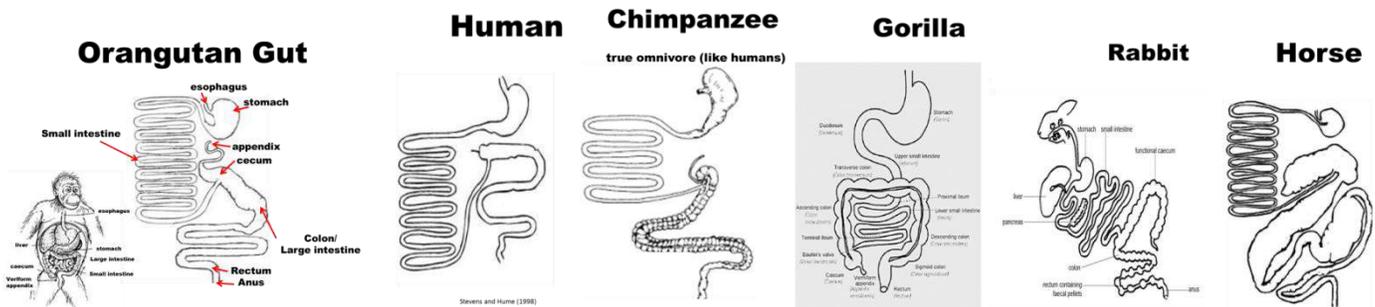
Orangutan cecums are quite large and can actually place them in types 2 and 3 (Lawson 2015).

Below is a chart modeled after Aiello, 1997, showing expected organ size for a typical mammal sized comparatively to a human, showing the differences in organ size depending upon the importance of that organ for survival. Clearly, humans devote more time to growing a large brain than a large gut, as that gave them an advantage over other mammals/primates.

Human Organ Size / Expected Organ Size



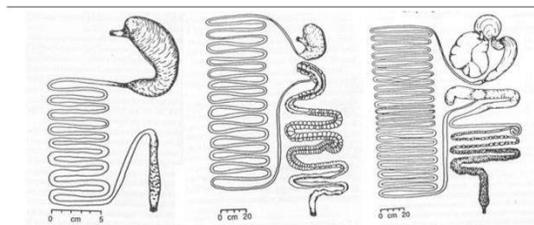
Below are charts comparing an orangutan gut to human, chimpanzee, gorilla, rabbit and horse guts so that one can see the similarities and differences depending upon gut capacity for more or less vegetation.



The following image shows comparative digestive tracts of a typical carnivore, omnivore and herbivore.

Mammalian Digestive Tracts

Carnivore Omnivore Herbivore



Carnivores have short digestive systems as their proteins are easier to digest than plant cellulose. Herbivores and omnivores have longer digestive systems to allow for the time needed to breakdown cellulose (aided by bacteria). Most animal species have fairly flexible digestive systems which are adapted to different foods and amounts able to be eaten at any one time (Karasov et al., 2011).

Higher level primates also eat foods which heal them when they are sick (diarrhea, parasites, malaria, etc.). Orangutans, due to their large size have high caloric needs. Fruit alone cannot accomplish this need (Delgado & van Schaik 2000).

Also, it is not always available and is most times not found in large enough amounts which not only affects diet but also the size of their social groups (Delgado & van Schaik 2000). Like humans and other larger primates, because orangutans take in such a variety of foods, they are in a sense omnivores. As such, infants need to learn many things about their environment in order to survive. They learn from others, but they also learn on their own due to individual exploration and evaluation (Bastian et al, 2010).

The important message here is that behavior and biology are always connected – you cannot focus on just one – you need to look at both features in order to enable the overall well-being of orangutans and any living organism.

Behavior and biology are also linked to orangutan ability to use tools which assist them in getting food and water. While all orangutans use tools in captivity, Sumatran orangutans are mostly known for tool use in the wild as it is not as frequently seen among Bornean orangutans (Commitante *et al* 2003). Some tools used in the wild are: leaves as "toilet paper", leafy branches as flyswatters, large leaves as umbrellas (Fox et al, 1999). Some tools they make are shaping sticks to get insects and to open fruit and seeds, and using bunched leaves to hold spiny fruit (Fox et al. 1999). In captivity, whether in a zoo or a rehabilitation center, orangutans show a high degree of inventiveness in their tool use. They can be a challenge because they can figure out ways to break out of their cages or enclosures! Tool use is linked to biology as orangutan hands are adapted for manipulation - though not as finely tuned as human hands (humans have very long thumbs – a huge advantage for humans).

The long thumb allows for the human power and precision grips (slightly modified in great apes).



Orangutan feet are very similar to their hands – an adaptation for living in the trees. Human feet are adapted to bipedal locomotion and are built for stability not flexibility



Orangutan Quadrupedal Foot
Small heel
Small, flexible ankle adapted for climbing
Flexible mid foot – no arches
Opposable, grasping big toe

Orangutan



Human



Human Bipedal Foot
Large heel
Stronger ankle adapted for walking
Stiff mid foot area and arches for propulsion
Big toe aligned with other toes for stability

Remember:



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Short Break for primate calls: Long call /Chimp call/Gibbon/Sulawesi macaque calls

Supporting rehabilitation: extending the enclosure Design tool (EDT) to Sanctuaries

Jackie Chappell (presenting), Wily Saundersm, Julia Mayatt, Fransiska Sulisty, Christina Nichols, and Susannah Thorpe (EDT)

Abstract

There is a clear need for rehabilitant orangutans to be able to express the full range of wild-type behaviors and skills so that they can be successfully reintroduced into the wild, as well as to enhance their welfare while in sanctuaries. Both the musculoskeletal system and the brain develop in response to the demands placed upon them throughout ontogeny.

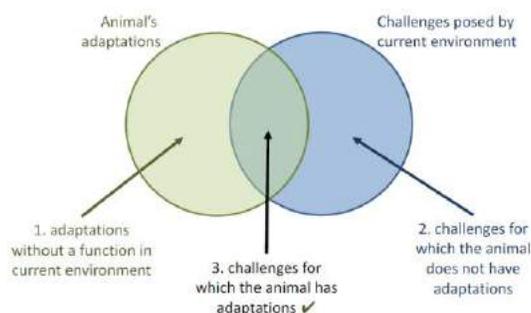
Thus, physical strength and cognitive skills are built cumulatively, and are harder to develop during adulthood. Techniques used in ‘Forest Schools’ with young orangutans are clearly effective in developing many of these behaviors. However, once individuals are too old for caregivers to work with safely and must be housed in enclosures or densely populated island habitats, additional measures are necessary to avoid losing the gains built in Forest School.

We need to equip sanctuaries with targeted techniques to understand which behaviors individual apes are not expressing appropriately, and methods to elicit these behaviors to ensure species-typical physical and cognitive development and maintenance. We have devised a web application called the Enclosure Design Tool (EDT) to elicit wild-type behaviors in captive apes. This has been well received by the zoo community, and we are now in the process of developing an EDT for orangutan rehabilitation centers in range countries. The EDT quantitatively compares data on the

behavioral ecology of captive individuals with the behavior of their wild counterparts, and recommends enclosure modifications to encourage wild-type behavioral profiles. After modifications have been made and more behavioral data collected, the EDT evaluates whether the changes have been effective in moving the behavioral profile closer to that of wild orangutans. During this project, we are working with the Bornean Orangutan Survival Foundation (BOSF) to develop an EDT for rehabilitant orangutans, which will be made freely available to other relevant institutions upon completion. We are currently collecting baseline behavioral data at the Samboja Lestari Orangutan Rehabilitation Center (BOSF), and will develop the EDT using this data and guidance and input from our Advisory Board and the wider rehabilitation center and sanctuary community. Successful development of an EDT for orangutan rehabilitation centers would provide a robust evidence base for improving the welfare of rehabilitant individuals in range countries, and ensure that they possess the physical and cognitive skills needed for successful reintroduction into the wild.

The challenges faced by orangutans in their environment are: large home ranges, highly complex forests, dynamic (changing: decaying, seasonal) forests with ever changing supports with flexible branches, narrowing gaps between food sources, finding mates, interactions with other orangutans and natural stress in dealing with their environment. Orangutans have adapted and evolved to meet many of these challenges.

How do these adaptations relate to orangutans in zoos, sanctuaries and rehabilitation centers?



Adapted from: Fraser, D. et al. (1997). *Animal Welfare*, 6(3), 187–205.

Bone responds to forces put upon it and the brain responds to stimuli. Infants and juveniles learn from their group members (for wild orangutans, typically their mother and possibly an older sibling).

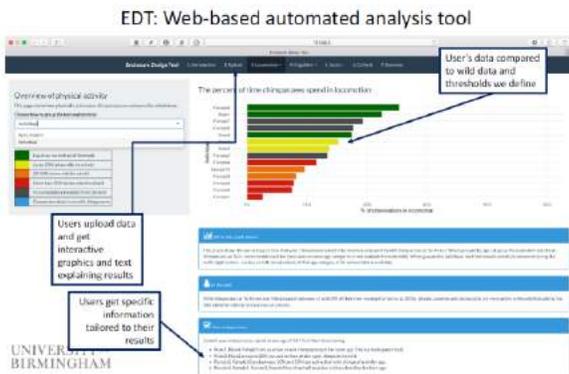
[In rehabilitation centers, young orangutans are trained in forest schools, then hopefully onto a release site, but some go back to a caged environment as they await possible release as they get more difficult to handle the older they get]

How can the skills learned in forest schools be built on and maintained? By using Exhibit Design Tool (EDT), bringing information on wild apes to captive situations in order to encourage similar behaviors.

EDT is a web based tool (designed originally for chimpanzees but currently has been extended to all great apes in zoos and *in situ* sanctuaries/centers) that allows for the comparison of behaviors of apes in the wild and makes recommendations about what is needed to modify enclosures to encourage absent or under represented behaviors. EDT also allows for zoos and sanctuaries to make changes themselves independently on an ongoing basis. Data for the tool are collected by zoo/sanctuary/center staff. The website includes a guidance document instructing staff on how to use EDT, a pre-constructed database and recording sheets to enter their behavioral ecology data, and a semi-automated tool that:

1. analyzes the data and compares it to wild conspecifics;
2. Creates automatic graphical and statistical reports;
3. offers appropriate suggestions for enclosure modifications based on generated reports; and
4. allows for collection and comparison of pre and post modification data.

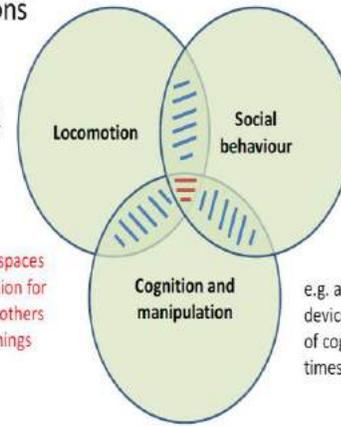
A sample page from the website is featured below:



Recommendations

e.g. introduce flexible supports to diversify locomotor behaviour

By focusing on shaded spaces we can use the motivation for one behaviour to elicit others or to compensate for things that can't change

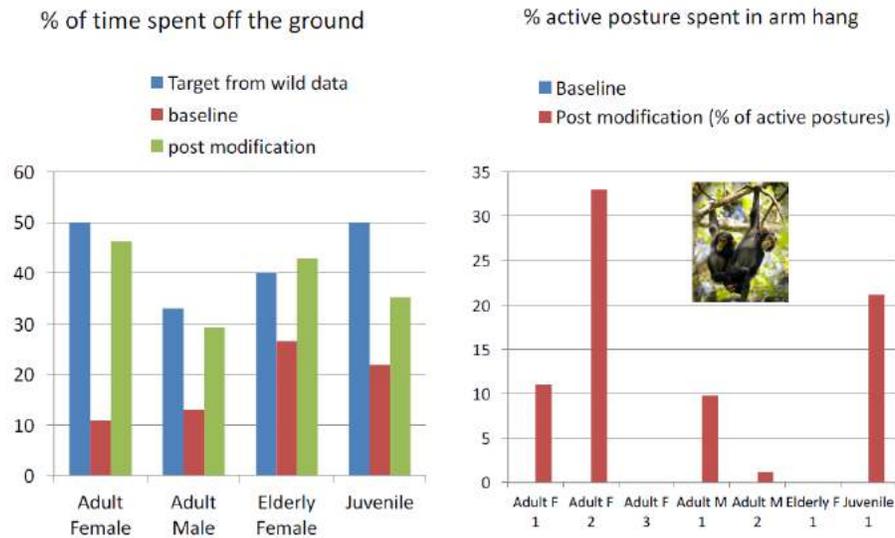


e.g. randomise feeding times to reduce aggression

e.g. add extractive foraging devices to increase duration of cognitively engaged times

EDT can then make recommendations, based on replicating the mechanical behaviors used in a forest canopy and the physical and cognitive challenges they pose to great apes. Users can then apply their own expertise to choose modifications that will work with their great ape within their own time, budget, and logistical constraints.

Twycross Zoo's modifications to their chimp enclosure after using EDT showed the following results:

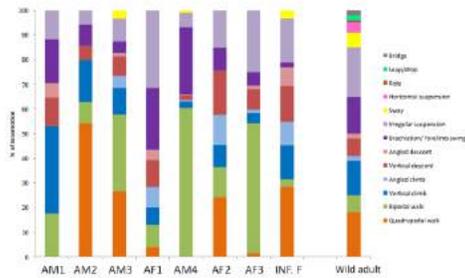


Twycross Zoo, based on EDT data, built a flexible webbing system that changes as chimps use it (tension changes), they hid food high up to encourage foraging, added lots of nesting materials and wobbly supports to simulate moving branches. They also lessened the attraction of going to the ground to encourage chimps to stay up in the webbing and branches.

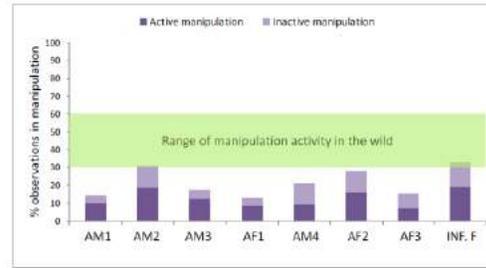
EDT can easily be adapted for sanctuaries/centers and orangutans. Use of EDT would help both releasable and non-releasable orangutans as these would be two different systems. Staff at the Borneo Orangutan Survival Foundation, Samboja Lestari (BOS-SL) site has already begun collecting baseline data so they can soon begin to use the tool. These data include, stereotypic behaviors, general behavior, aggression towards humans, tool use, nest building, use of supports, height usage, etc.

Preliminary BOS-SL data charts:

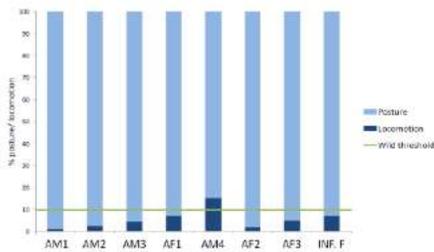
Diversity of locomotor behaviours



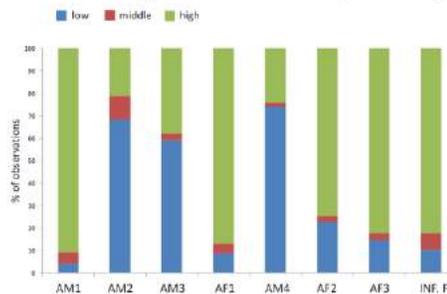
Percentage of time spent manipulating objects



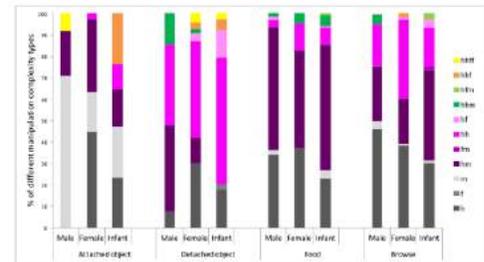
Posture and locomotion



Use of height of enclosure (all data)



Complexity of manipulation by type of object



The next step is to implement changes from these data into the enclosure and then collect post modification data.

Can EDT help sanctuaries/centers? Most likely yes as the tool can be adapted for each sanctuary/center use. The online version for zoos can easily be modified for orangutan sanctuaries free of charge.

Discussion

Old behaviors can affect data analysis – dominance issues can impact information and behavior seen / In rehab settings focusing on young orangutans for release: how much do we want to improve their life in a captive setting and, they need to spend time in an actual forest area – it is not about making their cages a nicer environment but a more efficient one toward forest skills / right now the EDT is focused on adult orangutans, maybe in the future it can be used to look at youngsters, but some of the knowledge gained may be used – but the tool it is mostly to allow them to learn forest skills.

How far should the distance be between humans and animals: 7 meters minimum – air particles stay for up to 8 hours – so infection can occur really easily...the longer the space is shared, the higher the probability of exposure. With or without masks...as they are not really effective in high moisture areas...also they are designed for one way transmission. How long can masks last? Use of masks needs to be coupled with other safety measures such as proper more effective ways to clean, periodic testing of personnel, proper protective clothing, etc.

The Dynamic World of Conservation Medicine. One World: One Health. Paradigms to Practice in Indonesia (Incorporating DRA for Dummies)

Steve Unwin (OVAG, Chester Zoo, IUCN)

Abstract

It is important to understand the links between conservation and sociology along with how One Health fits into conservation and veterinary involvement in both *ViaWildlife* Disease Risk Analysis (DRA). DRA allows for linking your clinical skills and principles to conservation and One Health issues; allows for knowledge of where to find Wildlife

Disease Risk Analysis information and tools to assist in wildlife health management; and an individual veterinarian's role in helping reduce disease spread at the species and ecosystem levels.

NOTE: Articles about One Health will be placed on the Google Drive for OVAG – everyone will have access.

1. Big picture – Understanding modern practices in conservation

The definition of conservation from the IUCN states: the protection, care, management and maintenance of ecosystems, habitats, wildlife species and populations, within or outside of their natural environments, in order to safeguard the natural conditions for their long-term permanence.

There are many ways to 'do' successful conservation work. Salafsky *et al* 2008, published: A Standard Lexicon for Biodiversity Conservation: Unified Classifications of Threats and Actions in the journal Conservation Biology, Volume 22, No. 4, 897–911. This article will provide you with a good understanding of the *language* of conservation, and the Open Standards process shown in the diagram below will provide an insight into how conservation is managed and practiced.

Conservation Measures Partnership Open standards flow diagram:



How does conservation happen? By combining scientific research, protection and management of habitat, capacity building, and awareness campaigns as well as community outreach and development projects. Conservation is not just about wildlife. Conservation is primarily about people.

Questions to ask:

Do you have cultural knowledge of where you are working? What is the level of community involvement and understanding? Do people trust of NGO's? Are there coordinated efforts? What creates human wildlife conflict – conflict over resources is common, but what about in your local area?

To help with promoting and creating effective conservation, organizations such as conservation NGO's and zoos are starting to integrate conservation efforts into an integrated One Plan approach, originally suggested by the IUCN through the Conservation Planning Specialist Group (CPSG).

One plan: Integrated species conservation planning that considers all populations of the species (inside and outside the natural range), under all conditions of management, and engages all responsible parties and resources from the start of the conservation planning initiative. Amongst other things, the strategy states that zoos have a duty to:

- Develop and adapt intensive wildlife-management techniques for use in protecting and preserving species in nature
- Support conservation-directed social and biological research
- Lead, support and collaborate with education programs that target changes in community behavior towards better outcomes for conservation
- Be major contributors of intellectual and financial resources to field conservation
- Provide ethical and moral leadership

All these efforts have people as the initial primary focus of investment.

2. Introduction to Conservation Medicine

As the leading scientific organization for wildlife conservation, the IUCN recognizes disease and disease spread as a threat to conserving biodiversity (<http://www.iucnredlist.org/news/biodiversity-crisis>). Vets must integrate themselves with other disciplines when working with wildlife. As part of a bigger picture, how can we prove that the effect of disease on health and welfare is actually something that needs to be considered in biodiversity focused conservations?

The following will introduce the concepts of conservation medicine and One Health, a set of tools to help us analyze disease risk in wildlife, and look at the basics of disease ecology and pathogen transmission.

Helpful background viewing:

- <https://www.youtube.com/watch?v=uodJ1-cgAW4> (Introducing One World One Health (Basic))
- <https://www.youtube.com/watch?v=8SDnFdpR7Cc> (University of Helsinki – human health links to nature) (Undergraduate level)
- <https://www.youtube.com/watch?v=LhQRqNhNDAE> (Lecture on one world one health for vet students) (Undergraduate level)

Helpful background reading:

- Wallace et al 2014. The dawn of structural One Health: A new science tracking disease emergence along circuits of capital.
- Woldehanna and Zimicki 2015: An expanded One Health model: Integrating social science and One Health to inform study of the human-animal interface.
- Amuguni et al 2017. One Health Integration into tertiary education example
- <http://rstb.royalsocietypublishing.org/content/one-health-changing-world-zoonoses-ecosystems-and-human-well-being>

What is One Health?

The disciplines of One Health Diagram



One Health is the collaborative efforts of multiple health science professions, together with their related disciplines and institutions – working locally, nationally and globally – to attain optimal health for people, domestic animals, wildlife, plants and our environment. CONSERVATION MEDICINE is the branch of One Health that focuses on disease risk mitigation from the point of view of wildlife.

One Health is an attempt to increase emphasis on adaptive risk assessment and mitigation with effective risk communication and trust between professionals to improve resolution of disease ecology issues. It is a comprehensive approach to health that focuses on:

1. Improving health and well-being through the prevention of risks and the mitigation of the effects of crises (emerging diseases) that originate at the interface among people, animals and their various environments.
2. Promoting cross-sectoral collaborations and a 'whole of society' treatment of health hazards, as a systematic change of perspective in the management of risk.

Rationale:

- Planetary Environmental health may affect human and animal health through contamination, pollution and changing climate conditions that may lead to emergence of new infectious agents.
- Worldwide, nearly 75% of all emerging human infectious diseases in the past three decades originated in animals.
- The world population projected growth from 7 billion in 2011 to 9 billion by 2050. To provide adequate healthcare, food and water for this growing global population, in harmony/ symbiosis with nature, health professionals, conservationists, veterinarians and their related disciplines and institutions must work together.
- Human-animal interactions/ bonds can beneficially impact the health of both people and animals.

Scope of One Health

- Convergence of human, animal and plant health and the health of the environment.
- Human-animal bond.
- Professional education and training of the next generation of one health professionals.
- Research- both basic and translational.
- Ensuring a safe food and water supply that is high quality, available and affordable.
- Agricultural production and land use/ soil health.
- Natural resources and conservation.
- Disease surveillance, prevention and response, both infectious and chronic diseases.
- Comparative medicine: commonality of diseases among people and animals, such as cancer, obesity and diabetes.
- Clinical medicine needs for interrelationship between the health professions.
- Environmental agent detection and response.
- Public policy and regulation.
- Global trade, commerce and security.
- Communications and outreach.

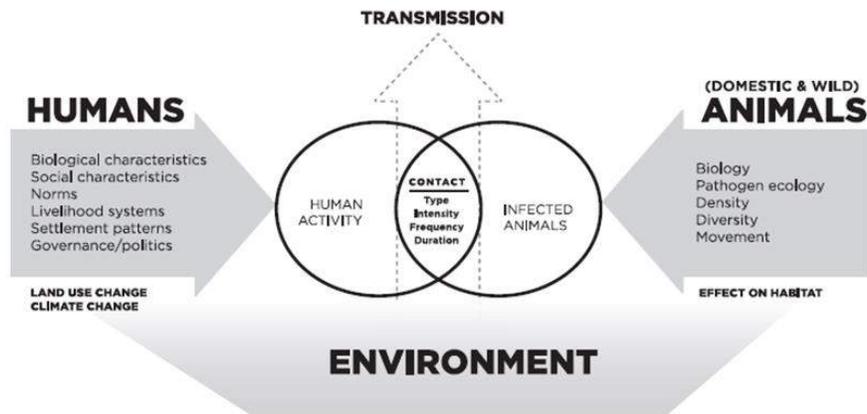
Potential outcomes from the One Health Approach

- More interdisciplinary programs in education, training, research, and established policy.
- More information sharing related to disease detection, diagnosis, education and research.
- More prevention of diseases, both infectious/ non-infectious; acute/ chronic.
- Development of new therapies and approaches to treatments.

As a consequence of increasing emerging disease threat the one health movement gained its 'One World One Health' trademark in 2004 at a Wildlife Conservation Society conference in New York. There was a concurrent call to action for preventing emerging diseases in human and animal populations and maintaining ecosystem integrity. By 2008 the UN

agencies and the World Bank had drafted a strategic framework, introduced at the 'One World, One Health: From Ideas to Action' conference in 2009. The premise of One Health is that people, animals and the environment form an interdependent ecosystem that needs to be considered in a coordinated manner.

Expanded model of One Health zoonotic disease transmission:



Disease and pathogen spread – wildlife to people and people to wildlife (which basically explains conservation medicine).

Recent zoonotic Diseases:

- HIV-1 virus – evolved from Simian Immunodeficiency Virus (SIVcpz) transmitted from chimpanzees to humans by the slaughter and consumption of infected wild chimpanzees (Gao et al, 1999, Nature397, 436-441)
- Bat rabies re-emerged - Deforestation in the Amazon Basin (Kuzmin et al. 2011, Emerging health threats journal 4).
- TB re-emerged in New Zealand - Farming of non-native deer and opossums (Nugent et al, 2015, New Zealand veterinary journal 63.sup1: 28-41).
- Monkeypox virus in the US - contact with pet prairie dogs exposed to a giant pouched rat recently imported from Ghana (Enserink, M. 2003, Science 300.5626: 1639-1639).
- SARS emergence in SE Asia – wildlife trade for food, medicine (Holmes ED and A Rambaut, 2004, Philosophical Transactions of the Royal Society of London B: Biological Sciences359.1447: 1059-1065).

Human Behavior has increased zoonotic diseases by: consumption of diseased animals, deforestation, wildlife trade, farming, and importation of animals.

The One Health Pyramid looks at how disease gets transmitted from one population to another.

One Health Global Network: www.onehealthglobal.net

Everything occurs within the environment, therefore there is contact and therefore there is transmission of disease.

The main driver of transmission is the increase in the human population, increase in the need for more resources, increase in contact with animals, leading to increase of transfer of pathogens.

Humans live in 78% of the natural environment, leaving only 22% for animals of which only 16% are in wild areas. Most wildlife is in the human occupied areas making it much easier for toxins and pathogens to travel between and within these populations of humans and animals. The vast majority of diseases originate from human to animals not the other way around!

We typically work with wildlife in protected areas...but that is only 16% of the land, while there are wildlife living there, most are outside of those areas, sometimes found in buffer areas, then towns and cities. Wildlife can exist in all of these areas – exposing humans to more diseases which can then be transferred to other animals. Both wildlife and domestic animals come into contact with vast human populated areas.

DRA: Risk Analysis is a logical, structured and evidence based approach that integrates both science and policy; supports decision-making in uncertain conditions, helps decision makers to consider an evidence based range of options for prevention and mitigation of disease risks. DRA has three main components: risk assessment, risk management, risk communication – qualitative, semi-qualitative or quantitative.

Manual of Procedures for Wildlife Disease Risk Analysis – on line free manual:

<http://www.cbsg.org/conent>

What is Risk Analysis?

Risk analysis allows us to make better decisions by taking the flawed human brain crisis management system out of the equation. Linking the One Health paradigm with risk analysis principles provides the training framework we operate with OVAG.

‘Risk analysis is a formal procedure for estimating the likelihood and consequences of adverse effects occurring in a specific population, taking into consideration exposure to potential hazards and the nature of their effects’ (Thrusfield, Veterinary Epidemiology, 2007). It is a tool to enable decision makers to insert science into policy.

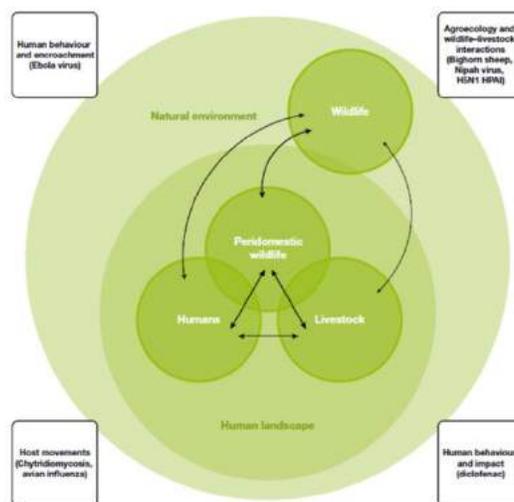
There is often a large degree of uncertainty in deciding what is going to be a problem disease for the animals, and what may not be. Often information on disease risk and population health is scanty at best. By working through a risk analysis process, the aim is not only to highlight what we do know, or strongly suspect, but also where we need to focus our research efforts, to find out what we don’t know. This includes the management (usually reduction) of the likelihood of exposure.

A risk analysis: Adds science to policy decision making / Is a transparent method to organize, assess and study a problem, question, or issue / Allows successful project succession planning / Increases communication between all stakeholders / Is Multidisciplinary / Identifies data gaps and research needs

We as humans are not very good at accurately assessing risk, including disease risk, therefore, we have invented tools to help us. The IUCN has already created a toolkit for wildlife disease risk analysis which is freely downloadable from the internet.

What is Disease Ecology?

Pathogen flow and drivers at the human-livestock-wildlife interface. The arrows indicate direct, indirect or vector-borne pathogen flow. Each box represents a driver:



Underpinning One Health practice is a foundation of basic disease ecology, which studies the flow of pathogens between host and environment. Human landscape on the diagram covers 78% of landmass and includes 84% of terrestrial

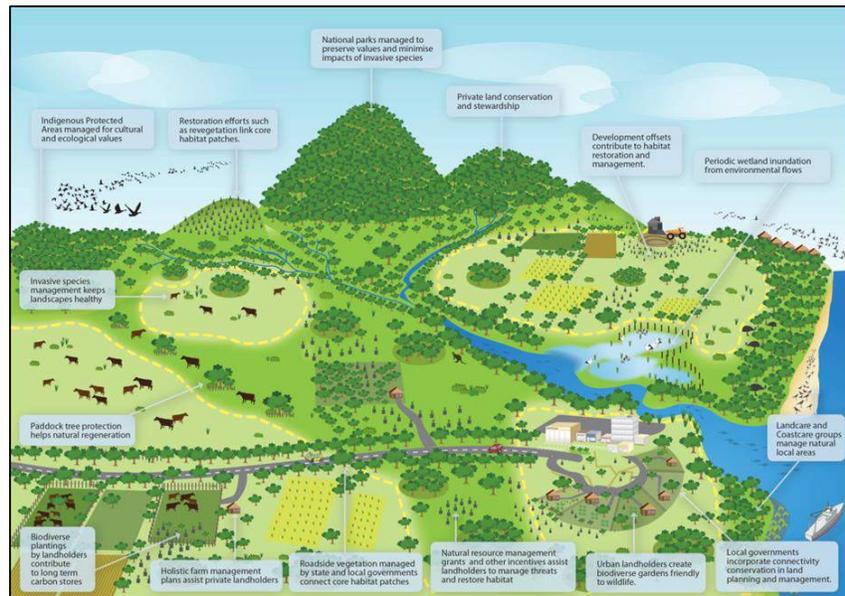
mammals. The natural environment covers 22% and only includes 16% of terrestrial mammals. 2/3rds of this 16% are located in places where people are not found and only 1/3rd of the 16% are in protected areas.

So, protected areas per se are doing a good job, but the potential issue is the interface with human systems, habitat fragmentation etc., as most wildlife is found at these boundaries and in the human altered landscape.

Who is affected in these cases of pathogen flow?

- the animal or animals in question (exposure to a pathogen or toxin) could cause disease outbreaks and/ or decline in a population.
- Other animals exposed directly or indirectly during and after an event (the event could be animal movement, urban development, changing land use).
- Any other species of plants or animals that share the same habitat.
- Humans that come into contact with wildlife.

An overarching example of Disease Ecology and One Health in action: Human, domestic animal and wildlife health is a product of good environmental management. Even in the idealized schema below [from the Aust. Govt. Dept. of Env. National Wildlife Corridors Plan] of strategies to maximize ecosystem health and biodiversity conservation, there are opportunities for pathogen movement - and management. Most of these occur along the boundaries between totally protected areas and areas of human encroachment.



3. Risk and Wildlife Disease Risk Analysis

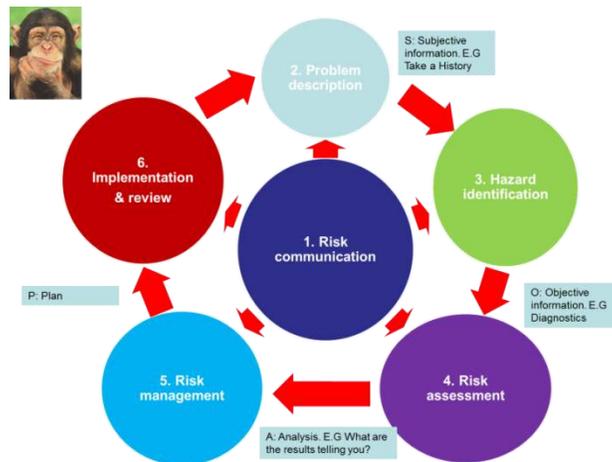
How do we define 'risk'? Risk is a combination of the likelihood of a hazard interaction and the consequences of that interaction. The human brain is not very good at assessing risk. Our brain has evolved to make rapid decisions in the face of a risk. So we are more likely to focus on the consequences of something happening, and put less emphasis on the likelihood. Finding out what is important, may not be the most obvious thing.

There is often a large degree of uncertainty in deciding what is going to be a problem disease for the animals, and what may not be. Often information on disease risk and population health is minimal. By working through a risk analysis process, the aim is not only to highlight what we do know, or strongly suspect, but also where we need to focus our research efforts, to find out what we don't know. This includes the management (usually reduction) of the likelihood of exposure.

What is risk? Humans are not very good at assessing risk – which is the likelihood of something happening and what actually happens... better to runaway than to face bad consequences, humans see the consequences but not the likelihood of something happening.

Uncertainty makes humans anxious – Risk Analysis lessens the anxiety by understanding the likelihood of what can occur.

Risk Assessment Diagram:



At the center of it all is COMMUNICATION!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

Ranking and Prioritization: Link defining question to potential hazards/threats / Establish criteria for importance based upon the question / Model high priority hazards.

Questions to ask:

What can go wrong? How can it go wrong? what is the possibility of a pathogen being released in the environment? Is there a potential population that may be susceptible? What is the likelihood that they will be exposed? What is the hazard? What is the infection process? What is the likelihood of susceptibility and release of pathogen? What is likelihood of exposure? After exposure what is the likelihood of being infected?

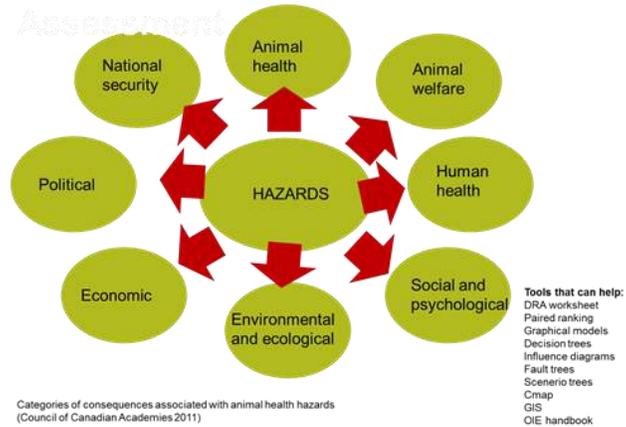
The 5 Steps of Risk Analysis:

Step 1: Timely, transparent sharing of information among risk assessors, risk managers and stakeholders (including the public). This helps the timely updating of risk assessment to appropriately respond to changes in the probability of the undesired event of interest, and the adjustment of management options. Making sure all stakeholders are fully informed of progress and given the opportunity for input as appropriate.

Step 2: Question time! 'What are the specific questions for this DRA' and 'What kind of risk analysis is needed? What is the nature of the problem? What are the management goals and decisions needed and how will the risk analysis help? What is the ecological level of concern (population, community, ecosystem)? Are there any existing policy or regulation considerations? What precedents are set by similar DRAs and previous decisions? What is the cultural and political history and current context of the problem as represented through the eyes and values of different stakeholders? What resources (e.g personnel, time, money) are needed and available? What level of risk is acceptable? What documents or data exist to describe the state of knowledge of the program?

Steps 3 and 4: Hazard identification and risk: The hazard identification step asks 'What can cause disease in the population(s) of concern? How can this happen? What is the potential range of consequences?

Step 3 and 4. Hazard ID and Risk Assessment



Release assessment – describe the biological pathways necessary for the hazard to be introduced into the area or population under consideration. List the relevant biological, ecological or geographical factors considered and the assumptions made.

STILL A RISK? Then...

Exposure assessment – describe the likelihood that the susceptible animal(s) will come into contact with the hazard in a way in which transmission may occur. Again, list the relevant biological, ecological or geographical factors considered and the assumptions made.

STILL A RISK? Then...

Consequence assessment – identify the biological, environment and economic consequences associated with the entry, establishment or spread of the hazard, together with an estimate of their likely magnitude and likelihood of occurrence.

STILL A RISK? Then...

Risk estimation – summarize above. This is a requirement before embarking on risk management strategies

Discussions:

Disease transfer in a group of wild chimps ... chimps were dying unexpectedly – why? When they sequenced samples from those dead chimps they showed it was the same as a human virus (RSV) found in Germany – brought in by a German researcher! Paper published.... We can learn from that – nice in theory, but not easy to enforce...so when we allow humans too close to wildlife - there is a high likelihood of disease transfer – foreigners need at least 10 days to 2 weeks to acclimate to the new area regardless of whoever they are – examples, vultures in India contributing to an increase in rabies, land use change in Australia affects horses (humans dying from necropsies on infected horses – Viabats, but not the bats are not at fault, the humans are)

Diagnostic Histopathology and Sampling Collecting Techniques for Clinical Correlation

Sil ViaArin Prabandari, Pusat Studi Satwa primate (PSSP),
Insitut Pertanian Bogor (IPB) Area
of specialty: macaques

Histopathology analysis is one of the ways in which to support the confirmation of a diagnosis. It involves the microscopic examination of tissue collected at the time of necropsy or biopsy. Histopathology focuses on the network architecture and provides information about the organization of cells in the network, and interactions between those networks. In most cases, histopathology becomes a definitive diagnosis that is considered a "gold standard" in diagnostic techniques. Histopathology can be used to identify:

Mass/Nodule

Inflammation → histopathology can distinguish the cause

Tumor → histopathology can determine whether the tumor is benign or malignant, as well as its type (epithelial, mesenchymal or round cell)

As a diagnostic support, care must be taken in the collection of samples, the selection of the fixative solution, packaging, and delivery; that samples are representative of the problem, that the lab and the pathologist used are reliable and can interpret reliable and quick results and that the clinic used has feedback control and accurate diagnosis, prognosis, and therapy.

Collecting, packaging and shipping of samples:

Collect from both the lesion area and the normal tissue area; collect sample randomly and not only from one area. Be sure to choose the correct fixative liquid, for example, transportation lasting more than 24 hours it is not enough to use only NaCl (sodium chloride). A good fixative solution is: 1. Neutral buffered formalin (NBF): 10%, 2. Formalin: 10%, 3. Alcohol: 70%.

Size of sample should be 1X1 cm with a depth of 0.5 cm. Cut on targeted lesion, do not send a large cut area.

If it is a heart, and if all is infected, pack with a sterile gauze and place in a container with fixative liquid. The sample must be wet from the fixative liquid (does not have to be a lot of liquid as long as the sample is wet). Fixative liquid should ideally be 1:10 (organ:liquid). Options for container are using plastic clips and packing with more than two layers: 1st gauze, 2nd plastic clips/container, box for shipping.

Discussion:

Is there a recommended courier? Any courier in Indonesia should be able to send the sample. Are permits needed to send the sample? Yes, you must get permit/letter (SATS-DN) from KSDA. In Nyaru Menteng, to process SATS-DN it is relatively easy and it is valid for 3 days. At present, it is difficult to buy formalin in Indonesia. In North Sumatera if someone wants to buy formalin they need to attach a STRV (veterinarian registration letter). In Nyaru Menteng, they can get formalin from one pharmacy which is Kimia Farma (Gov't pharmacy). How long does it take for PSSP to process the sample? Ten working days from when the sample is received. If the sample is an entire cadaver, that would need 22 working days to process. Samples for biopsy, how should those be packed? Similar with organ sample packing. An alternative to formalin is paraformaldehyde. Paraformaldehyde is a powder, and can be diluted to 4%. When using sterile gauze, there is no effect on the tissue histopathology results? The aim of using sterile gauze is to keep the tissue wet from the fixative liquid and does not cause tissue damage (no effect on histopathology result). There is no difference in results, even if using a different fixative liquid. How long until the tissue is still able to be processed (no decomposition yet)? For fresh organs, around 4-8 hours, more than that, the tissue will begin to decompose. When sending a brain sample, should the whole brain be sent? No - only the area that has lesion/abnormality: this reduces the chance of checking the wrong target area. Ideal ratio of organ and fixative liquid is 1: 10. However, if the ratio is not exact, it is still okay, no difference in the penetration of formalin into tissue. Once in the fixative liquid the sample can be stored for years. Is it okay to use diluted 37% formalin to 10% using NaCl fisiologis? Not known as I have never tried it. Suggestion: instead of using aquabidest, use aquades. If there is no fixative liquid available yet, the sample can be stored at 4 degree celsius, but not for more than 24 hours. Additional info: formaldehyde 37% is equal to formalin 100% -- so when diluted formaldehyde you need to remember that it is equal to 100% formalin. Additional info: cut the sample to 2 cm and later the laboratory can further process it. Do not cut in large sizes. Additional info: Always have organ sample in reserve in case there is a need for further investigation or if sample is lost or damaged during transportation.

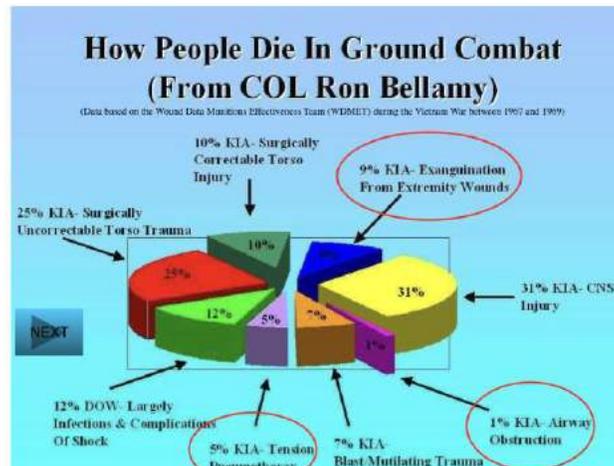
Hemorrhage Control In The Austere Environment

Chris Cousar (PA-C, TP-C, DMT, FSWM)

Abstract

It has been demonstrated, in the Global War on Terror, that massive hemorrhage is the primary cause of preventable death on the battlefield. This concept is currently used in civilian trauma care as well. Commercial tourniquets, hemostatic gauze, and Damage Control Resuscitation is becoming commonplace in civilian trauma care. As such, the first priority in providing trauma care in an austere environment, is controlling massive hemorrhage and preventing the increased morbidity and mortality associated with hemorrhagic shock.

Whether in a jungle or a city, the treatment for massive hemorrhage is the same. Here in Southeast Asia, there can be jungle trekking, darting, etc., so there is a high potential for trauma cases. Whether looking at for example, the Boston marathon bombing or the Viet Nam War or the wars in Iran and Iraq, many injuries (amputations, death from bleeding out, air way obstructions, pneumothorax injuries) are the same and require the same treatment. Proper emergency trauma care is crucial to victim survival. Col. Ron Bellamy once said... "90% of combat deaths occur on the battlefield before the casualty ever reaches a medical treatment facility."



Also, whether looking at humans or great apes, wilderness medicine is very applicable to the above as deaths can be preventable. Orangutans have a lot of surface area with extremities which makes them susceptible to injuries similar to humans and similar trauma and treatment.

Massive hemorrhaging can be fixed in a field setting, but an understanding of the processes is required.

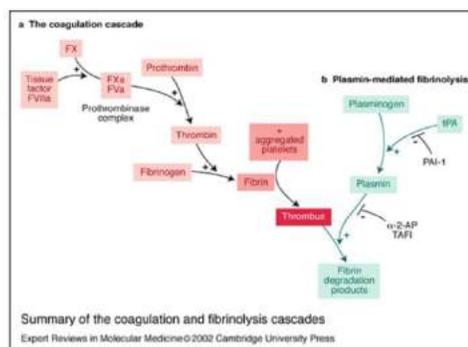
First, hemostasis – blood normally flows unimpeded through intact endothelial blood vessel walls. If a wall becomes damaged, a fast, localized, controlled response tries to stop the bleeding.

There are three phases of hemostasis:

1. Vascular spasm and retraction
2. Platelet plug formation
3. Coagulation

This is followed by fibrinolysis. As clots are forming, they are also breaking down. Vascular spasms are greater with amputation than a small cut!

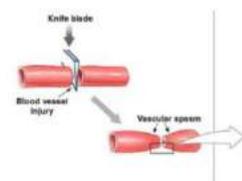
Fibrinolysis



1. Vascular Spasm and Retraction

Stimuli cause vasospasm:

1. Direct injury to smooth muscle
2. Chemicals released by endothelial cells & platelets
3. Reflexes initiated by local pain receptors



Spasm becomes more efficient with increased tissue damage.

airway), **R**espiration (decompress suspected tension pneumothorax and support ventilation/oxygenation as required), **C**irculation (establish IV/IO access and administer fluids as required to treat shock), and, **H**ead injury/hypothermia (prevent/treat hypotension and hypoxia to prevent worsening of traumatic brain injury and prevent/treat hypothermia). But, if there is only one thing you can do for a casualty, – stop him from bleeding to death and do it as quickly as possible for if there is a slice of the femoral artery, the casualty will be dead in three minutes.

When is bleeding life – threatening? If there is pulsatile or steady bleeding from the wound; blood is pooling on the ground; the overlying clothes are soaked with blood; bandages or makeshift bandages used to cover the wound are ineffective and steadily becoming soaked with blood; there is a traumatic amputation of the arm or leg; there was prior bleeding, and the patient is now in shock (unconscious, confused, pale).

Where a tourniquet can be applied, it is the *first* choice for control of life-threatening extremity hemorrhage. A tourniquet is applied before the spasming stops and applied without delay! Apply the tourniquet without removing clothing – make sure it is clearly proximal to the bleeding site. If you are uncertain about exactly where the major bleeding site is on the extremity (night operations, multiple wounds), apply the tourniquet “high and tight” (as proximal as possible) on the arm or leg. The tourniquet needs to be above the wound as high as you can. Tighten it until the bleeding stops –make sure it is tight so there is no blood flow to the extremities. If one does not work, use another.

Following are various steps for applying a one handed and two handed tourniquet.



Combat Application Tourniquet

GEN 7



Instructions for One-Handed Application

Courtesy of North American Rescue



1



Step 1

Insert the injured limb through the loop in the band and position tourniquet 2-3" above the bleeding site. If the most proximal bleeding site is not readily identifiable, place the tourniquet as high as possible on the limb.



2



Step 2

Pull band **TIGHTLY** and fasten it back on itself all the way around the limb, but not over the rod clips. Band should be tight enough that tips of three (3) fingers cannot be slid between the band and the limb. If the tips of three (3) fingers slide under band, retighten and re-secure.



3



Step 3

Twist the rod until bleeding has stopped.



4



Step 4

Snap the rod inside a clip to lock it in place. **Check for bleeding and distal pulse.** If bleeding is not controlled, or distal pulse is present, consider more tightening or applying a second tourniquet above and side-by-side to the first. Reassess.



5



Step 5

Route the band over the rod and between the clips. Secure with the grey securing strap. Record time of application.



Combat Application Tourniquet

GEN 7



Instructions for Two-Handed Application

Courtesy of North American Rescue



1



Step 1

Route the band around the limb, pass the red tip through the slit of the buckle, and position tourniquet 2-3" above the bleeding site. If the most proximal bleeding site is not readily identifiable, place the tourniquet as high as possible on the limb.



2



Step 2

Pull band **TIGHTLY** and fasten it back on itself all the way around the limb, but not over the rod clips. Band should be tight enough that tips of three (3) fingers cannot be slid between the band and the limb. If the tips of three (3) fingers slide under band, retighten and re-secure.



3



Step 3

Twist the rod until bleeding has stopped.



4



Step 4

Snap the rod inside a clip to lock it in place. **Check for bleeding and distal pulse.** If bleeding is not controlled, or distal pulse is present, consider more tightening or applying a second tourniquet above and side-by-side to the first. Reassess.



5



Step 5

Route the band over the rod and between the clips. Secure with the grey securing strap. Record time of application.

There is a better survival rate if tourniquet is applied before person goes into shock as that increases mortality. No amputations were caused by tourniquet use and it is not true that you may lose the limb with a tourniquet. However, it should be used only for severe bleeding.

It needs to be tight! Yes, it can be painful but it still needs to be tight. Tighten until it can no longer be turned. Ketamine can be used for tourniquet pain (20 ml is typical for humans). If individual is in shock, morphine cannot be used as it lowers blood pressure. Ketamine raises blood pressure which is good for shock victims. Damage to limbs is rare if it is on for two hours. If the tourniquet is needed four to six hours, that may be okay or possibly not okay. After six hours or more, leave it on and think about amputation. If the two hour mark is reached, slowly loosen and check blood flow. If there is still bleeding, leave it on. Do not wait too long to apply, as you must stop the blood with the tourniquet. Swelling will happen. After ANY tourniquet application, monitor the casualty closely to ensure that the tourniquet remains tight and that bleeding remains controlled. It is very important to reassess – reassess- reassess!

Tourniquet mistakes to avoid:

Not using one when you should / Using a tourniquet for minimal bleeding / Putting it on too proximally if the bleeding site is clearly visible / Not taking it off when indicated / Taking it off when the casualty is in shock or has only a short

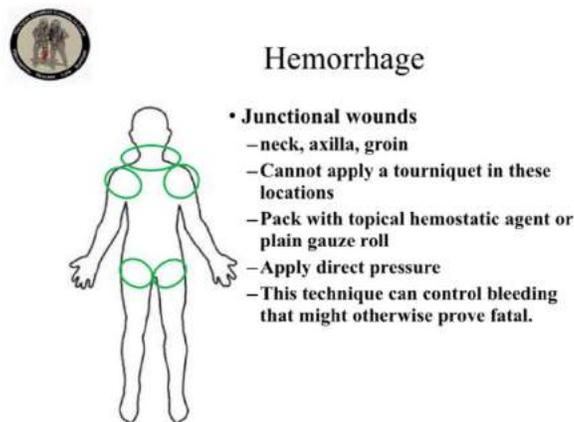
transport time to the hospital / Not making it tight enough – the tourniquet should both stop the bleeding AND eliminate the distal pulse / Not using a second tourniquet if needed / Waiting too long to put the tourniquet on / Periodically loosening the tourniquet to allow blood flow to the injured extremity

Tourniquet points to remember:

Damage to the arm or leg is rare if the tourniquet is left on for less than two hours / Tourniquets are often left in place for several hours during surgical procedures / In the face of massive extremity hemorrhage, it is better to accept the small risk of damage to the limb than to have a casualty bleed to death / Tightening the tourniquet enough to eliminate the distal pulse will help to ensure that all bleeding is stopped, and that there will be no damage to the extremity from blood entering the extremity but not being able to get out / Every effort should be made to convert tourniquets in less than 2 hours if bleeding can be controlled with other means / If bleeding remains controlled with Combat Gauze, leave the loosened tourniquet in place / If the bleeding is not controlled with Combat Gauze, re-tighten the tourniquet until bleeding stops / Restoring blood flow to the limb by transitioning to Combat Gauze at the 2-hour mark will minimize the chance of ischemic damage due to the tourniquet

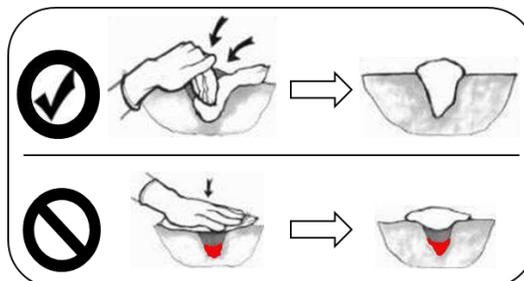
Do not attempt to remove the tourniquet if: The casualty is in shock / You cannot closely monitor the wound for re-bleeding / The extremity distal to the tourniquet has been traumatically amputated / The tourniquet has been on for more than 6 hours / The casualty will arrive at a medical treatment facility within 2 hours after time of application / Tactical or medical considerations make transition to other hemorrhage control methods inadvisable

If wound is not in an extremity, a tourniquet is not an option, (for example, at the neck) but there are other ways to control the bleeding with the use of a hemostatic dressing.



Examples of hemostatic dressings are: Combat Gauze, Celox Gauze, and Chito Gauze. Combat gauze contains kaolin which jump starts the coagulation, but it is really the direct pressure that does the same with standard gauze with firm direct pressure. Celox and Chito gauze contain crustacean particles which activates coagulation.

With gauze, identify the wound and source of bleeding, take gauze and pack it into the wound, directly into the bleed, and apply pressure - it will stop (more than one gauze can be used if needed). Once bleeding stops, maintain dressing in place. Do not remove it. Combat Gauze may be re-packed or adjusted in the wound to ensure proper placement. Reassess frequently to monitor for recurrent bleeding. Transport casualty to next level of medical care as soon as possible.



Health Screening for Staff and Visitors: How to create a workable program

Yenny Jaya (OVAG, SOCP), **Steve Unwin** (OVAG, Chester Zoo, IUCN)

Background reading. Pg 11-16, and the OVAG/ PASA disease risk analysis workbook (2015):



Health policies in Indonesia are quite strong.

1. Problem Description

- a. Pathogen spread from human to orangutans is increasing and guidance is required on how to mitigate this.

Assumptions:

- a. Knowledge of diseases of concern and routes of transmission
- b. Knowledge of exposure likelihood
- c. Confirmation that staff are trained
- d. Understanding of social and legal aspects of staff and visitor health

Sample scenario: There are approximately three visits per week from local communities; these include community members, military and school children with up to 20 people per group. These visits are considered important for community engagement in the project and for conservation. The visitors can view the orangutans from a fence line platform at lunchtime (the time when orangutans are let back into the forest enclosure). Visitors wear (washable and reusable) masks and are requested to be quiet. The masks are not really necessary as visitors should not come within 10 meters of the orangutans (Macfie & Williamson 2010), but it is a good idea to use them as it facilitates understanding of disease transmission as long as the masks are handled and stored appropriately, and disinfected each time they are used. Depending on how long orangutans stay at the periphery of the forest enclosure, viewing is likely limited. From time to time, perhaps three times per year, small groups of international tourists are flown in by helicopter to the centre. They are taken to the local community for cultural exposure, and then go to the centre to observe the orangutans at the same platform as local community members. Due to a recent security incident the centre is in the process of building a landing site for a helicopter close to the main entrance of the centre.

2. Communication: staff training

- a. Personal hygiene and general biosecurity
- b. Regular discussions on disease risk and pathogen specific information sheets
- c. Engaging with local health authorities
- d. Importance of a work place health plan

What happens if your staff gets sick? You must know what the legal regulations are in your country. In Indonesia, the legalities involving aspects of the workplace are: regarding sick pay, the employers must pay full wages for the first four months of sickness absence, 75% for the fifth to eighth month and 25% for any remaining period of absence prior to termination of employment; regarding ill-health dismissals, the employers cannot consider dismissing an employee for absence from work due to illness if the length of the absence is under 12 consecutive months. (From <http://www.personneltoday.com/hr/employment-law-indonesia-10-key-facts/>).

Indonesia: Health and Safety:

Employers are required to protect employees' welfare, safety and health, and employees are entitled to protection of their occupational health and safety.

Employers and managers have a range of specific statutory health and safety obligations.

A joint employer-employee health and safety committee must be set up in all workplaces employing 100 or more employees, and in workplaces with fewer than 100 employees that use potentially dangerous materials, processes or installations.

The Directorate General of Labour Inspection within the Ministry of Manpower and Transmigration is responsible for monitoring and enforcing compliance with health and safety legislation, and may impose various sanctions.

Employers must enrol employees in a statutory occupational accident and illness insurance scheme and pay contributions to the scheme.

(From: http://www.xperthr.co.uk/international-manual/indonesia-health-and-safety/155684/?cmpid=ILC|PROF|HRPIO-2013-110-XHR_free_content_links|ptod_article&sfid=701w0000000uNMa)

3. Assess: Pathogens of concern Tier 1

Tuberculosis / Hepatitis / Respiratory viruses / Pathogenic enteric bacteria / Pathogenic enteric parasites

Assess: Pathogens of concern Tier 2

What pathogens are in your local area in people? What is in your orangutan that has either been confirmed or likely from a human source? What is in the area where our visitors are coming from?

Assess: Non infectious diseases:

Diabetes and cancer / Lung function testing / Physical trauma – backs and lifting, animal bites, attacks / What are workers being exposed to?

Other risk factors pertaining to human health: Immunocompromised/suppression, exposure to animals that are infected with zoonotic infections and open transmission pathways

Assess: Base testing on risk in your area – likelihood and consequence: Who? Center staff, park personnel, tourists, researchers, veterinarians, film crews, journalists? Zero risk? Precautionary Principle?

Great ape tourism and research sites, where people spend considerable time in close proximity to wild animals, create opportunities for human-to-great ape disease transmission. Visitors travel from all areas of the world. They will have spent hours in enclosed spaces (airplanes) and in transit (airports), and will have been exposed to thousands of other travellers and their pathogens. Upon arrival in great ape range countries, visitors may be further exposed to additional pathogens through interaction with local people and animals. Their own susceptibility to becoming ill may be enhanced by the fatigue and stress of travel, changes in diet or climate, and the novelty of pathogens to which they are exposed. These individuals often have their first ape encounter within 72 hours of leaving their homes. Furthermore, in some regions, it is not uncommon for tourists to visit great apes at several sites in succession, or to visit a bat cave, a school, an orphanage, or a community with livestock or other animals that are a potential source of disease. Thus, tourists may inadvertently transport pathogens into great ape habitat, or from one ape group to another.

Given the worrying conservation status of great apes worldwide and the fact that disease outbreaks in small populations can be catastrophic, applying the **precautionary principle** to recommended best practice for great ape health is warranted. Thus, in the absence of scientific evidence that a disease agent or human action or policy is or is not harmful to great apes, it is safest to assume that such agents or actions do pose a health risk until scientifically proven otherwise. The following best practices, designed to minimise the risk of human-to-great ape disease transmission, should be applied and adhered to at all great ape sites where people (PAA personnel and visitors) are coming into close proximity to great apes.

4. Manage: How? Frequency? Both dependent upon likelihood of exposure.
Employee health program – what to ask/ test for?/When to test?
<https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html>

Animals – common ones seen include:

- TB – intradermal testing on arrival and every 2 years
- Hepatitis on arrival and every 2 years
- Enteric pathogens - every 3 months
- Respiratory pathogens - every 3 months

Summary

Describe what the human health risk you are dealing with

Confirm and contact who you as management need to be communicating with (local health authority, staff representation etc.

Assess what are the health hazards for your site (both general and specific) and the requirements you have under Indonesian law

Draw up a plan based on the items in numbers 1 through 3 above, including:

Diseases of concern

Communication matrix between managers, vets and general staff

Surveillance: New zoonotic disease identified (Health authority/ Vet)

Disease fact sheet produced by Vet staff

Hygiene and biosecurity measures that are reviewed and updated as needed (Manager and Vet)

Staff communication is handled verbally and with fact sheets (Health authority/ Vet/ Manager)

Confirmation of review of disease surveillance

Regulations concerning animal welfare in Indonesia (From: <http://www.isaw.or.id/sample-page/regulations-concerning-animal-welfare-in-indonesia/>)

Indonesia's Criminal Code prohibits intentionally causing an animal unnecessary harm. Law 18 of 2009 also addresses animal welfare, requiring that measures are taken in the interest of animal welfare in relation to capture, husbandry, slaughter, and transport. The provisions apply to vertebrates and some invertebrates capable of feeling pain. This law refers to animals as industrial products, and appears to be focused on the health and productivity of animals as property rather than on the prevention of animal cruelty.

The anti-cruelty provisions of the Criminal Code apply to farm animals. Livestock transportation and slaughter are to be conducted so that animals are free from fear, pressure, and torture. Law 18 of 2009 also applies to farm animals, providing that animals' needs for feed and health be met, and that killing be done according to certain health, safety, and welfare guidelines. Secondary legislation passed in 2012 requires that animal suffering be reduced at slaughter, that animals be afforded the Five Freedoms, and that those involved in animal use "have competence in the field of animal welfare".

The duty of care and anti-cruelty provisions also apply to animals used in research, but there is no legislation specifically regulating animal testing.

Example from SOCP Visitor health requirements: Based on both SOCP and Indonesia government regulations. Health screening must be completed and sent to SOCP two weeks prior to a proposed visit, Visitors must wear a face mask and there is NO CONTACT with orangutans. Long term visitors need vaccinations appropriate for the area and heavily recommended are Hepatitis B, tetanus, and rabies.

There needs to be consensus between centers so that visitor rules are the same throughout them all. There are many cases of foreign visitors jumping from center to center, going to wherever they can get better access. That

should not be allowed to continue. If rules and criteria are the same throughout the centers, then the rules would be easier to enforce and visitors would be also forced to follow them, whichever center they are visiting.

Discussion:

News crews are the worst and woo centers with money. This is not helpful as it reduces your standards. Too much misinformation can be triggered by such visitors. Sometimes you have to turn people away. Sometimes there are cases where volunteers pay to come in to be volunteers. Regulations still need to be enforced. People think paying entitles them to contact. Foreign visitors are not the only challenge, but government officials also can be the cause of violation of rules. But if there is consistency throughout, then there is a better chance of enforcement – though it can be difficult. Sepilok has been trying to enforce stronger guidelines for visitors. We must have one voice and approach at the government level for clear regulations that we can use to enforce those regulations but we must all be speaking as one.

Point person: Yenny will collect written protocols from the various centers so OVAG can put something together as an OVAG approved statement for protocols for visitors.

Medical Supply Auction at 7:00 pm (enter photos)

Day Two July 24, 2017

Distribution of Efficacy of IUCN Guidelines (**Dr. Susan Cheyne** Questionnaire) in Bahasa and English to be returned by end of workshop.

Field Sample Collection

Steve Unwin (OVAG, Chester Zoo, IUCN)

When collecting field samples for analyses, always take multiple samples (aliquots) as samples can get lost or damaged. Taking consistently analyzed samples can often give a good history should you need to trace anything back through time for a particular disease. Even decomposed animals can be used to collect samples from. Recently a new anthrax strain was found in a dead chimpanzee using PCR from a partially decomposed chimp.

A useful book to have available for vet staff is: Field and Laboratory Methods in Primatology: A Practical Guide, edited by Joanna M. Setchell and Deborah J. Curtis published by Cambridge University Press.

Tissue samples can be:

1. Frozen: however, the cold chain must be maintained (cannot be thawed and re-frozen).
2. Stored in RNAlater where the cold chain can be interrupted or it can be stored at room temperature for weeks to months (though it is expensive). Again, always preserve several aliquots.

RNAlater is used mainly for PCR (viruses, bacteria). PCR techniques for parasites are still being developed. Recommended is 10% of buffered formalin for histopathology using saline or distilled water. For preservation and storage of RNAlater: Mix sample well, store preserved samples at room temperature for up to 7 days without degrading sample or freeze at 4 degrees C for 24 hours or longer if needed. Transporting samples at room temperature is acceptable.

For post mortems, sample as many organs as possible, but always try to get at least samples of blood rich organs: spleen, lung, liver, lymph nodes, heart (blood), as these are sufficient to diagnose many pathogens using PCR. There is more information regarding post mortems in the Post mortem Program in the 'What to do in a disease outbreak' folder already on the Google Drive site for OVAG.

Blood samples:

1. Can also be frozen but the cold chain must be maintained for whole blood, buffy coat, serum.
2. Blood samples can also be dried (using Guthrie filter paper for example) and must be kept and stored dry on silica gel (or similar substance). When drying blood smears or samples in a field setting, be careful of flies!!!

3. Blood can also be stored in RNAlater, where again, the cold chain can withstand being interrupted. Again, also save several aliquots.

Analyses: PCR (viruses, bacteria, blood parasites). Serology. For microscopy (blood parasites, hematology): blood smears.

Swab samples (nose, throat):

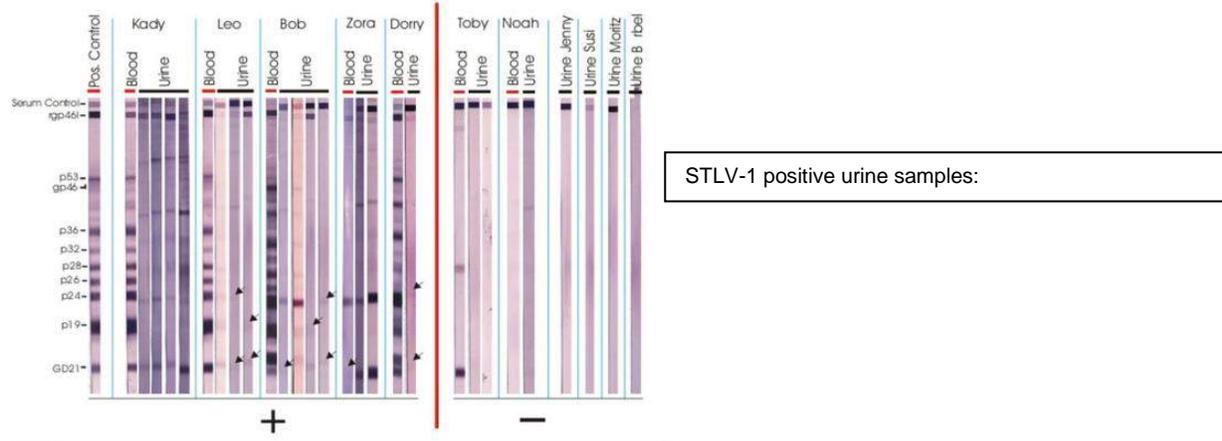
1. Can also be frozen but cold chain must be maintained
2. *RNAlater* can also be used (1:2 mix/shake well) and again always in several aliquots.

Analyses: PCR (mainly respiratory viruses, bacteria, parasites). For bacterial cultures various special media can be used (ex. STGG).

Urine samples

1. Can be kept frozen in something like liquid nitrogen but the cold chain must be maintained
2. Dried (Guthrie filter paper) saving several aliquots.

Analyses: PCR (viruses, bacteria, (parasites)). Antibody detection (ex. STLV) basic urinalysis.



Fecal samples:

1. Can also be kept frozen in liquid nitrogen but cold chain must be maintained.
2. In *RNAlater* (1:2; mix/shake well!) Always in several aliquots.

Analyses: PCR (viruses, bacteria, parasites). For coprology: e.g.10% formalin, ethanol, SAF (see information from previous presentations by Wendi Bailey on the OVAG Google Drive)

Fruit wadges:

1. Can be frozen (liquid nitrogen) but cold chain must be maintained
2. *RNAlater* can also be used and then the cold chain can be interrupted

Analyses: PCR (respiratory viruses, bacteria). For bacterial cultures: various special media.

Specific issues regarding veterinary field work:

Where do you analyze? This can be a challenge as finding a lab with the proper facilities is variable. Need to consider what their requirements for collection are, what they can cover, and what is their sensitivity and specificity. Consider labs in country as well as outside of country (if possible). You can also consider using a mix of both in country and out of country labs.

Analyses in the forest – yes it is possible! What is needed? Some cover (2 walls, concrete floor) and a generator. PCR in a suitcase? It does exist but is not yet available.

Extraction of DNA:

With a few simple bits and pieces found about the home, you can extract and have a look at DNA. The method explained below is a home-science experiment that has its basis in the 'Marmur' preparation used by biotechnology laboratories the world over. So you can do it at home safely without fear of breaking any United Nations Conventions or blowing up the kitchen.

As said, there is no real risk attached to extracting DNA at home. You *can* extract DNA from fruit and vegetables like peas, broccoli, onions and even kiwi fruit (in fact any living organism) - but human DNA extraction is probably the most fun. To extract DNA at home you will need the following:

saline solution (a glass of salty water) / a clean glass / 1 tsp (5ml) washing up liquid/detergent / 3 tsp (15ml) tap water / a clean teaspoon / a bottle of ice-cold alcohol (gin or vodka are excellent (If you don't have those available, any alcohol will do, such as rubbing alcohol) / and a decent amount of spit.

Method: Swill out your mouth with the saline solution for about 30 seconds. This is to collect the DNA contained in your saliva, and around the walls of your cheeks. You can also extract DNA from blood, hair, skin or even semen too, but the techniques for obtaining these types of samples are more difficult to do at home without more complex equipment. Spit the contents of your mouth into a glass containing a mix of three teaspoons of water and one teaspoon of washing-up liquid/detergent. You are thus (hopefully) transferring the DNA from your cheek cells into the solution. Stir this mix slowly and gently (known as mechanical agitation) for a couple of minutes. During this process it is necessary to break up tissue (in this case, cheek cells) mechanically, and then to degrade both the cell membranes and those surrounding the nuclei - releasing the DNA contained within them. Slowly pour some of the ice-cold alcohol carefully down the inside of the glass, allowing it to settle on top of the solution. DNA is insoluble in cold alcohol and while there will be a few bubbles, the other compounds in the mixture will dissolve, and the DNA will separate from the other ingredients. Leave it for about two to three minutes for this to happen. If the process has worked, you will see a spindly white substance, maybe clumps of it if you are really careful, forming on top of the salt/detergent mixture. Be patient as it will happen slowly. The resulting 'goo' the DNA.

You can then try taking the string of DNA out to investigate further. To do this a thin, long tool like a kebab skewer or firm plastic straw will do the job. Simply stick the utensil in the mess and twist it slowly, the DNA strands will wrap around it. You must do this *very* carefully as the DNA is extremely fragile. Once you have DNA strands out you can place them under a microscope. You could try staining the DNA to make it easier to look at under the microscope, or you could even test its acidity with some natural pH indicators like beetroot and red cabbage. Always make sure you dispose of the results properly.

The use of nanopores is a new technology and has been used in Ebola and Zika investigations. A nanopore is a really tiny narrow hole, developed to look at sequencing of DNA, RNA, and infectious disease investigations without using PCR. In its devices, Oxford passes an ionic current through nanopores and measures the changes in current as biological molecules pass through the nanopore or near it. The information about the change in current can be used to identify that molecule. Nanopore sequencing is a fourth generation approach used in the sequencing of biopolymers- specifically, polynucleotides in the form of DNA or RNA. Using nanopore sequencing, a single molecule of DNA or RNA can be sequenced without the need for PCR amplification or chemical labeling of the sample. Website of interest for nanopore technology: <https://www.youtube.com/watch?v=IMzNL7JmHtQ>

CPSG Disease Risk Analysis toolkit and beginners guide to RT PCR:

Serologic (antibody) Tests	Usefulness in wildlife	Sensitivity
Competitive inhibition ELISA	High	High
Protein A or G ELISA	High	Moderate
Virus neutralisation	High	Moderate
Haemagglutination inhibition	High	Moderate
Complement fixation	High	Moderate
Agar gel immunodiffusion	High	Low
Direct immunofluorescence	High	Moderate
Indirect antibody ELISA	Low	High
Indirect immunofluorescence	Low	High
Western blot	Low	Moderate

Agent or antigen detection tests	Usefulness in wildlife	Sensitivity
Taqman/real-time PCR	High	High
Bacterial or fungal culture	High	Moderate
Virus isolation	High	Moderate
Necropsy/biopsy/cytology	High	Variable
Conventional PCR for agent DNA	High*	High
Conventional PCR for agent RNA	High*	High
Direct antigen capture ELISA	Moderate	High

*If positive results confirmed

Discussion:

How about homemade RNA later? Do they work? Unknown (but we will try to find out). What should you take into the field in case you find a dead orangutan? Field pack – dry swabs (from throat), if bones are present, take shavings. If you have formalin, Guthrie or some form of filter paper you can save samples. You can also do a field post mortem. Follow primate necropsy protocol – even in the field. Make sure you are protected! In the field, it might be useful to dig a hole near the body so the ground acts as a table – take your samples, then when done use the hole to bury the body.

Orangutan Behavioral Rehabilitation For Reintroduction: Best Practices Recommendations

Anne Russon (Orangutan Kutai Project, Taman Nasional Kutai, and York University, Toronto Canada)

Abstract

Presentation will offer recommendations on best practices for rehabilitating ex-captive orangutans for reintroduction to free forest life. The emphasis will be behavioral rehabilitation, the most time-consuming and complicated facet of rehabilitation. Recommendations are based on studies of rehabilitants' behavior pre- and post- release to forest life, including my own 20+ years research. First, the challenges that orangutans face in the wild (ecological and social pressures, developmental constraints) and the additional difficulties that rehabilitants face due to early life in captivity and in rehabilitation (distorted sociality and learning, notably human orientation). Second, based on these considerations, recommendations for ecological and social rehabilitation programs that best generate the knowledge and skills that ex-captives need for successful free forest life and that best limit their chances of conflicts with humans once free.

Orangutan rehabilitation is the longest running rehabilitation program – so there has been a lot from which to learn from over 50 years. The orangutan rehabilitation survival rate has been about 40%, but the data has been very weak. The important issues to consider are:

Survival: How long are they surviving?

Post-release: Limited tracking/care of released individuals

Release Failures: Often due to poor learning/effective behaviors

Behavior of Rehabilitated: Ecological (“easy”) & Social (hard) Ecological behaviors are easier to learn than social behaviors

Pre-release training: Limited effectiveness

Humanization: Too adapted to humans. The major problem being it is hard to reverse!

Why de-humanize? Humans are the main threat to orangutans, so over habituation to humans must be considered. Not doing so leads to

1. Over habituation: lose fear/wariness of humans. Released orangutans do not avoid humans but rather approach, and possibly attack them.
2. Blurred species identity: Orangutans treat humans as orangutans; they learn to act like humans in regards to sex, they chase outsiders; sleep in beds, raid kitchens, etc.
3. Knowledge of human resources/objects: Orangutans become crop raiders, stealing and using human items causing injury, disease transfer, and even death.

Our target – orangutans must be able to mimic wild orangutan behavior: feeding, travel, rest, social and more. At various wild sites, orangutans eat from several hundred different items. They must know how to find it, attain it, prepare or process the foods using mouths, hands, feet and tools which requires skill and practice. Feeding is very complex as some food items are seasonal and difficult to find.

Travel – Orangutan home ranges vary between males and females. A female’s home range is 3-8+ km², with males having a larger area. An orangutan must know, where-how-when to establish a range and how and when to use it. Daily travel can be between 200 meters to 2 km, using both arboreal and terrestrial methods. They must be able to navigate the forest as well as understand social routes, find mates and be able to improvise as they go. They must navigate the social world as well as the physical one.

Rest – Learning the complexities of nest making: making a basic nest, a complex nest, which trees work well, how big, where, what position in the tree, when? Night nest making: build before it gets dark. The multiple uses of nests: as a place to have sex, to hide, gain protection from the rain, a place to play, to lie in.

Social – Identifying relatives (maternal), friends, allies, and competitors, outsiders such as non-kin or transients. Learning how to communicate using vocalizations and gestures; needed social skills for mating: how to find a mate, how to avoid undesired mates, how to operate in a consortship. How to parent: feeding, carrying, caring for and teaching offspring.

Predators – How to identify them, how to detect them, what is a safe response (including humans).

Self-medicating - How do you self-medicate; which plants? How should they be used? When should they be used?

Another issue that needs to be considered is that here is a lot of variation between orangutans, such as coloration, genetics, and biology; and if their biology is different so is their behavior. There are two to three species, with 3 subspecies genetically. Their life stages, growth capacities, interests, and skills are varied. Size variations are from 2 kg to 120+ kg, living to 50+ years. Their habitat varied from forest type to food species consumed to productivity. Locations also vary dependent upon seasons and human presence. There is a vast amount of variation in the challenges orangutans face in their lives and what they need to know in order to survive. How they succeed in the wild is determined by their capacity to learn and continue learning as orangutans have little to go on instinctively.

Wild learning: food knowledge, skills regarding locomotion, and problem solving. There is independent learning (trial and error learning on your own) and social learning (from mother, sibling) by use of co-feeding, as orangutans learn by imitation.

Wild Learning chart:

STAGE	QUALITY	LEARNING
Infant 0 - 4/6	dependent * growing-learning	Basic diet/feed - travel - kin, nest
Juvenile 4/6 - 7/9	semi independent * learning	feed - travel - nest - socialize, explore & play (Male established range)
Adolescent 7/9 - 15+	independent * social	Female establishes own range. Males roam. sex & competition

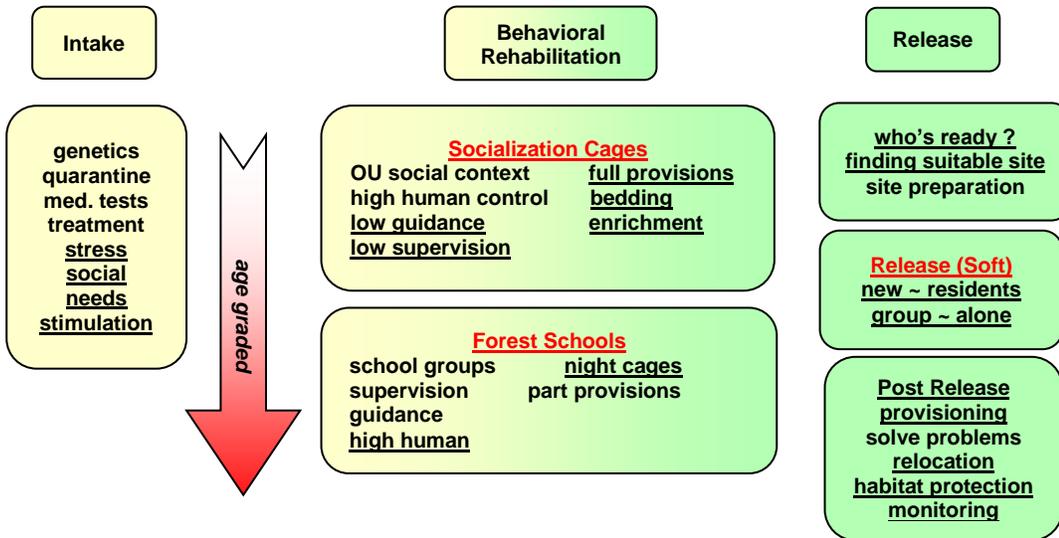
Review of behavior rehabilitation methods:

Direct release: learning is too hard with no local ecological knowledge, no local social network, leading to stress, injury, and lost – not a good option and can be dangerous.

Socialization cages: minimal and leads to wrong ecological learning, distorted social learning, boredom, and social stress. Encourages an increased focus on humans as they are 100% dependent on humans and as a result is ineffective.

Forest schools: controlled learning but limited, basic (grade school – SD) ecological learning, learner social network but dependent on others and what they may have to offer, with controlled human contact which may not be ideal but offers the best chance of getting orangutans to learn.

Programs all 3 methods:



Forest School Recommendations:

Forest: protected area, similar to eventual release area, there must be 100% control over access (no locals, no visitors). No human food should be allowed in the forest school area, with minimal facilities (protective caging, storage, handling for provisions and waste, and staff needs). These should all be invisible and inaccessible to free orangutans.

Program: orangutans should be in small groups and age-graded. Orangutans should spend all day in forest with the Forest School team (to guide and supervise) as they learn to forage, travel, learn arboreality techniques, nest making, and socializing. There should be daily formal monitoring. As needed at post: provisions, sleeping accommodations. NO VISTORS.

The focus needs to be on learning:

Forest: assist, guide, supervise, teach? Feeding, nesting, travelling, arboreality (✓)

Sociality: encourage, support, supervise, mediate (✓✓)

Humans: are caregivers, but then they need to begin to separate and help orangutans become more independent. Be the police: stop fights, encourage avoidance of humans and staying away from humans (✓✓✓)

Age-graded chart:

Infant-1 (0 – 2)	pro-active care: lead the way teach - guide – support – affection, ASAP!!
Infant-2 (2 – 4/6)	responsive care: help on need/request monitor – support – foster orangutan focus
Juvenile (4/6 – 7/9)	foster independence: help on need monitor – mediate if needed
Adolesc (?) (7/9 – 11/13)	avoid interaction: police as needed monitor – dominate – mediate

ALL: avoid humans: people – area, food things

Humans working with orangutans must learn as well: staff must learn about the forest foods in the Forest School area so they can show orangutans; staff must guide them and help them establish knowledge of the area (travelling); staff should encourage social learning and social activities. They should police activities but pull away as needed.

For orangutans in most forest schools there are some that know more than others and they can teach others (forest skilled vs. more naïve individuals). This is similar to older - younger sibling relationships as they are willing to learn from each other, offering opportunities, monitoring or supervising them.

Learning to de-humanize is a difficult challenge as eliminating all human contact is not feasible since rehabilitation is an entirely human dependent process with health, food, housing, training and management all provided by humans. As most orangutans received at centers are Infants and young juveniles, they need someone to take care of them taking the place of a mother who they rely upon for survival and the learning of foods and travel. Juveniles are semi-independent and still need some maternal guidance. As the biological mother is killed to gain the infant, humans must fill this role while managing to provide support and then managing withdrawal. This is a very difficult and delicate balance.

The de-humanizing framework:

Relationships: Participants' interaction patterns (expectations, behaviors) generated by their interaction history

Relevance: Primate social systems are characterized by long-term inter-individual relationships (parent-offspring, kin, dominance, mating partners, allies)

Individualized: There is an interaction history with specific individuals, e.g. mother-infant, maternal kin, friend, mating partner, and/or ally. Mother-infant relationship is strongest as it involves attachment.

Generalized: There is an interaction history with a given 'class' of individuals e.g., members of other groups (outsiders, newcomers, transients, females from other kin clusters).

Attachment is the social bond between an infant and the primary caregiver (a more capable, protective individual – typically the mother). Attachment evolved to promote infant survival. In primates, it is fundamental to normal infant development. Deprivation causes severe irreversible abnormalities. Ape and human attachment behaviors are comparable.

Relationships	Wild orangutans
attachment	mother
individualized (other)	maternal kin residents
generalized	transients

Relationships	Rehabilitant orangutans	
	orangutans	humans
attachment	s-mother	s-mother
individualized (other)	groupmates	other s-mother? "The Vet" regular staff
generalized	new arrivals orangutans from other groups	occasional visitors (office staff, media, tourists)

Substitute mother	Human	O-peer
more competent, protective	++	
infant-environment mediator	++	
feed	++	
interpret & manage situations – emotions – reactions	++	+
guide learning	+	++
24-7		++
re-orient to orangutans	+	++
daily forest companion	+	++

These are Complementary with both in balance

Individualized relationships with humans: forest school staff have history, are skilled, attentive, familiar and are there for the long term.

Orangutan-experienced	<ul style="list-style-type: none"> skilled, attentive relationship-based interactions
Presence & interest: long-term, regular	<ul style="list-style-type: none"> familiarity vs. novelty draw experience consequences
Agenda with rehab orangutans	<ul style="list-style-type: none"> relatively appropriate behavior
Front-line	<ul style="list-style-type: none"> local people, dedicated training: limited, practical, on-the-job wild OU behavior: limited knowledge supervision: limited choices: personal experience/views 'job', go home

Generalized relationship with humans: Visitors

Orangutans are naïve	careless and inattentive
Presence and interest is transient	novel and fun – draw the orangutans attention and ignore the consequences,
agenda with rehab orangutans is personal rather than rehabilitation	Inappropriate behavior, seeking close encounters, offering food, forgetting or ignoring rules – always a negative impact on the orangutans

Ex-captives get human food/objects → associate humans and food → attracted to humans → improve human manipulation skills → contact, aggression, wounds, infectious disease ** volume/frequency related **

Humanizing influences chart:

Relationships	Pros-cons	Solution
Generalized	<ul style="list-style-type: none"> major problems not needed hard to predict hard to manage 	<ul style="list-style-type: none"> minimize <u>not</u> with release-eligible rehabilitants <u>only</u> non-releaseable, very tight controls
Individualized	<ul style="list-style-type: none"> problems needed predictable <u>can be managed</u> 	<ul style="list-style-type: none"> essential only few, dedicated gradual 'weaning' better training better supervision

Recommendations

Forest School Teams: small, “dedicated” group (mothers, guards, vets). Individualized relationships with orangutans

- a) “*Mothers*” (attachment, young women): responsive → gradual ‘wean’ ~ 4-6 yr. foster orangutan vs. human interaction
- b) *Guards*: police problems (men)
- c) *Supervisor(s)*: knowledgeable (wild OUs, ex-captives, rehabilitation), regular, corrective,

Trained formally on wild orangutan behavior, rehabilitation aims, managing ex-captives (nb problems) and monitoring: regular formal observations and review

Conclusion: Forest schools are “BBS” – the best of a bad situation: Not cure-alls, and not easy to achieve. When/where forest schools are well-managed, especially regarding social relationships, ex-captives make excellent progress. Forest schools are better than other alternatives.

New book on primate introductions: www.drbenjaminbeck.com

Discussion:

Should rehab orangutans be released with wild orangutans? Too much conflict can occur between the individuals – not a good idea from both perspectives. Sometimes, humans dump animals in an area where there are wild orangutans, sometimes they can get lucky – but it is not something to promote. How can human contact be managed at a release site? Relationships are for life (long term relationships and memories). Humans need to keep pulling back and keep the post far away from orangutans. There should not be a Viable population of orangutans and make sure release forests are appropriate. What can human foods be replaced with? Try using foods that are not locally available. Give them lots of leaves. Adults should already know, learning is no longer their main priority – youngsters are better learners – as that is their main job – learning. Once orangutans learn easy food is available at human settlements, it is very hard to unlearn that knowledge. Once they learn about a human village, they will typically find their way back – even if they get hurt when they go back! Try sending them to a new area where humans are farther away.

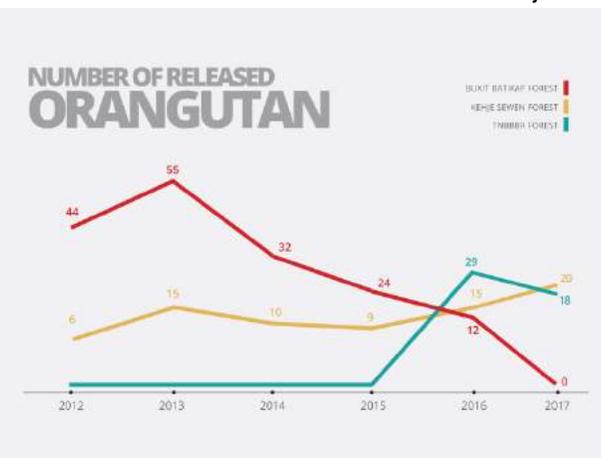
Release Management - Borneo Orangutan Survival Foundation (BOSF)

Jamartin Shiite, CEO, BOSF

BOSF received the Brand of the Year award.

BOSF has two rehabilitation centers: Samoboja Lestari (which currently has 180 orangutans needing to be released) and Nyaru Menteng (which has 400+ orangutans needing to be released). BOSF maintains that you can release rehabilitated orangutans in an area where there are wild orangutans if the wild orangutan population is less than .01 per meters square – 0.03 currently.

Orangutans are not released without health tests. All people working in the forest with orangutans need to be free from disease as well. The current release sites for BOSF are Batikap Conservation Forest and Bukit Baka Bukit Raya National Park in Central Kalimantan and Kehje Sewen Forest in East Kalimantan.



Number of orangutans released:

Batikap: 167

Bukit Baka Bukit Raya National Park: 47

Kehje Sewen Forest: 75

Must have post release monitoring to ensure survival.

After release – health condition of orangutans is monitored upon arrival and every day for two months with a vet.

Long term data is not equal as weaker ones are monitored more intensively. Typically: Focal Animal Sampling (every 2 minutes), observation (* tentative). Month 1: Nest to nest (NN) every day. Month 2: NN 6 days per individual and patrol. Month 3-12: NN 6 days per individual per 2 months and patrol. Second and third year: patrol only. Monitoring team meets daily in the evenings to discuss day's activity.

Immediate checks conducted upon release: have they recovered from anesthetic and travel?; are they moving through the canopy and making nests?; are they finding food by themselves?

Regular observations: are they adapting to their new habitat?; finding sufficient food and behaving 'normally' over time?; Providing information to assess whether to intervene in case of ill-health / deterioration.

Long-term: focus on a few individuals for a long-term record of adaptation, plus continued close monitoring of 'at-risk' individuals.

Post Release Monitoring tasks are: phenology (observation of fruit season dynamics); recording climate (temperature, humidity, rainfall, and river water level); inventory of biodiversity (birds, mammals, and reptiles); briefing or evaluation.

Challenges: bee protection, proper protective gear, finding separate, new areas for release groups in similar forest area.

Ultimate goal: births (how many have there been and are the babies surviving?)/aggression, inquisitive ones, constant review of SOP and candidate selection, relocation of aggressive/nuisance individuals, mitigating human-orangutan conflict, compensation (money reimbursements to local people when orangutans enter their villages).

From 2012 – 2017, there have been 8 births at the release sites: six in Batikap and two in Kehje Sewen. This is an indicator of the success of BOSF's orangutan reintroduction program and the addition of new wild orangutan populations in the forests.

Solutions: implement collaborative plan with district government and other organizations; have regular joint forestry, BKSDA/BOSF patrols, produce and ratify human-orangutan conflict plan; develop investigative unit; increase NGO, company partnership around release sites.

Lessons learned (after 25 years): rehabilitation is important; older rehabilitants do worse than younger ones; the younger orangutans entered forest school while the older ones went straight to the islands; the social learning opportunities in forest school are important; history before rescue, and history before release, both play a part in reintroduction success; pay extra attention to orangutans in the critical range.

Initial adaptation: the most important time in reintroduction as it takes most orangutans one to three months to adapt to finding food in the wild. They may need assistance if this time frame is delayed. What to look out for: monitoring team must look closely at feeding data for first six weeks in real-time.

BOSF is the largest rehabilitation center in the world which is not a positive thing. The plan is to be the smallest! Protecting the orangutan and protecting the forest should become one.

Even un-releasable orangutans should be in the forest (protected) and not in cages.

Rehabilitation Process For An Infant Sumatran Orangutan In Jantho Reintroduction Station

Mukhlisin (presenting), **Yenny Saraswati**. SOCP

Abstract

Ganteng is one of twin baby orangutans born at the Orangutan Sumatran Quarantine Center-Medan. For about 5 years, Ganteng lived with his mother (Gober) and his twin (Ginting) inside a cage without any human intervention. Beginning in 2015, Ganteng, Gober and Ginting were moved from the Medan Quarantine Station to Jantho Reintroduction Station, Aceh. At the release stage, things did not go as planned. Gober and Ginting left the cage while Ganteng stayed in the cage. For approximately 6 months, Ganteng followed forest school program with a keeper. The progress level of his behavior was very gradual. This started with the growth of the trust system between Ganteng and the keeper, then continuing with his growing abilities in climbing or swinging, recognizing and finding forest foods, socializing with other

orangutans, making and using a nest, to the final stage of survival in the forest. Until now, Ganteng has been able to adapt well, as evidenced by his behavioral activities in the forest, his movement patterns (which are quite far) and also eating mostly food from the forest. The rehabilitation process for orangutans does not have a definite guideline, as each process is related to the ability of each orangutan. The success of a rehabilitation process is how the orangutan can survive in existing forest areas, and eventually reproduce to provide new individuals. This case is a good learning example, which later can be used as a reference when rehabilitating captive orangutans.

Ganteng's Story: video shown of a blind female Gober with twins Ganteng and Ginting.



After cataract surgery, Gober regained her eyesight. The father (Leuser) was also blind due to 62 air pellets shot into him, his injuries are permanent. Gober and her twins were all released in December of 2014 in the SOCP Jantho Release Forest in Banda Aceh.

Gober and Ginting appeared to adapt well to their new home, but Ganteng was not as confident, appearing fearful and confused and did not feel comfortable enough to follow his mother and sister (who was still nursing). He needed more time to adapt than his sister and mother. Ginting would visit Ganteng at the cage site, and had contact with other orangutans in the area. Ginting was much more confident and even began straying away from her mother, however, Ginting was found dead in March of 2015.

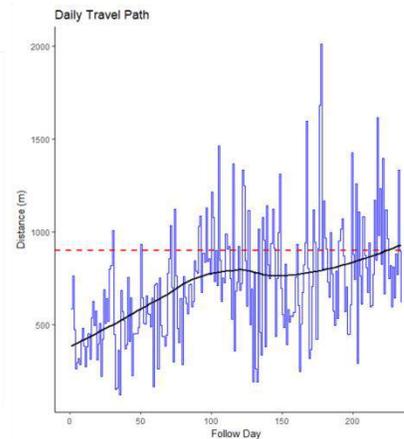
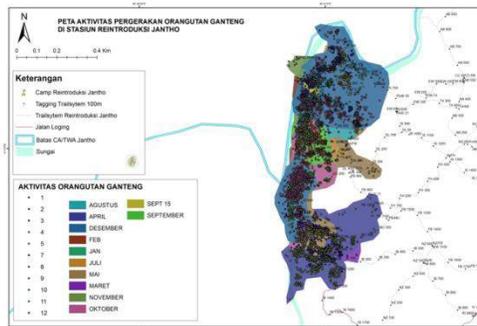
In order to encourage Ganteng into the forest he was given extra training while in the forest cage. He was given forest leaves, and though he was inside the cage, the door was opened and caregivers were able to go in and out of the cage as well. The staff would often go into the cage with him to offer comfort and to encourage him to come out of the cage. He was also with another orangutan (Meysin) that was nearing release. Meysin was eventually released, and Ganteng wanted to follow him, but staff decided he was not yet ready. Ropes were strung up from the cage to the trees with food hanging from them and slowly he made his way out. He was given a treat if he followed the staff further into the forest.



After three months of this 'extra training' he improved but still received food from the staff. He even began sleeping in the forest, making nests (sometimes stealing another's nest) and spending time with other released orangutans, though still remaining close to the cage site.

His medical issues were: diarrhea, dehydration, flu, fever, minor injuries (maybe pig caused). His daily patterns regarding food and movement matched wild orangutans, but he still rested above the cage, in branches or on ferns, sometimes in an old nest or making a new nest.

Map of Ganteng movement

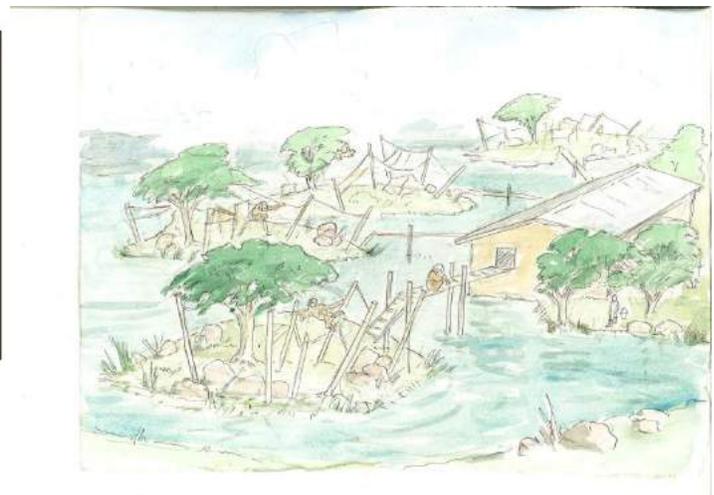
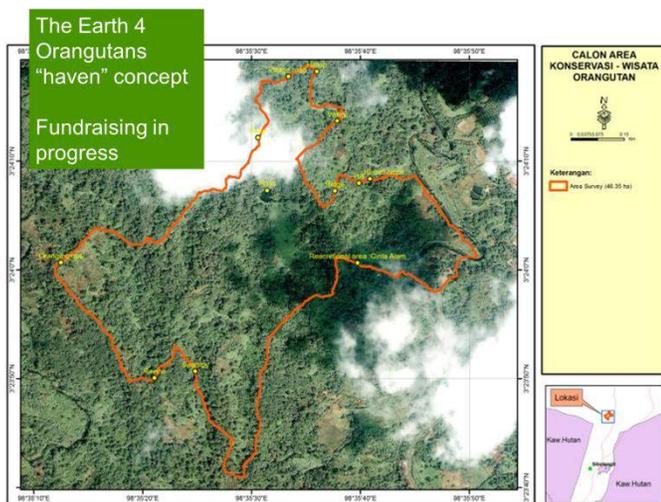


Hopefully Ganteng will continue to improve and Gober will have more offspring.

Conclusions:

In the reintroduction process, it is necessary to teach skills for new habitat adaptation, especially for orangutans born in quarantine / zoo. Training / forest schools better help orangutans survive after being released. In addition to the staff, other orangutans can also become trainers in the release process in the forest school. Monitoring for a long time is needed, especially for young orangutans when released.

Also presented was information on SOCP's Orangutan haven project for unreleaseable orangutans which is nearing completion.



End question: what do you think about the forest school as a training program?

Discussion:

Psychological stress can cause severe problems. How do individuals respond to change? The focus cannot only be on disease but on what is happening psychologically with that orangutan. Is proper data taken pre-release? Is temperament taken into consideration? Pre-release data is as important as post release data. One Health addresses psyche as well as the physical. Even within wild ones, behaviors vary within individuals and that needs to be looked at. There is collected data on gibbons, it is not perfect, but it is a start. The big problem with gibbons is that a pair is released. No breeding is allowed in cages, as the pair is not released with infant as infants cannot keep up. Orangutans are sent with mothers or friends, but these relationships can falter. Knowing in advance about relationships is good, but things can change in the forest and can cause problems. Sometimes as a vet we forget about the psychological aspects, but it is

unintentionally forgotten. Vets also need to see if orangutans can cure themselves before intervening. Testing is never perfect for health cases, TB especially, but tests that various centers use also vary. Is there a minimum of the types of TB tests done at centers? We do not know orangutan wild TB strains, so we need to be cautious. No releases that can cause clinical disease should be entered into. The more you test the more information you will have. OVAG does have an obligation to make sure centers test properly. Vets need more training in testing for TB. How can we test for TB in the wild? This is difficult, which is all the more reason to be cautious. Run as many tests as you can over periods of time. STAT paks do not work on orangutans (we already have that information). At OVAG 2010, we had discussions about TB tests, recommendations were made to the TB wildlife specialist group, with OVAG members, it is in the OVAG google drive documents. TB is an increasing issue with human populations across the world – testing is difficult in terms of accuracy. There has been a huge change, when we started OVAG not many centers were releasing, today, so many orangutans are being released, but TB is an increased risk, do we have a program for pre-release? At the moment OVAG has a statement about what we recommend – if it needs to be modified or changed, fine, but as OVAG, we can only advise, but we do need government participation, we need them to look at it from a public health side. Who regulates? It must come from the government. What is the best route? There is never one answer. Each country and organization has to find the best route. If you see a potential issue and do not address it and if that risk is discovered and you avoided it – then it can cause more problems. Human hospitals and labs need to come under One Health so they can be regulated and be used more effectively. If OVAG can produce an agreed visitor testing protocol, pre-release protocol statement, then a document under the name of OVAG can be used to include people from the national level. Wording needs to be important...guidelines are FYI, policies are usually at the higher level (very broad), standards and protocols are much more specific. But true regulations with consequences must come from government. Are there cases of releases for blind or half blind? Euthanasia is not allowed without government approval along with vet approval. Non-releasables would not fit into that category. Hepatitis: simian (orangutan) strain Hepatitis orangutans are releasable as it is endemic. Releasing orangutans with previous infections depends on the infections. Sometimes if you can see if they are sick, it may be too late (across the great apes).

OVAG Strategic Meeting – OVAG Committee

Maximizing and Measuring Impact

Steve Unwin (presenting) OVAG, Chester Zoo, IUCN,
Fransiska Sulistyo OVAG, BOSF, Kay Farmer

Exploring the role of OVAG (real and potential) through an approach called ToC (Theory of Change). ToC helps explain the story of how and why the world will be different because of what you are doing.

Measuring impact and a review the current OVAG Theory of Change.

Background: the term 'sanctuary' is perceived differently across the world. Sanctuary, in some places, refers to a protected area, or it can be a facility that provides life time care only and not rehabilitation and release prospects. In Asia, the term more frequently used is 'rehabilitation center'. The term Rescue center is often used to describe a facility that offers a sanctuary option until the animals are moved elsewhere but we will use the term 'sanctuary' as all encompassing.

Questions to ask ourselves:

Why work with orangutans and other wildlife? Is it to study primate behavior, health, welfare and conservation? Can it be assumed that you want to make a difference? But how do you ensure you make a positive difference? How will you know when you have made a difference? How will you know that you have made the difference you set out to? Many efforts fail because these questions are not asked.

The five reasons why many conservation efforts fail are (taken from www.mongabay.com):

1. There is a lack of local buy-in
2. Past history is ignored
3. Sufficient funding is lacking

4. Full participation of law & order is lacking
5. There is a lack of clearly stated goals.

The Mongabay site is a great way to keep informed about international conservation issues. These reasons are listed in no particular order and this information has not been generated from a systematic evaluation of successes and failures but nonetheless it highlights points needing to be focused on. The importance of setting goals, outcomes, desired impact etc., is key to effective conservation.

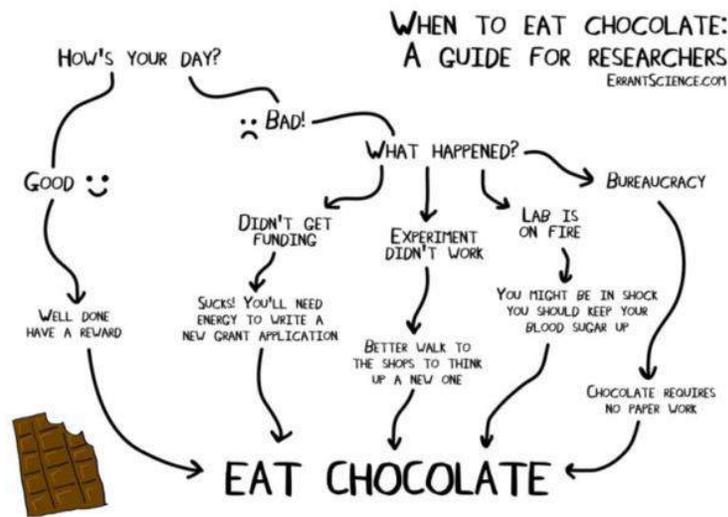
It is a lot easier to get somewhere, if you know where you want to be! It is the same for all types of projects, programs, and organizations. Conservation initiatives need to start with goals and objectives that you want to achieve within a given period of time. These goals help chart out specific strategies and actions, and associated resources (financial, human, infrastructure) that can make the conservation project a success. Unfortunately, many conservation projects set out with very fuzzy, poorly designed goals, or they might start out with some goals but they get forgotten or lost along the way because there is not a regular check in. Why? Because we want to see the details, who does what, when and how, plus the costing – there is security and comfort in knowing the details. So we rush into planning the activities before we have designed the overall process, and looked at the bigger strategy. This can lead to reduced effectiveness or even to failure and we do not have time for that.

What makes a good conservation leader?

An ability to share a clear, long-term vision
 Orientation toward 'hands-on' management / An ability to switch thinking between the big picture and the detail / A willingness to encourage learning, improvement, and receptiveness to alternative solutions.

Activities in the conservation sector are typically influenced by factors beyond the control of managers. Conversely a leadership approach is under managers' direct control and has an impact on attainment of results. Effective leadership is one factor that should not be left to chance but should be considered seriously for its impact on achievement in biodiversity conservation.

The following group work scenario uses a chocolate model:



The premise here is really focusing on chocolate being the answer to effective wildlife conservation health. Follow the logic...note the direction of the arrows of the basic results chain (Hypothesis).

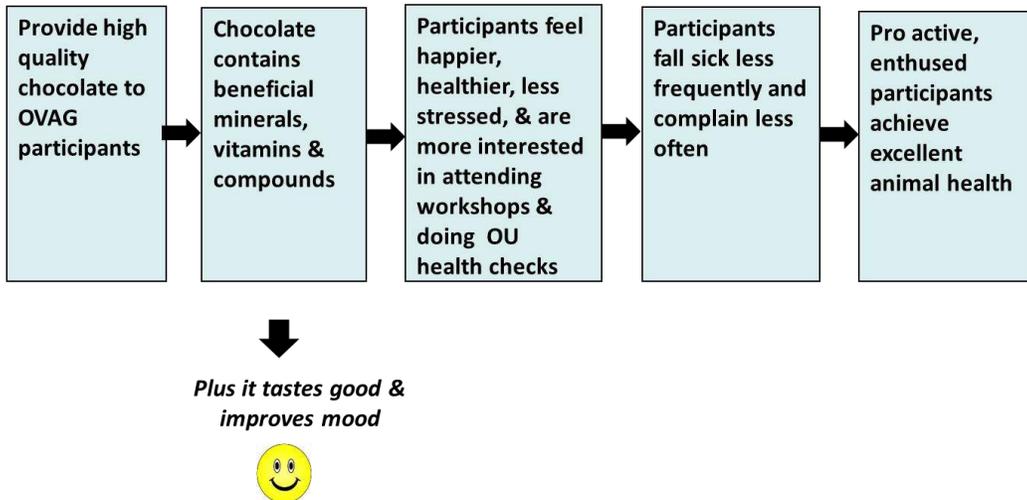
Scenario: Javier has identified a problem with OVAG participant performance and because he really likes chocolate, and thinks it helps his performance, he has decided that it will also help OVAG.

This is often how we do conservation; we start with the problem and then immediately jump into thinking about and planning activities, and in this way making many assumptions. In this case, that eating chocolate, will be the answer, and look no further.

But this approach can lead to us to take too many leaps of faith, and we do not have time to make mistakes. We need to know what works and why.

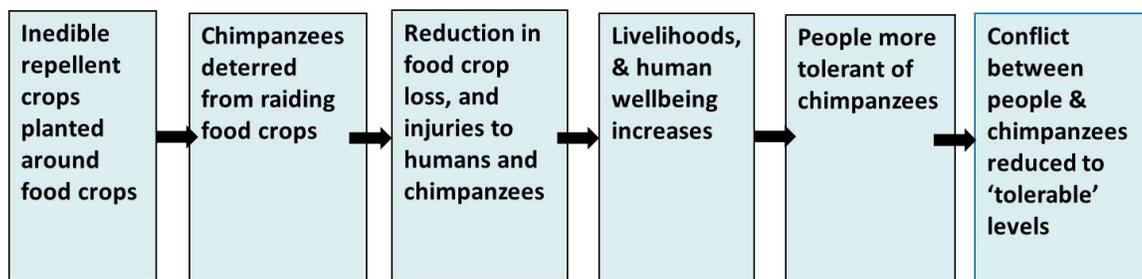
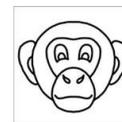
The chocolate diagram is a simple results chain depicting the assumed relationship between chocolate consumption and effective outcomes. We could also add a further longer-term outcome related to becoming professional/accomplished primatologists, etc.

Project: Eat chocolate to improve OVAG outcomes



Below is a very simplistic results chain for a human wildlife conflict issue – yes this may be too simple but, it is just an example. Again take a note of the direction of the arrows.

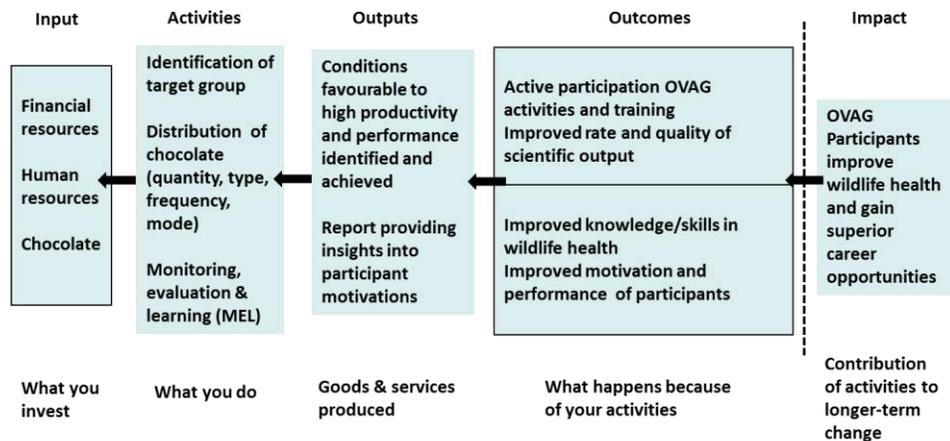
Project: Reduce conflict between people and chimpanzees



Back to chocolate and to explore a little deeper. The logic is fitted into a style of language that is frequently seen in conservation project documents – obviously significantly simplified – it does not matter if your understanding of these concepts is different, as long as you and the people you work with have a shared understanding, that is what matters. (Note ‘report providing insights’ – this was in the recent questionnaire).

Note the change in direction of the arrows – this is a basic theory of change which takes a different approach and works from the impact backwards. For a real project all the planning and preparation required to have sufficient information to populate a full theory of change would have been done.

Eat chocolate: Theory of Change



Already it is much easier to see some of the questions arising from this way of thinking from the standard 'activity first' approach. Note the accountability line and the issue of what to evaluate e.g., outcome level (often at output level).

The basis of a theory of change: Used for thinking about change – it is the story of how and why the world will be different because of what you are doing. It describes a sequence of events that are expected to lead to a particular desired outcome (result/impact/change as a consequence of the activity). It is also known as Theory of Action, Change Hypothesis, etc. Core questions: What change, for whom, why, and who says so?

The key features are:

- Participatory – which improves the quality of the thinking and the project; also increases ownership and effectiveness
- Backward mapping
- Making assumptions explicit
- Visual story telling

The key features of ToC is that it is participatory in nature – all well designed projects should include the key stakeholders e.g, marginalized groups, educating children, etc.

Disease risk analysis theory – the theory of change is equivalent to risk assessment stage.

ToC explains how you see the world, how change happens, and how you are going to intervene based on that understanding. (Problem tree and stakeholder map are tools/processes that help you generate the information you need to support the design and development of your project. Logframe is a management and measurement tool).

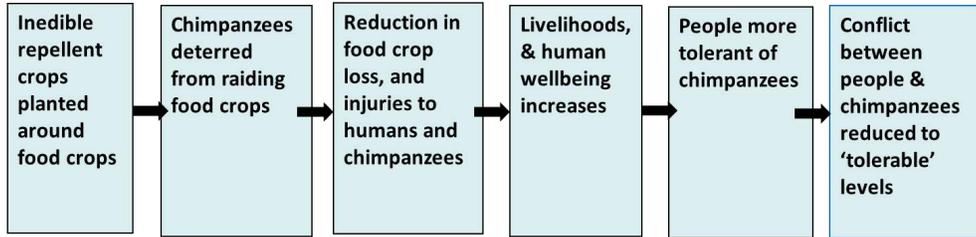
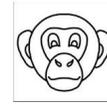


Links between tools/approaches (Adapted from Gray Dot Catalyst, 2015)

As you can see, it is not a quick process and this is just a snapshot view of what it might look like.

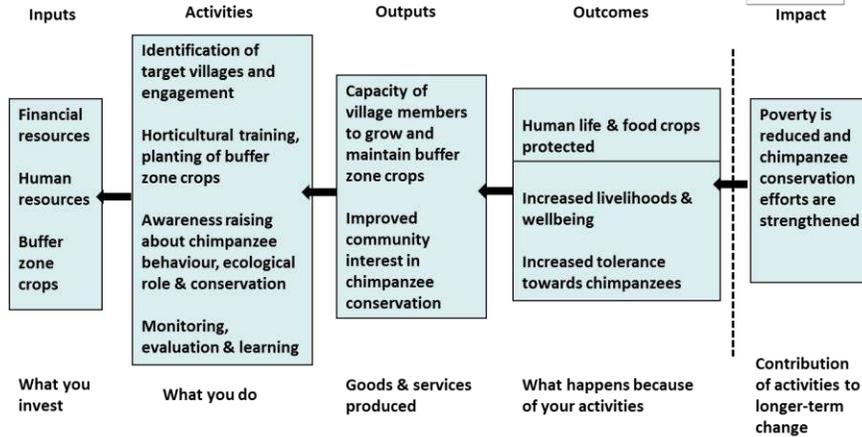
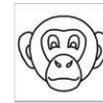
Getting back to Project chimpanzee scenario.... this is what we started with... a simple logical chain of thought, a hypothesis.

Project: Reduce conflict between people and chimpanzees



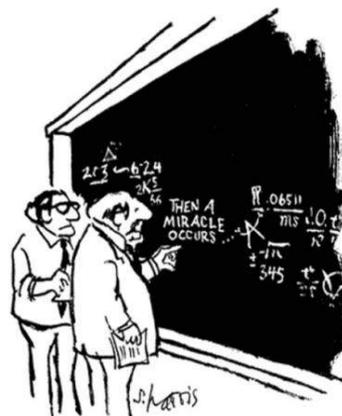
Then a different approach...

Conflict resolution: Theory of Change



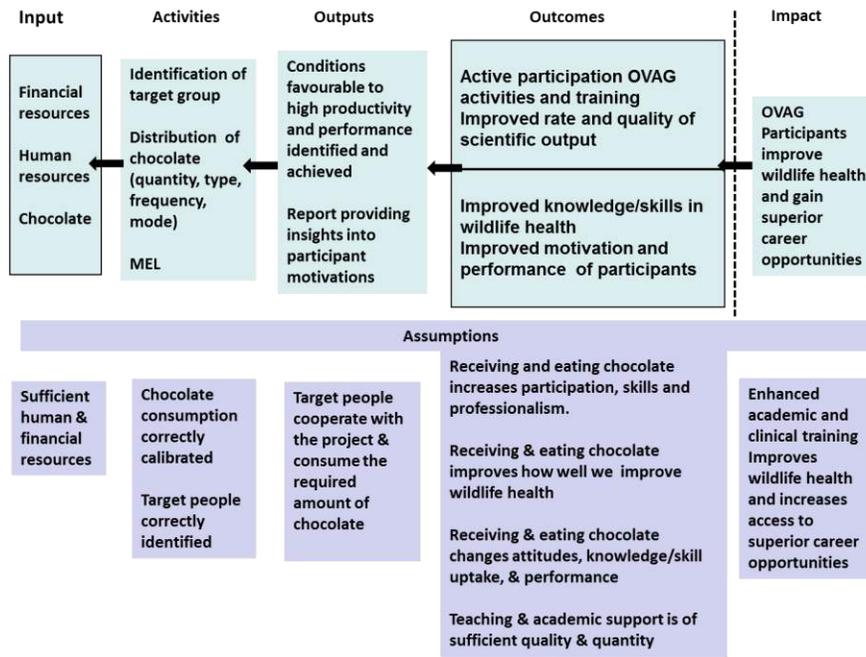
There might be a few holes in the logic for both project chocolate and project chimp, and testing the logic by asking if X happens, does Y happen, and is there anything missing, can be further stimulated by deliberating on and identifying assumptions - saying them out loud.

One of the key features about ToC is making assumptions explicit – and there are a lot of assumptions in conservation that often are not spoken about.



- Assumptions about **causality** - what leads to what to bring about change.
- Assumptions about **implementation**.
- Assumptions about **external factors** that influence the project.

Back to Scenario Project: Eat chocolate and think about some of the assumptions that underlie the hypothesis.



Enhanced academic profile increases access to superior career opportunities: – maybe there may be something else going in wider environment that is preventing access e.g., roles (and experience/skills required) change over time. For example in the US Trump is cutting funding for the environment, we may also experience the same in the UK due to Brexit. Indonesia?

Modified attitudes, knowledge, skills & performance enhances academic profile – maybe trends in conservation are influencing the type of roles available and different skills sets are being sought.

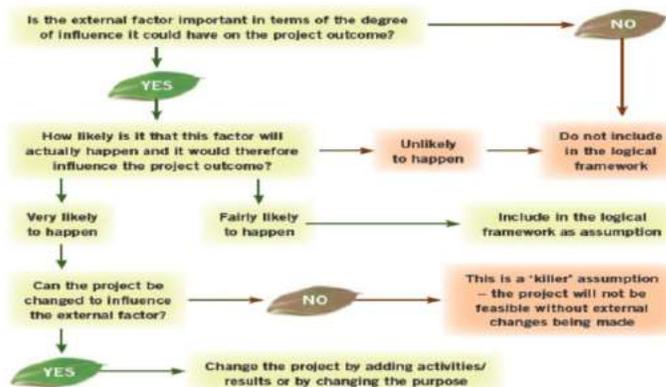
There may be other knowledge and skills that are lacking (e.g., soft skills) and need to be enhanced or experience gained.

Target people cooperate with the project & consume the required amount of chocolate – if they don't do this then we might not be able to identify the conditions favorable for high productivity. What about a control group?

Distribution of chocolate (quantity, type, frequency, mode) – and what if we cannot calibrate what is the right amount of chocolate, and what is the 'right' type of chocolate.

Sufficient human & financial resources – what if we only budget for cheap chocolate and we need to buy really expensive chocolate to get the required effect?

The following image is copied from a BLI publication; it is an aid to help selection of assumptions. When you talk through your project you may come up with a great deal of assumptions but will not need to consider them all (note them all down somewhere of course) but some may be more important than others. For example, an assumption about levels of participation and marginalized groups, then designing a project that facilitates a voice for all to achieve effective conservation outcomes.



How do we know if we are making a difference?



OVAG plus chocolate = healthy orangutans

Characteristics of indicators:

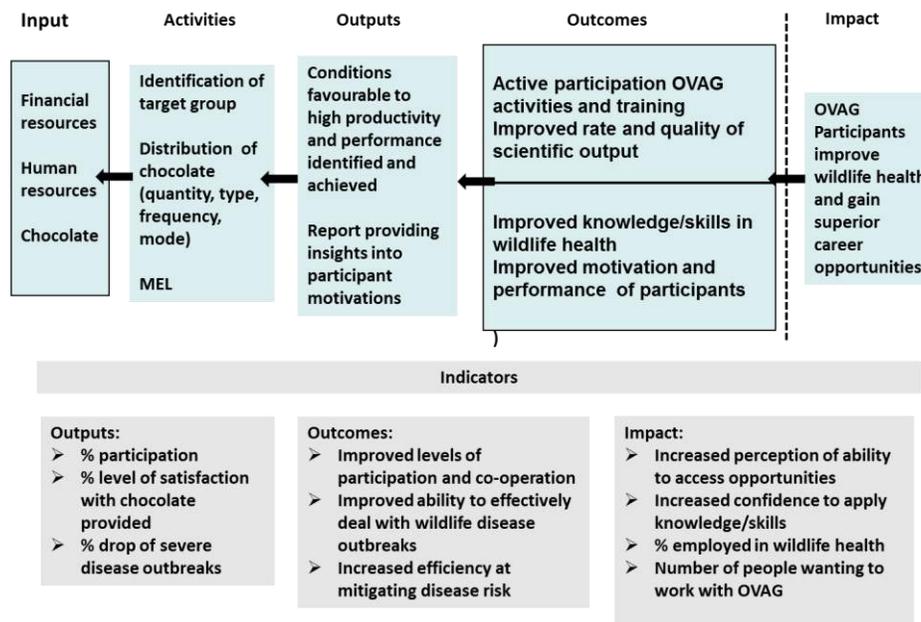
The following questions must be answered about each indicator:

- **What** will be affected? (Indicator)
- **Who** will be affected? (Population)
- **How many** will change? (Target)

“I’ll know [outcome reached] when I see [indicator].”

Now, think about the impact:

If the target is OVAG participants, then **“Proactive high academic and clinical achievers have gained access to superior training in OVAG career opportunities when 75% of the participants are employed in effective conservation health management roles in 5 years”**

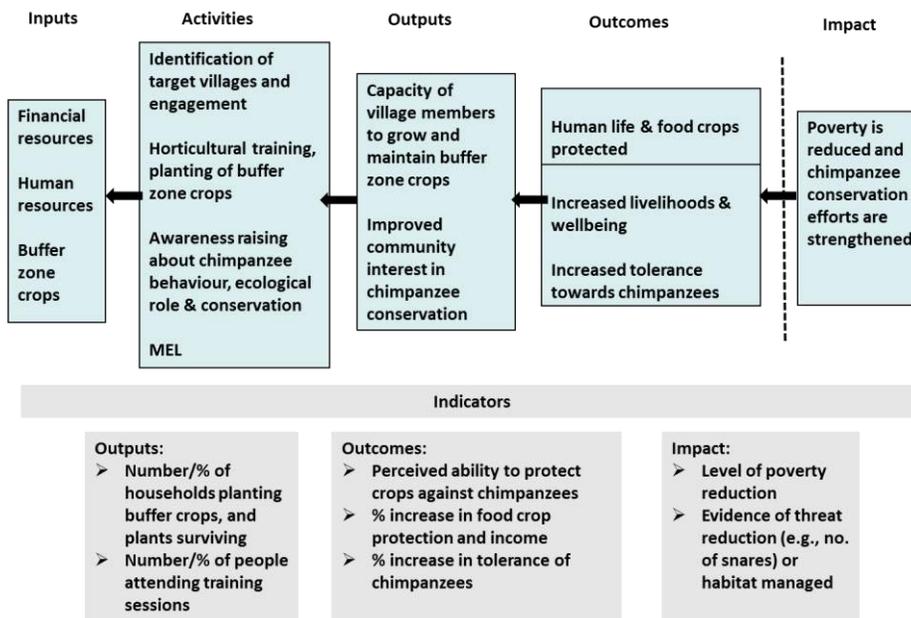


The importance of control groups and comparison of different approaches is to answer the why question e.g., not only what works but why, so that key features can be identified. For example, that might need to be in place for a strategy to work.

Impact 1: OVAG to empower people of Indonesia and Malaysia to be able to do what they want to do – if you feel you have power, you do.

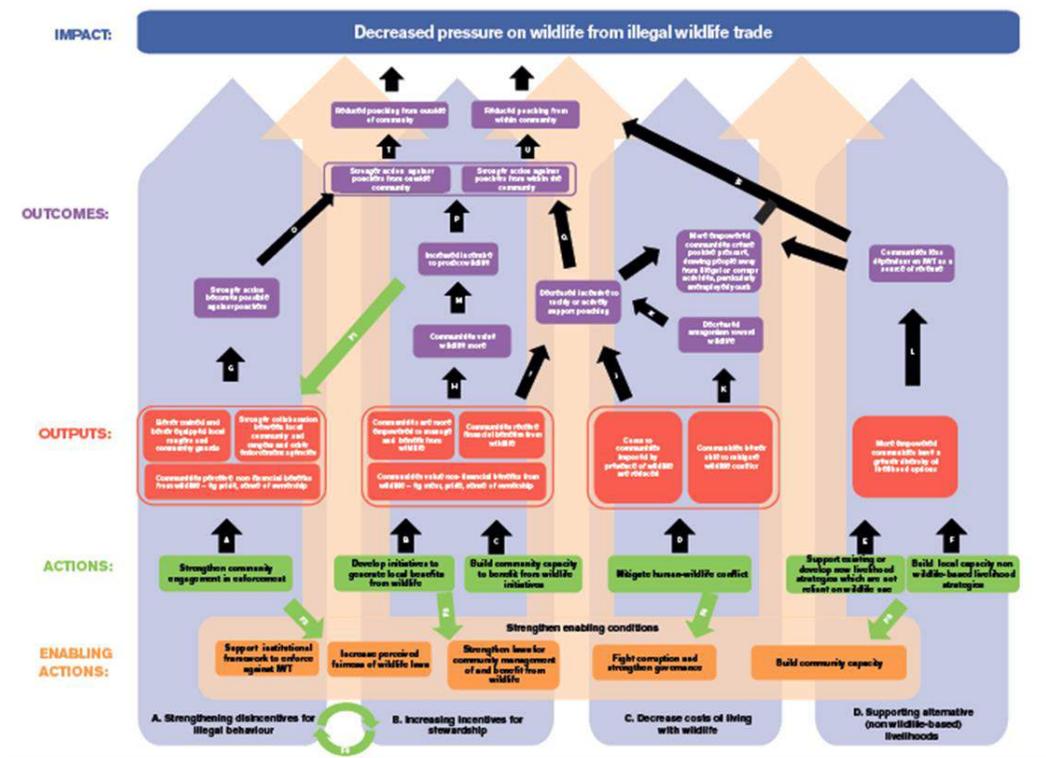
Outcomes: People wanting to work with OVAG – this year OVAG is the largest – a possible indicator ..as we answer the chain of questions, the more quantitative we come.

Back again to Project chimp - think about how to collect evidence e.g., surveys, interviews, focus groups, etc. (qualitative data); transects, nest counts, number of snares, etc. (quantitative data).



(comparison of baselines to end of project, & control group)

A simplified ToC but life is complex and messy:



Biggs *et al.*, Conservation Biology (2017) 31: 5–12; Biggs *et al.*, (2015) IIED Discussion Paper. IIED, London. <http://pubs.iied.org/14656IIED>

IIED – using similar terminology, 4 pathways of change or strategies: (1) strengthening disincentives for illegal behavior, (2) increasing incentives for stewardship, (3) decreasing costs of living with wildlife, and (4) supporting alternative (non-wildlife) based livelihoods.

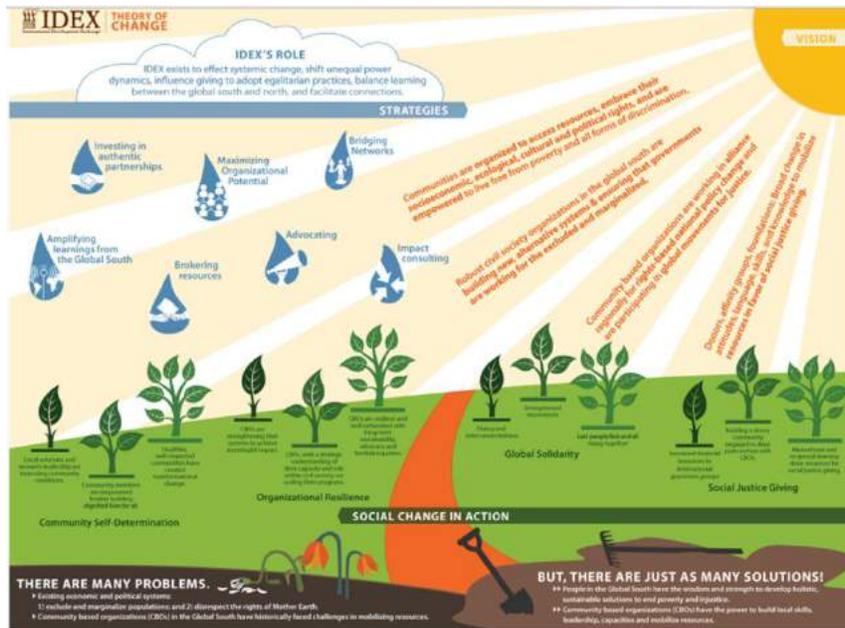
CODE*	ASSUMPTION
PATHWAY A: Strengthening disincentives for illegal behaviour	
A1	Community rangers use equipment and training to combat IWT and not to poach themselves or for other purposes (ie community governance is at an adequate level and corruption is sufficiently controlled).
A2	Collaboration between communities and other enforcement agencies leads to stronger action against IWT and not stronger collusion for IWT or other activities (governance and control of corruption is at an adequate level).
G3	An increased sense of non-financial benefits contributes to willingness to take stronger action against poachers.
G5	Communities have not already been intimidated by poachers, and are willing and able to take stronger action against poachers.
O1	Collaboration between communities and other enforcement agencies leads to stronger action against IWT and not stronger collusion for IWT or other activities (governance and control of corruption is at an adequate level).
PATHWAY B: Increasing incentives for stewardship	
B10	Benefit sharing within the community is sufficiently equitable and 'elite capture' – where the elite capture most or all of the benefits – does not undermine the schemes.
PATHWAY C: Decreasing costs of living with wildlife	
D4	Compensation does not lead to perverse behaviour, ie damage from wildlife is not actively induced to receive payments.
PATHWAY D: Supporting alternative (non wildlife-based) livelihoods	
E2 and F2	Alternative livelihood schemes do not generate perverse incentives, ie money is not reinvested in poaching or other land-uses that damage wildlife.
L	IWT is not so high in value that that all other potential forms of income (through tourism, etc) cannot compete financially.

Example assumptions (Biggs *et al.*, 2015)

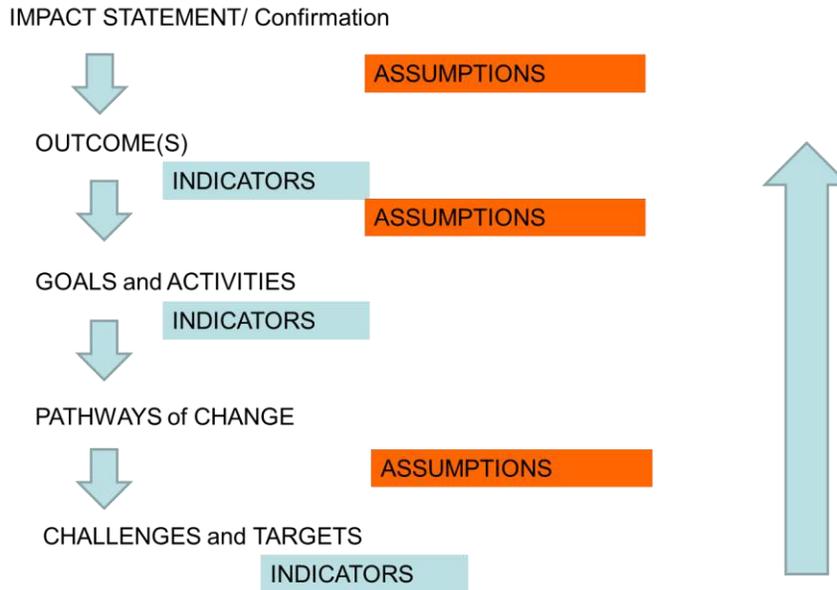
If you search on the internet for ToC you will see that they all look very different. Remember, one of the key features of a ToC is that it is visual.



Below is a very visual ToC which would be used for more external audiences:



The OVAG Committee has developed a draft theory of change for OVAG:



OVAG – What are we trying to do?

IMPACT STATEMENT 20 YEAR FRAME

Successful integration of One Health programs into conservation efforts leading to successful disease mitigation in wild populations and linked public health and environmental disease issues with a proven contribution to the protection of SE Asian wildlife, habitat and human health that can be used as a model for other regions.

The material will be incorporated into OVAG’s Theory of Change and hence ongoing strategy. Everything is open to change, including this impact statement!

Challenges and Targets. Foundational (completion of OVAG

Phase 1) 2016-2017

Establishment and teaching of a tertiary short course in One Health and Primate Ecology at Gadjah Mada University

Target: 5 CPD agreements confirmed between OVAG research and industrial partners

Successful execution of OVAG training program.

Target: 90% approval rating from participants on content

Establishment of an OVAG 5 year strategy agreed on by all participating organisations

Target: All participant organisations sign up to an agreed strategy

OVAG workshop program to include examples of improved animal health from participating organisations

Target: 30 organisations engaged and clinical expertise evaluated

Assumptions:

Successful linking of participation, learning and outcome in mitigating health risks

Successful knowledge sharing leading to a measurable legacy

Successful orangutan health programmes will assist in reconstitution of appropriate, self-sustaining and protected native habitat

Decision makers in target organisations and Governments will be interested in participating in the project and commit to ongoing professional development of participants

Sufficient funding and technical support is available to support the required number and diversity of participants for a successful One Health program

Successful disease mitigation responses from participants who will be successful in reducing disease risk in wildlife populations and local community situations

OVAG PHASE 2 (2018-2022). PATHWAYS OF CHANGE

1. Capacity

Building: Project managers:

biosecurity knowledge.

Veterinarians:

Critical thinking skills – individual diagnoses through to wildlife disease risk analysis and One Health.

Human Health

Practitioners: One health and biosecurity in communities in boundary areas

2. Policy:

Government level decision-makers:

A developed Animal Welfare Act for Indonesia (cf Malaysia).

Academia:

Integration of DRA and One Health into veterinary, biology and relevant post graduate programmes

3. Research:

Filling data gaps on emerging infectious disease in wildlife in SE Asia utilising OVAG partners. OVAG understands the link between welfare and conservation. We promote good animal welfare through training and open workshop discussions within the workshops as well as providing invited field site visits to assist with welfare related issues

4. Raising

Awareness:

Target – high level government about information gathered from pathways 2 and 3 and promotion of pathway 1.

Goals and Activities

1. Capacity Building:

OVAG will provide expert training on relevant disease investigation techniques and an appreciation of conservation management on a global scale. We will provide expert clinical technique demonstration, written materials in One Health, primate medicine and wildlife disease surveillance and analysis. Via workshops, improved access to international scientific output channels

2. Policy: OVAG

champions to communicate process and lessons learnt from development of Malaysian Animal Welfare Act to relevant Indonesian authorities. **TARGET:** Draft policy 5 years (Indonesia). Intermediate indicators/targets: Provision of a university certified post graduate course in wildlife medicine and One Health at Gadjah Mada University in Indonesia, based on OVAG materials.

3. Research. Embark

on evaluated conservation medicine and welfare research that fills the data gaps below and by partnering with international leaders in the field of study E.G Gut microbiology wild v captive (UoB), Respiratory pathogens (IAR/ IZW), welfare – enclosure design tool – adopt for orangutans and rehab practise (UoB); Ecohealth Alliance/Tufts.

4. Raising Awareness.

Engage relevant ministries and ministers in areas of policy and research being undertaken by OVAG and partners. Integrate capacity building activities to provide a united voice to policy makers and practitioners alike (OVAG, Indonesian Zoo Association/ SEAZA, etc)

Assumptions:

- Successful linking of participation, learning and outcome in mitigating health risks
- Successful knowledge sharing leading to a measurable legacy
- Successful orangutan health programmes will assist in reconstitution of appropriate, self-sustaining and protected native habitat

Decision makers in target organisations and Governments will be interested in participating in the project and commit to ongoing professional development of participants

Sufficient funding and technical support is available to support the required number and diversity of participants for a successful One Health program

Successful disease mitigation responses from participants who will be successful in reducing disease risk in wildlife populations and local community situations

OVAG phase 2 Completion 5 years (2022)

PHASE OUTCOME STATEMENT: There exists a sustainable regional cadre of professionals able to provide capacity building, advice, guidance and management of One Health matters with wildlife in Indonesia and Malaysia

OVAG network and methodology becomes the gold standard in capacity building for those involved in conservation health in Indonesia and Malaysia

Target: All NGOs involved in conservation health are a part of OVAG or have modelled their work on OVAG

Assumptions:

- Participants remain in the One Health field in sufficient numbers to contribute to successful restoration of healthy wild populations
- Increased extent, diversity, condition and connectivity of biodiversity in Indonesia and Malaysia
- Full engagement of policy and decision makers
- Restoring wildlife within their ecological range will improve the health and resilience of the environment and enhance the ecosystems ability to adapt to a variety of climatic events
- Creating a body of knowledge that creates the opportunity to successfully protect the environmental values that give wildlife habitats international significance

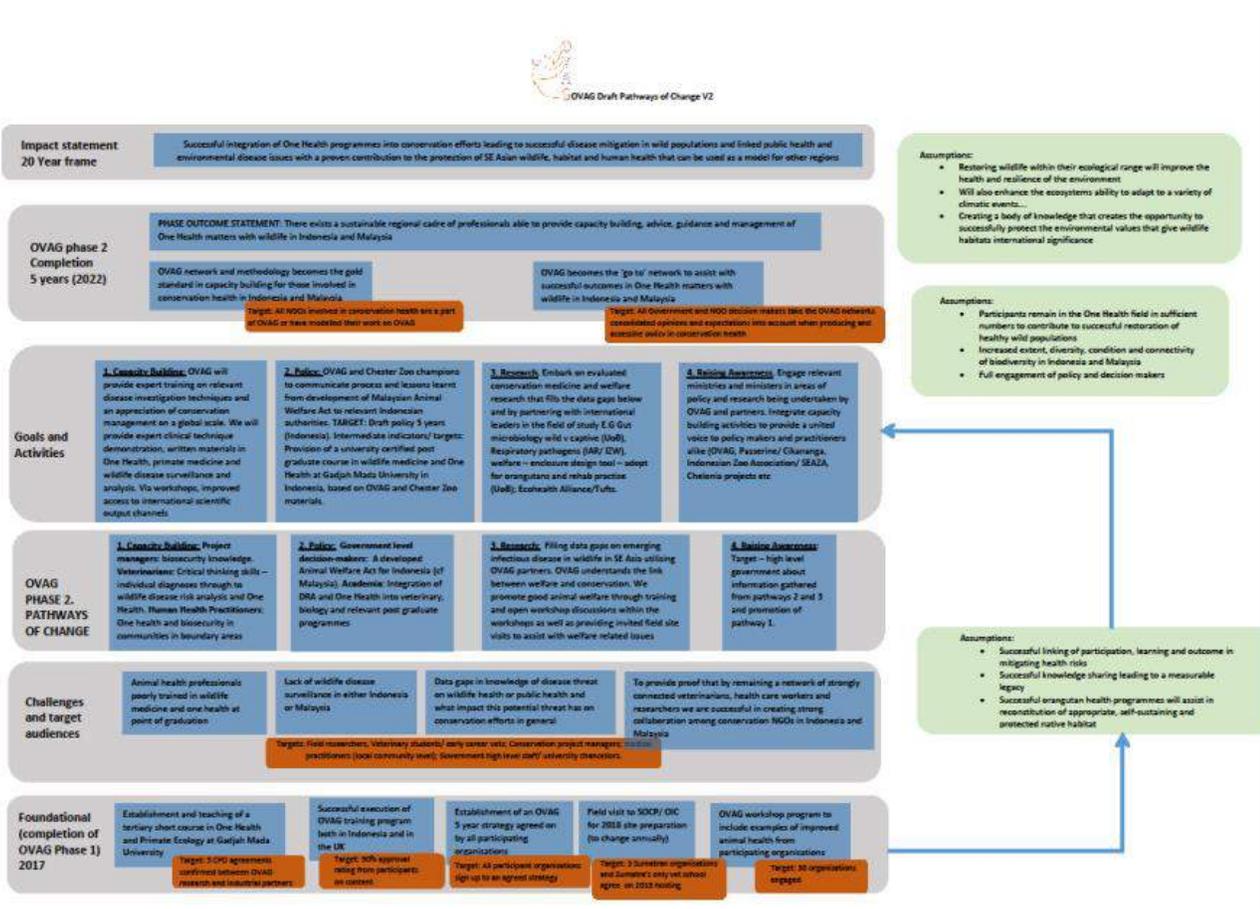
OVAG becomes the 'go to' network to assist with successful outcomes in One Health matters with wildlife in Indonesia and Malaysia

Target: All Government and NGO decision makers take the OVAG networks consolidated opinions and expectations into account when producing and assessing policy in conservation health

Again, OVAG's Impact Statement:

IMPACT STATEMENT 20 YEAR FRAME

Successful integration of One Health programmes into conservation efforts leading to successful disease mitigation in wild populations and linked public health and environmental disease issues with a proven contribution to the protection of SE Asian wildlife, habitat and human health that can be used as a model for other regions



Working Group Session:

There are 3 challenges to work on in a sanctuary context

Often with projects we are forced to work in 3 year cycles and that's what the group work will reflect, however, your impact will be longer-term.

Group work (1 hour):

Organize yourselves	5 minutes
Impact (goal/vision)	10 minutes
2-4 outcomes (change)	15 minutes
Intervention for 1 outcome	10 minutes
Assumptions (for above)	10 minutes
Ideas for indicators	5 minutes
Organize presentation	5 minutes

Each group should nominate: 1 time keeper / 1 person to facilitate the group work / 1 person to capture the work

Decide how to present work (5 minutes per group to present key points)

Take home messages:

Start with thinking about the change you want to see.

Involve the 'right' people.

Explicitly discuss assumptions – always question the logic.

Monitor, evaluate and learn – share the learning and adapt.

What do you want to see over the next 5, 10, 15, 20 years?

Instructions for Theory of Change group work given to participants

Developing a full Theory of Change (ToC), if conducted in a participatory manner (which is one of its key features), can take time. Though there is limited time to understand key concepts, the focus will be on some crucial elements. At the end of this document there is a glossary of key terms used.

A key component of the ToC is the process of “backwards mapping,” beginning with the impact and working back toward the earliest changes that need to occur. This is the opposite of how we usually think about planning, because it starts with asking “What must exist for the outcomes to be reached?” rather than with “What activities can we be doing to advance our goals?” That comes later in the process for ToC.

Questions to help draw out your ToC:

- What are the long-term changes that need to happen?
- What are the barriers to those changes? Who and what (groups, structures, systems, relationships, processes) needs to change?
- How will the project try to influence these things?
- How will you know if you have brought about change?

At each step test the logic: “If X happens, does Y happen? Is anything missing?” Discuss whether logical linkages occur between the impact, outcome and intervention.

Step 1: Organize your group (up to 5 minutes)

- If your challenge has more than one option to choose from (1&3), decide which one you are going to do.
- Allocate roles; you will need a time keeper, someone to facilitate the group work, and someone person to record the work (make clear notes of key points).

- At this point you may want to think about how you are going to present your work to the rest of the group no: nominate one person, as a group etc.

Step 2: Identify and record the projects main intended impact (up to 10 minutes)

- This is the long-term goal your project will contribute towards (it may also be referred to as the vision, impact, ultimate outcome) – e.g., what will the situation look like in 15 years thanks to the project. Review the current impact statement. If you are happy with it as it is, great move on to the next section. If not, note down your thoughts and suggestions for the review:

Successful integration of One Health programs into conservation efforts leading to successful disease mitigation in wild populations and linked public health and environmental disease issues with a proven contribution to the protection of SE Asian wildlife, habitat and human health that can be used as a model for other regions

- If it helps brainstorm words, cluster common elements, and then discuss to reach consensus. Aim to capture the key meaning (precise wording is not important for today).
- As you discuss impact, some of the discussion may highlight interventions (groups of actions) and assumptions - please keep a note of them for later.

Step 3: Identify and record 2-4 project outcomes (up to 15 minutes)

- The next step is to work backwards from the impact and identify the changes your project will achieve, the project outcomes – these are the changes that contribute to the impact. Who and what needs to change to contribute to the impact? You may be looking for changes in conditions, institutions, relationships, capabilities, attitudes, and behaviors. **Remember whilst your impact reflects long-term change, OVAG CUURENTLY has funding for 3 years, so design accordingly.**
- Review the current project outcomes. If you are happy with them, great move on to the next section. If not, note down your thoughts and suggestions for the review:

PHASE (2022) OUTCOME STATEMENT: There exists a sustainable regional cadre of professionals able to provide capacity building, advice, guidance and management of One Health matters with wildlife in Indonesia and Malaysia

- **OVAG network and methodology becomes the gold standard in capacity building for those involved in conservation health in Indonesia and Malaysia**
- **OVAG becomes the 'go to' network to assist with successful outcomes in One Health matters with wildlife in Indonesia and Malaysia**
- For our purposes today, the same approach used to identify impact can be used to identify outcomes (brain storm words, cluster common elements, and discuss). If you are finding this difficult, think about the barriers to achieving change, and then turn the barrier (negative) in to a positive (outcome/change). Also remember, an outcome describes a result - a change that has taken place, not a need or activity. A simple test is to ask does it describe changes that we can plausibly enable or facilitate in people, groups, institutions or environments.
- Deciding on outcomes can be time consuming and you may need to work with what you have by the end of the time, aiming for at least one agreed outcome to work with for the next step.
- As you discuss outcomes, some of the discussion may highlight interventions (groups of actions) and assumptions - please keep a note of them for later. The assumptions we have already:
 - **Restoring wildlife within their ecological range will improve the health and resilience of the environment**
 - **Will also enhance the ecosystems ability to adapt to a variety of climatic events....**
 - **Creating a body of knowledge that creates the opportunity to successfully protect the environmental values that give wildlife habitats international significance**
- Aim to capture the key meaning (precise wording is not important for today).

Current Identified Pathways for Change for OVAG with assumptions:

1. **Capacity Building:** Project managers: biosecurity knowledge. Veterinarians: Critical thinking skills – individual diagnoses through to wildlife disease risk analysis and One Health. Human Health Practitioners: One health and biosecurity in communities in boundary areas
2. **Policy:** Government level decision-makers: A developed Animal Welfare Act for Indonesia (cf Malaysia). Academia: Integration of DRA and One Health into veterinary, biology and relevant post graduate programs
3. **Research:** Filling data gaps on emerging infectious disease in wildlife in SE Asia utilising OVAG partners. OVAG understands the link between welfare and conservation. We promote good animal welfare through training and open workshop discussions within the workshops as well as providing invited field site visits to assist with welfare related issues
4. **Raising Awareness:** Target – high level government about information gathered from pathways 2 and 3 and promotion of pathway 1.

Assumptions

- Successful linking of participation, learning and outcome in mitigating health risks
 - Successful knowledge sharing leading to a measurable legacy
- Successful orangutan health programs will assist in reconstitution of appropriate, self-sustaining and protected native habitat
- Participants remain in the One Health field in sufficient numbers to contribute to successful restoration of healthy wild populations
 - Increased extent, diversity, condition and connectivity of biodiversity in Indonesia and Malaysia
 - Full engagement of policy and decision makers

Step 4: Identify a project intervention (goal or activity) for 1 of these pathways (up to 10 minutes)

- Discuss the outcome and decide which interventions would best accomplish this.
- Remember outcomes are the result of project interventions (strategies are normally a coordinated sequence of interventions, and activities are groups of actions that make up an intervention). For example, an intervention might be capacity building for law enforcement and the various activities needed to make that happen would be things like developing the curriculum for a training course, screening applicants, identifying trainers and venue, organize work placements and exchange visits etc.
- **1. Capacity Building:** OVAG will provide expert training on relevant disease investigation techniques and an appreciation of conservation management on a global scale. We will provide expert clinical technique demonstration, written materials in One Health, primate medicine and wildlife disease surveillance and analysis. Via workshops, improved access to international scientific output channels
- **2. Policy:** OVAG and Chester Zoo champions to communicate process and lessons learnt from development of Malaysian Animal Welfare Act to relevant Indonesian authorities. TARGET: Draft policy 5 years (Indonesia). Intermediate indicators/ targets: Provision of a university certified post graduate course in wildlife medicine and One Health at Gadjah Mada University in Indonesia, based on OVAG and Chester Zoo materials.
- **3. Research.** Embark on evaluated conservation medicine and welfare research that fills the data gaps below and by partnering with international leaders in the field of study E.G Gut microbiology wild v captive (UoB), Respiratory pathogens (IAR/ IZW), welfare – enclosure design tool – adopt for orangutans and rehab practise (UoB); Ecohealth Alliance/Tufts.
- **4. Raising Awareness.** Engage relevant ministries and ministers in areas of policy and research being undertaken by OVAG and partners. Integrate capacity building activities to provide a united voice to policy makers and practitioners alike (OVAG, Passerine/ Cikananga, Indonesian Zoo Association/ SEAZA, Chelonia projects etc.

Step 5: Articulating critical assumptions (up to 10 minutes)

- The whole ToC is in a sense a set of assumptions – modelling what you believe will change, and will have to change, as a result of the initiative e.g., context, causal mechanisms and relevant enabling factors. It is important to discuss the assumptions going in as wrong assumptions can undermine the ToC. Bringing assumptions to the surface and developing a consensus on which are true is a critically important foundation of ToC and why it is so popular.
- Many assumptions will have been articulated throughout the process – you should have noted them down so revisit and discuss whether they are critical or not to achieving the outcomes, and whether you will need to make a change/act on now, or just be mindful of and track as the project progresses. For example, a critical assumption for a conflict mitigation method is that mitigation techniques are implemented as demonstrated. Articulating this assumption then helps direct you to consider how you can ensure that techniques are implemented effectively.

Step 6: Ideas for indicators (up to 5 minutes)

- Consider how you would measure the change associated to the proposed intervention. Indicators are the measurable evidence of meeting a goal, usually visible signs, which demonstrate that the outcome has been fulfilled, and can involve quantitative measures or qualitative information.
- Some we currently have for OVAG:
 - **Examples of Integration with other engagements including Indonesian zoo husbandry practises (CZ), EAZA welfare assessments (CZ), UPM engagement with the Malaysian Government (UPM); Elephant conflict work in Sumatra; SWD elephant and sun bear projects.**
 - Successful assisted enforcement of current animal welfare and wildlife law in Indonesia and Malaysia.
 - Number and location of successful ;protected orangutan releases
 - Number and success of OVAG participant organisations
 - Number and position of participants as decision makers in conservation health
 - Area protected
 - Number of participants successfully trained
 - Number and quality of scientific output
 - Number of Indonesians and Malaysians involved in conservation
 - Indicators OVAG PHASE 2 completion:
 - Integration of One Health into tertiary education system for environmental and resource management
 - MSc, PhD and post doc programs in One Health and Public Health in Indonesia and Malaysia

- Welfare guidelines based on sound scientific principles adopted
- Successful protection and sustainability other wildlife populations utilising the experiences gained with the orangutan
- Number of requests of non great ape taxa interested in the OVAG model – EXAMPLES VIA CHESTER ZOO – Passerine bird groups (Andrew), Chelonia groups (Gerardo), Zoos (Johanna)

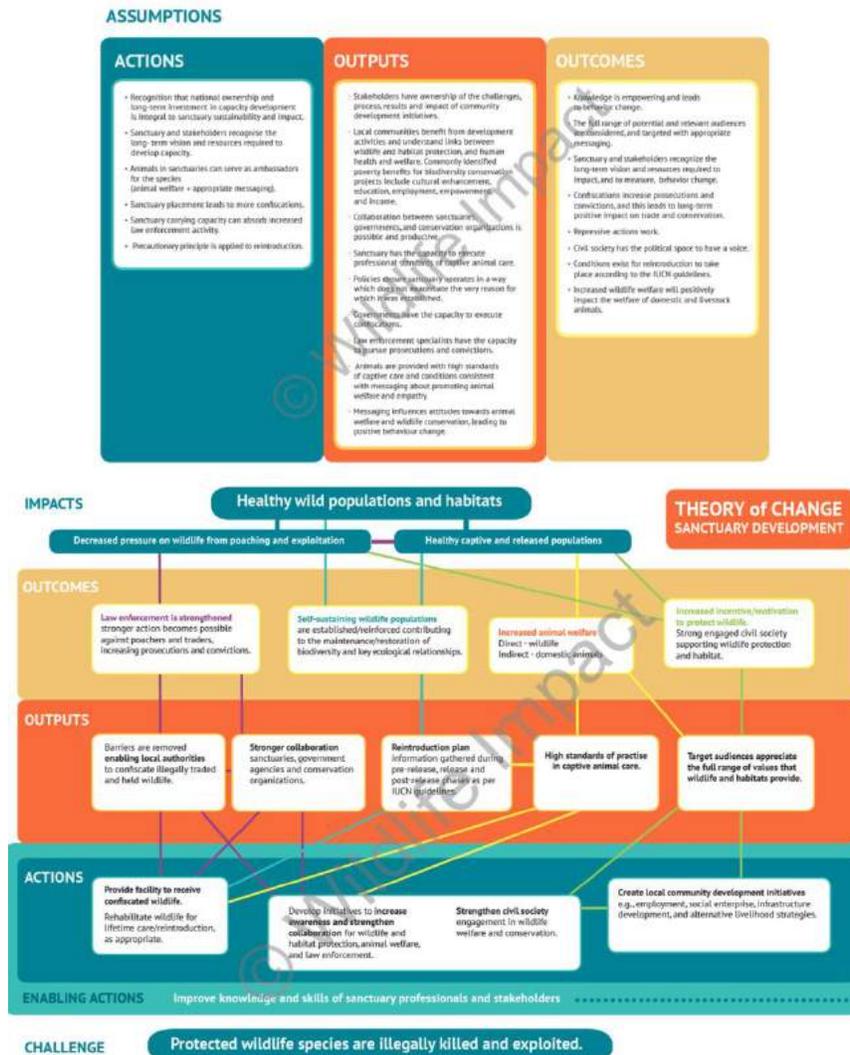
Step 7: Organize presentation (up to 5 minutes)

- Make sure you have captured all the key information; please be clear as we want to record your work.
- If you have not already, decide how you are going to present your work to the rest of the group e.g., one person, the whole group etc. Each group has 5 minutes to summarize their key findings.

Future Challenge: Develop a ToC for a sanctuary for orangutans that cannot be released to the wild, or a release project for 400 orangutans.

Challenge: Arrival rates of rescued orangutans in Indonesia is staggeringly high; over two-thirds of all of all great ape seizures are orangutans. Indonesia’s government has decreed that all healthy orangutans should be reintroduced by 2015. This remains an ongoing process but not all orangutans are sufficiently healthy to be released. One organization alone has released over 200 orangutans, plan to release another 400, but an additional 150 are not deemed eligible for reintroduction. Those not deemed eligible for reintroduction are not currently kept in facilities designed to provide life-time care.

Below are examples from Wildlife Impact.



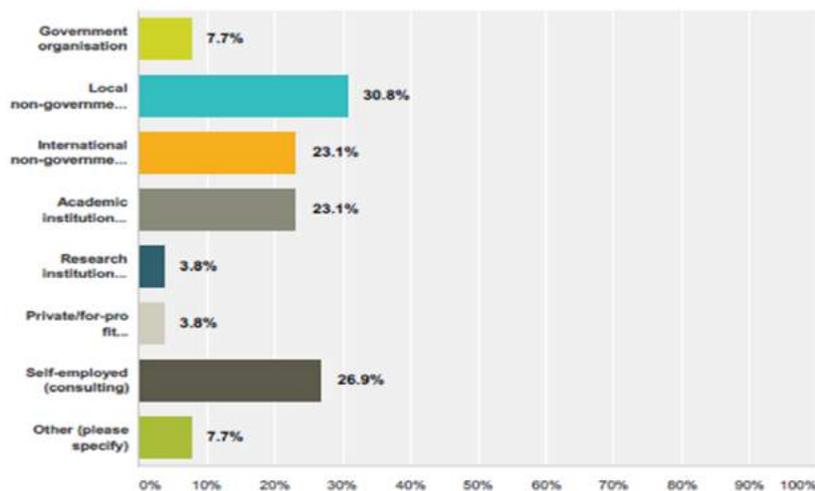
An important outcome of training is to increase participants' belief that they can affect change – this idea of perception of control. Additionally if a trainee's work environment was negative, the impact of training on practical skills, job performance and perception of control will be lower. The acquisition of conservation medicine theory and the opportunity to network has been consistently perceived by participants as improving their conservation performance.

Increasing Capacity – Perception of Control

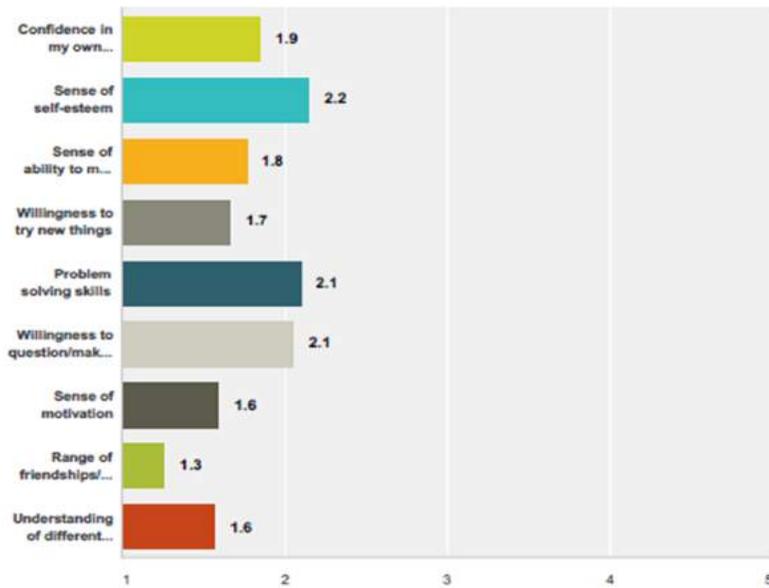


Feedback on OVAG questionnaire: N=57 . 28 in English 29 in Bahasa

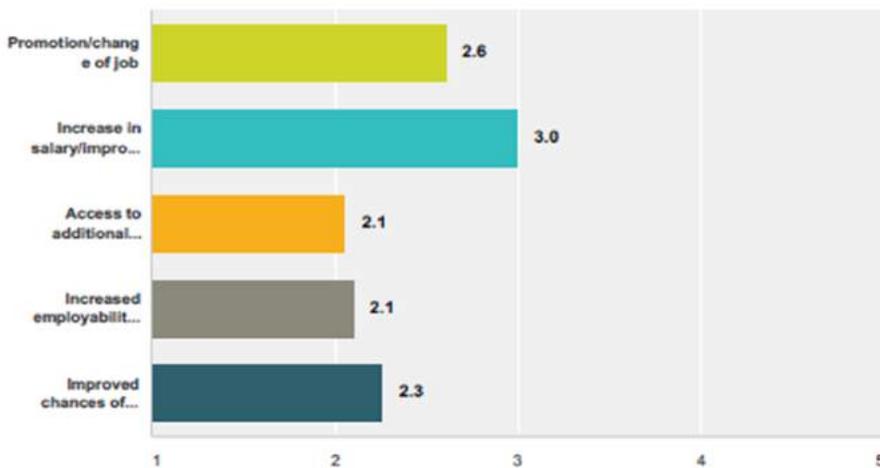
Question 8 results: Your current place of employment is with a.... (28 answered, 3 skipped)



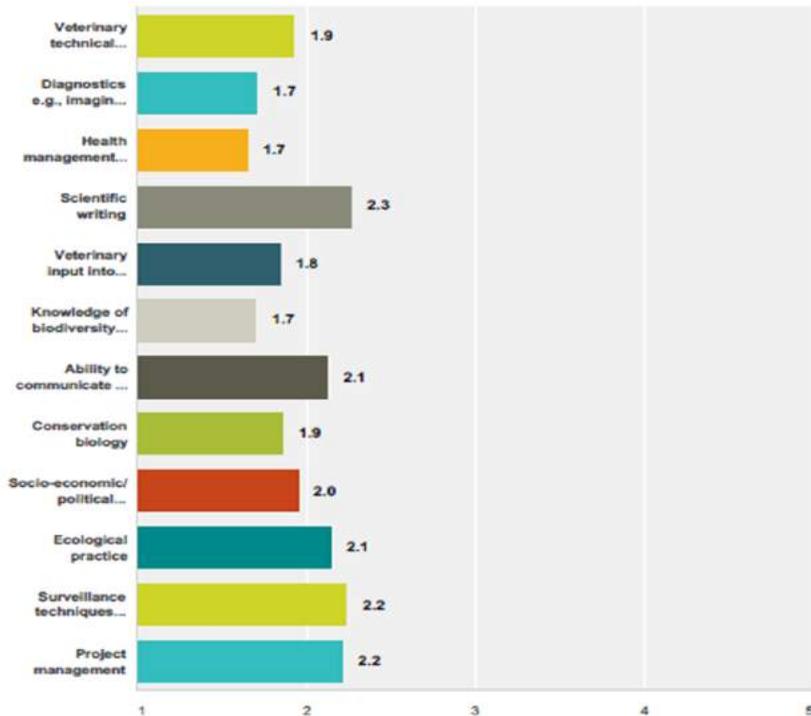
Question 12 results: Your participation in OVAG may have provided a variety of benefits for your personal development. Please tick one box for each statement that indicates whether the following has increased or decreased for you as a result of your involvement with OVAG: (25 answered, 4 skipped)



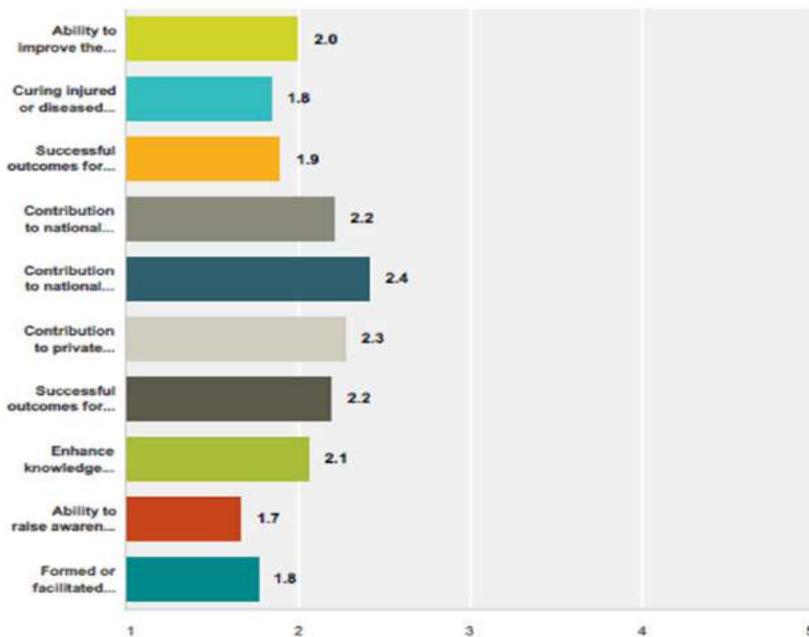
Question 13 results: Your participation in OVAG may have facilitated enhanced employability or economic advantages. Please tick one box indicating your level of agreement for each statement: (25 answered, 4 skipped)



Results for question 14: Your participation in OVAG may have provided a variety of opportunities to build and/or enhance technical skills. Please tick one box for each statement that indicates whether the following has increased or decreased for you as a result of your involvement with OPVAG: (25 answered, 4 skipped)



Results for question 17: Your participation in OVAG may have provided opportunities/enhanced your ability to contribute to biodiversity conservation, wildlife welfare and One Health. Please tick one box for each statement that indicates whether the following has increased or decreased for you as a result of your involvement with OVAG: (24 answered, 5 skipped)



Where is OVAG now?

1. CPD agreements: OVAG-UGM already in place, OVAG-Abaxis already in place. Forthcoming: OVAG-IPHP; OVAG-UPM, OVAG-SKU
2. 90% approval: achieved 85-95% approval over the last 5 years
3. 2018 hosting: Approached already by OIC and SKU (only vet school in Sumatra and only one with a wildlife field unit)
4. 30 organizations engaged – currently at 25

Not included - law ENFORCEMENT as that is an ongoing process – will need to integrate once have laws in place 2017 Targets achievable?

In addition to 5 years' worth of quantitative data on effectiveness of training techniques we also have the beginnings of narratives from the OVAG family:

1. *BOSF: From OVAG 2009 we agreed that all orangutans with positive Hep B serology should be tested for OuHV, and based on that, BOSF have been able to release more than 40 orangutans who otherwise would not have been released. As most of them are wild orangutans, they serve as important individuals in our reintroduced population in the release sites. Also, from that workshop we identified that PSSP is capable of doing the tests. From OVAG 2009 and 2010 we discussed and agreed about management of orangutans with TB, i.e. diagnostic protocols, and euthanasia decision for relapsed cases. This has improved our biosecurity and the welfare of the orangutans. Additionally for Nyaru Menteng, we have finished a DRA for TB, which identify gaps in our biosecurity protocol and the document has become a reference to our pre-release health check protocol/SOP for Reintroduction. At OVAG 2009, we learned about EMCV and how to manage a disease outbreak, which helped us a lot when having an EMCV outbreak in 2014. If we had not heard and learned about EMCV, we might not have been able to find the cause of the outbreak as fast as we did and would not have been able to get the tremendous help from Taronga Zoo. BOSF veterinarians now help lead OVAG.*
2. *Samboja: The voice of the vets is stronger now. Conservation managers are easier to be convinced when we say that the particular issue has been endorsed during OVAG meetings and or discussions (not necessarily and not only at annual OVAG meetings, but also by email or the OVAG WhatsApp group). We have managed to raise awareness of the presence of OVAG among wildlife communities in Indonesia, including wildlife centers, stakeholders (including governmental agencies) and students. Other wildlife communities now can see the benefit of the OVAG network for Indonesian orangutan vets, and this encourages them to create similar networks. Compared to other wildlife centers, orangutan centers have a relatively easier time finding new vets because the candidate recruits have heard about OVAG previously and therefore feel assurance at the prospect of finding support when they work at orangutan centers (this type of support is still a rare thing for vets working in other wildlife centers in Indonesia). We see that the vets who started working in/after 2009 at the orangutan centers stay longer than before (current average: more than 4 years). Vets know that skill improvement in many and various aspects is imminent. Knowledge has definitely increased (one vet said this is due to the fact that the discussions in the OVAG group are really focused and can easily be compared with the opposite situation as a member of other Indonesian wildlife groups). Confidence among the orangutan vets is being raised much higher since OVAG. OVAG meetings are "enrichment" for the orangutan vets, so it has been such a joy to be part of OVAG. Drh. Anta added that one of the reasons she is doing her PhD in orangutan health is because she is convinced at the prospect that we are going towards the right direction and that she somehow can participate.*
3. *OVAG as a group: IVMA accreditation, MoU with UGM, liaisons via university faculties to relevant Government departments (Ministry of Forestry Via Bogor and UGM, Ministry of Natural Resources and Environment via UPM) and direct (SWD)*
4. *Individuals: Ricko Jaya – from student to manager of a wildlife conflict unit in 6 years due to OVAG.*

Indicators Foundational:

- Number of participants and organizations engaged
- Number of CPD agreements
- Number of site One Health plans
- Number of individuals saved/ protected

- Successful, evaluated short course program delivered *via* UGM

Indicators OVAG Phase 2:

- Examples of Integration with other engagements including Indonesian zoo husbandry practices (CZ), EAZA welfare assessments (CZ), UPM engagement with the Malaysian Government (UPM); Elephant conflict work in Sumatra; SWD elephant and sun bear projects.
- Successful assisted enforcement of current animal welfare and wildlife law in Indonesia and Malaysia.
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- Integration of One Health into tertiary education system for environmental and resource management
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- Number and position of participants as decision makers

PHASE (2022) OUTCOME STATEMENT: There exists a sustainable regional cadre of professionals able to provide capacity building, advice, guidance and management of One Health matters with wildlife in Indonesia and Malaysia

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Aim to capture the key meaning (precise wording is not important for today).

Current Identified Pathways for Change for OVAG with assumptions:

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2. Policy: Government level decision-makers: A developed Animal Welfare Act for Indonesia (cf Malaysia). Academia: Integration of DRA and One Health into veterinary, biology and relevant post graduate programs

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4. Raising Awareness: Target – high level government about information gathered from pathways 2 and 3 and promotion of pathway 1.

Assumptions

Successful linking of participation, learning and outcome in mitigating health risks

Successful knowledge sharing leading to a measurable legacy

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Step 4: Identify a project intervention (goal or activity) for 1 of these pathways (up to 10 minutes)

Discuss the outcome and decide which interventions would best accomplish this.

Remember outcomes are the result of project interventions (strategies are normally a coordinated sequence of interventions, and activities are groups of actions that make up an intervention). For example, an intervention might be capacity building for law enforcement and the various activities needed to make that happen would be things like developing the curriculum for a training course, screening applicants, identifying trainers and venue, organize work placements and exchange visits etc.

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Successful assisted enforcement of current animal welfare and wildlife law in Indonesia and Malaysia.

Number and location of successful; protected orangutan releases

Number and success of OVAG participant organizations

Number and position of participants as decision makers in conservation health

Area protected

Number of participants successfully trained

Number and quality of scientific output

Number of Indonesians and Malaysians involved in conservation Indicators

OVAG PHASE 2 completion:

Integration of One Health into tertiary education system for environmental and resource management

MSc, PhD and post doc programs in One Health and Public Health in Indonesia and Malaysia

Welfare guidelines based on sound scientific principles adopted

Successful protection and sustainability other wildlife populations utilizing the experiences gained with the orangutan

Number of requests of non-great ape taxa interested in the OVAG model – EXAMPLES VIA CHESTER ZOO – Passerine bird groups (Andrew), Chelonia groups (Gerardo), Zoos (Johanna)

Step 7: Organize presentation (up to 5 minutes)

Make sure you have captured all the key information; please be clear as we want to record your work.

If you have not already, decide how you are going to present your work to the rest of the group e.g., one person, the whole group etc. Each group has 5 minutes to summarize their key findings.

GLOSSARY OF TERMS¹

Activities/actions implemented to bring about each of the outputs or outcomes on the pathway to change.

Assumptions are statements that explain connections between the desired changes, and the expectations about how and why proposed interventions will bring them about. They may be factors and conditions that are beyond the direct control of the project but are important to understand and monitor, to know that the project is achievable, and if it needs to be adapted in light of changes.

Evidence is existing empirical/scientific information used for supporting decision making.

Goals are statements about what a project aims to achieve.

Means of Verification are sources of evidence used to verify data or statements made during reporting, to ensure it is appropriate and applicable.

Impact is not intended to be achieved solely by the project. This is a higher-level situation that the project will contribute towards achieving.

Indicators are quantitative or qualitative variables used to assess change or occurrence of outputs or outcomes which allow you to demonstrate what you have achieved and when. The basic principle is that 'if you can measure it, you can manage it'.

Interventions are groups of actions/activities/tasks.

Logframe is a tool to manage your project, and measure progress.

Outcome is the change brought about by the projects actions – that is, what do you expect to achieve as a result of this project.

Outputs are what is produced by the projects i.e., if the outputs are achieved then the logic is that the outcome will also be achieved.

Pathways to change are a series of changes required to achieve long-term outcomes from implementation of project activities

Project is a distinct strategy planned and designed to meet specific goal(s). It is generally composed of a range of interventions with multiple activities implemented over the project timeframe.

Strategies are normally a coordinated sequence of interventions.

Target is a threshold or benchmark used to demonstrate progress or achievement of success.

Theory of Change is a specific and measurable conceptual model of the goals, interventions, assumptions, and outcomes of a project that forms the basis for strategic planning, on-going decision making, monitoring and evaluation.

¹ This list includes some terms not used in this lecture and document but commonly used in conservation.

Day 3 – 25 July at UGM

Genetic and Phenotypic Characterization of CF Airway Disease in Non-human Primates Chronic Respiratory Disease in Orangutans: Signs, Symptoms and the Search for the Cause

Jennifer Taylor-Cousar, MD, MScS Associate
Professor of Medicine and Pediatrics, Pulmonary
Divisions National Jewish Hospital, USA

Abstract

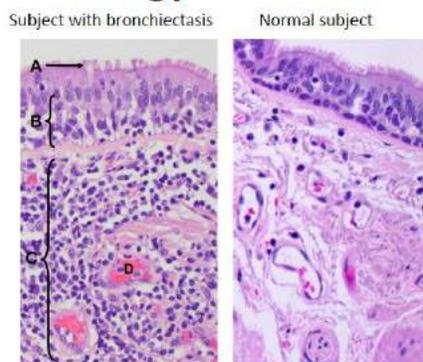
Gram negative rod infection, bronchiectasis and chronic sinus drainage characterize the respiratory syndrome that is present in approximately 20-40% of captive orangutans in U.S. and European Zoos, and leads to morbidity and mortality in this critically endangered species. Although, respiratory disease was originally thought to be related to zoo captivity, respiratory disease has also been identified in animals presenting to and/or residing in open air captivity in rescue centers in Borneo and Sumatra. Furthermore, a recent evaluation of predisposing factors demonstrated that diseased animals were more often genetically related to animals with respiratory disease (93%) than to healthy animals (54%).

During this presentation, we will discuss

- 1) Radiologic evaluation to identify early respiratory disease
- 2) Non-surgical treatment of respiratory disease
- 3) An update on the progress of the Orangutan SSP supported research study to identify a genetic cause of chronic Sino pulmonary disease in orangutans.

Bronchiectasis – a widening of airway (from the Greek) bronchos: airway and ectasis: widening

Pathology of Bronchiectasis



- A = pseudostratified columnar, ciliated epithelium;
- B = thickened epithelium with intraepithelial lymphocytes;
- C = submucosa with dense infiltrate of lymphocytes and plasma cells;
- D = blood vessel with reactive endothelial cells.

McShane et al. AJRCCM 2013; 188(6): 647-56.



Case courtesy of Dr Ian Bickle, Radiopaedia.org, rID: 34599; McShane et al. AJRCCM 2013;



Imaging of Bronchiectasis

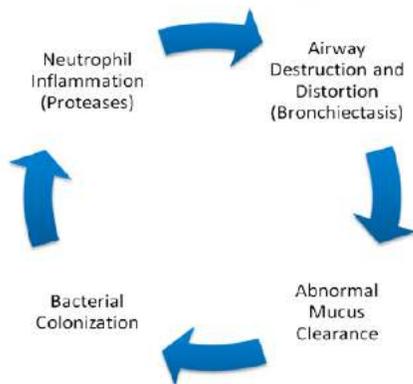


The specific criteria include the following:

- (1) The internal diameter of the bronchus is larger than that of its accompanying vessel; or
- (2) the bronchus fails to taper in the periphery of the chest

Causes of diffuse bronchiectasis in humans: Cystic Fibrosis (CF), Primary Ciliary Dyskinesia (PCD), Immunoglobulin Deficiency, Young's Syndrome, Rheumatologic Disease, Alpha-1 antitrypsin Deficiency and Idiopathic

Vicious Cycle of Lung Destruction

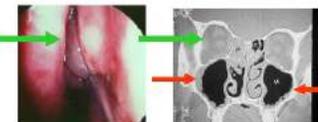
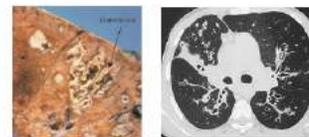


McShane et al. AJRCCM 2013; 188(6): 647-56.

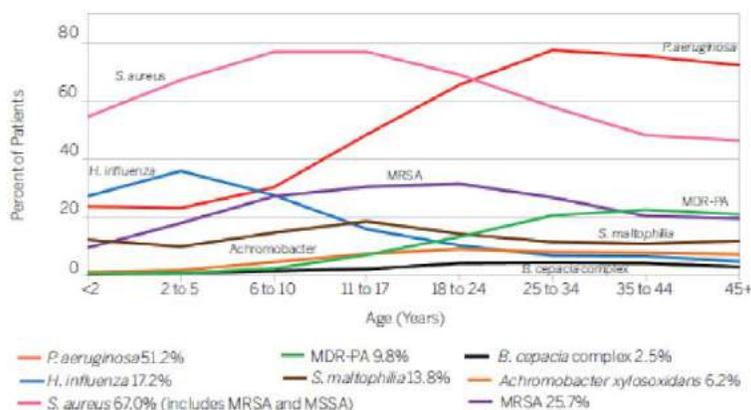


Respiratory Manifestations

- Pulmonary infections
 - Cough
 - Sputum production
 - Chest pain
 - Airway reactivity
- Sinus disease
 - Nasal polyps
 - Chronic sinusitis



Prevalence of Respiratory Organisms



CF 2010 Annual Patient Registry Report



Treatment of Bronchiectasis:

1. Principal One: Mobilize airway secretions (airway clearance)—treatment: hypertonic saline. When somebody gets bronchiectasis they have to consume drugs for the rest of their lives; take drugs for 28 days, stop for few days and continue again for 28 days.

Hypertonic Saline (HS):

Australia study: BID 7%HS for 1 year: small improvement in pulmonary function/substantially fewer exacerbations

UNC study: QID 7% HS for 14 days: improved pulmonary function/improved symptom scores

2. Principal Two: Control airway infection

Inhaled antibiotics: target *P. aeruginosa* / preventive maintenance therapy (cycled 28 days on/off)

Medicines: Tobramycin/Aztreonam/Colistin

Anti-inflammatory Therapy:

Low dose of erythromycin (400-600 mg qd) to treat diffuse panbronchiolitis (Japan studies)

-Patients has reduced morbidity and mortality

Chronic oral azithromycin (250 mg qd or 500 mg MWF) given to patients with CF

-Improved lung function and reduced rate of exacerbation/antimicrobial and immunomodulatory effects

Acute treatment of Bronchiectasis: Droplet versus Airborne Masking.

Droplet

- An infection that can be spread through close respiratory or mucous membrane contact with respiratory secretions
- Particles are large and generally travel no more than 3 feet from the patient
- E.g. Influenza, RSV, *N. meningitides*, pertussis, rhinovirus (common cold)
- Requires standard precautions plus **surgical mask**

www.cdc.gov

Airborne

- An infection that can be spread over long distances when suspended in the air
- Particles are very small (<5 μm), can also be transported in dust
- E.g. Chickenpox (varicella), measles, *Mycobacterium tuberculosis*
- Requires standard precautions plus **N95 mask**



Wearing a Mask

- Mask should **fully cover the nose and mouth, and fit snugly**
- **Wash hands** after removing mask



When you want to put on a mask, hold the strings; do not to hold the mask because it will affect the hands if there are droplets on the mask.

Symptoms of Pulmonary Exacerbations:

I	Symptoms
A	Increased frequency, duration, and intensity of cough
B	Increased or new onset of sputum production
C	Change in sputum appearance
D	New onset of increased hemoptysis
E	Increased shortness of breath and decreased exercise tolerance
F	Decrease in overall well-being, increased fatigue. Weakness, fever, poor appetite
II	Physical Signs
A	Increased work of breathing, intercostal retractions and use of accessory muscles
B	Increased respiratory rate
C	New onset or increased crackles on chest examination
D	Increased air trapping
E	Fever
F	Weight Loss
III	Laboratory Findings
A	Decrease in FEV ₁ of 10% or greater compared with best value in previous 6 months
B	Increased air trapping and/or new infiltrate on chest radiograph
C	Leukocytosis
D	Decreased SaO ₂

Treatment of Pulmonary Exacerbations:

RX guided by surveillance sputum cultures – *S. aureus*, *P. aeruginosa*, other gram negative bacteria
 Higher doses of antibiotics and often of longer duration
 Intensification of airway clearance regimen

Common Oral Antibiotics:

ciprofloxacin: 750 mg BID x 21 days
 levofloxacin: 750 mg daily x 21 days
 trim/sulfa: 2 DS tablets BID x 14-21 days
 linezolid: 600 mg BID x 14-21 days
 doxycycline: 100 mg BID x 21 days

Common IV Antibiotics:

piperacillin/tazobactam: 4.5 g q6hrs
 tobramycin: 10-12 mg/kg q24hrs
 ceftazidime: 2-3 g q8hrs
 meropenem: 2 g q8hrs
 colistimethate: 50-80 mg q8hrs

Respiratory Anatomy in Humans & Apes

Main difference: upper respiratory tract in apes

sinuses: large maxillary sinus / small sphenoid sinus / lack of frontal/ethmoid sinus

Extensive laryngeal air sac (air sac is connected to trachea so the liquid in air sac can be found in lung as well).

Lower tract is virtually the same across species.

Chronic Respiratory Disease in Captive Orangutans

Upper and lower airway disease (air sacculitis/pneumonia/bronchiectasis)

Occurs in approximately 20% - 40% of captive orangutans (also orangutans from wild to rehabilitation centers)

Accounts for about 16% of adult mortality – most common cause of death in adolescents in the U.S. captive population

Number one health concern of orangutan holding institutions

Etiology of Chronic Respiratory Disease

Incompletely understood

Chronic upper airway drainage contaminating the air sac (case series of juvenile Bornean orangutans with air sacculitis: 50% had evidence of upper respiratory tract infection in the 6 months prior to presentation)

Other hypothesized predisposing factors: exposure to human pathogens/overcrowding with fecal contamination of the environment/stress-related immunosuppression/altered airway flora related to chronic antibiotic use

Discussion:

Using hypertonic saline can breakdown the route and usually after flushing with saline and follow up with antibiotic it will speed recovery sooner. Maybe technically it is quite difficult to do in an orangutan. Also flushing with hypertonic saline should be done every day.

How to deal with an orangutan that needs to be anesthetized but has pus/liquid in its air sac? Do not have orangutan lying down before put intubation. Keep the head higher, put intubation, then lay orangutan down. That is to avoid the pus going down to the lung.

Orangutan Respiratory Disease, a Summary from Samboja, East Kalimantan

Agnes Pratamiutami (presenting), Chief Veterinarian, BOSF Samboja Lestari, **Nancy P. Lung**, VMD, MS. Veterinary Advisor, Orangutan SSP; **Jennifer Taylor-Cousar**, MD, MSCS Associate Professor of Medicine and Pediatrics, Pulmonary Division, National Jewish Hospital, USA

BOSF Samboja houses 172 orangutans: 40 adults, permanent captives, ex-TB / 74 = adults (14 to 31) long-term captives / 58 = forest school, pre-release / 25 identified with “respiratory disease” Ages from 7 to 25 years of age

Definition of Respiratory Disease: Inflammation and/or infection in any or all of the compartments of the orangutan respiratory tract: Sinuses / Air sac / Lungs

Identification of Respiratory Disease by Clinical Signs: Chronic nasal discharge / Sneezing / Enlarged, pendulous air sac / Coughing / Abnormal breathing pattern / Raspy breathing sounds / Foul smelling breath / Evidence of chronic headache

Of the 25 identified cases in June 2017, 7 are females and 18 are males. 20 have been chronic and/or intermittent since 2010 (beginning of medical records). 5 have had a single occurrence. Since 2010, Samboja vets have performed >60 x marsupialization procedures!! Guaranteed to be more than anyone else in the world!!

Case Management prior to study:

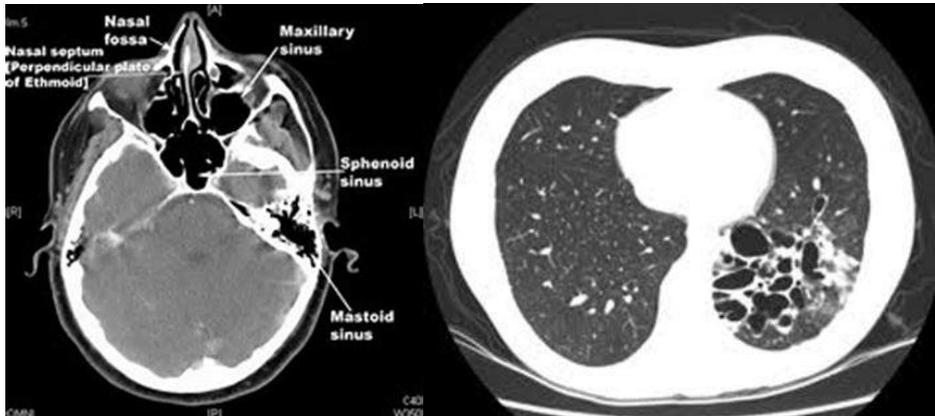
- Marsupialization of any enlarged air sac
- Flushing of the air sac every 1-2 weeks
- Re-opening the marsupial if it closes
- Lung wash
- Culture
- Antibiotics
- Chest x-rays
- Cbc

Purpose of the study: To broaden the focus on air sacculitis and look at the entire respiratory tract. Identify the best techniques to diagnose sinusitis, air sacculitis, pneumonia and bronchiectasis. To create a “respiratory disease scale” of severity that can be used by the orangutan medical community. To utilize treatment plans adapted from cystic fibrosis treatment in humans, then assess the efficacy of these treatments.

Early stages of the study (the learning curve):

Tried the **water’s view x-ray** to diagnosis sinusitis. Tried auscultation and chest radiographs. Created a respiratory exam and work-up check list to be followed for each procedure. Successfully partnered with the local hospital to do **CT scans** on affected orangutans at Samboja.

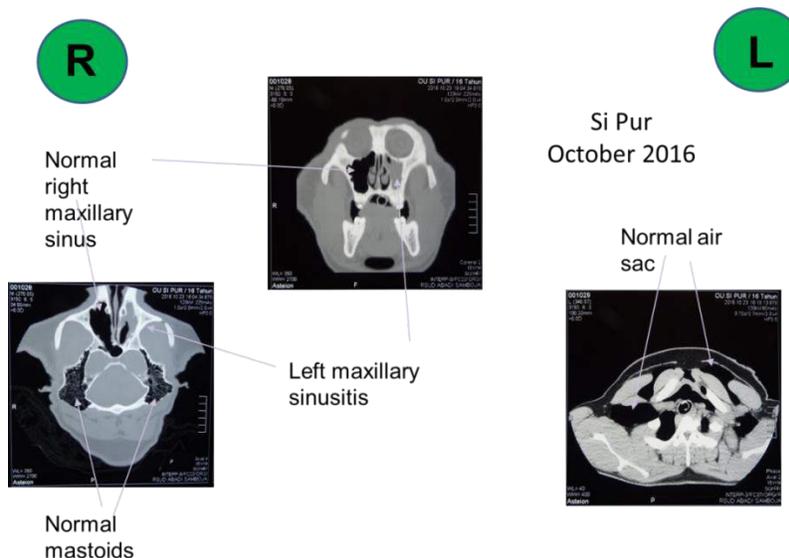
Why CT? It is currently the **ONLY** tool that can accurately assess all compartments of the respiratory tract! It is not practical for all centers, for all zoos, and for all orangutan respiratory cases, but maybe we can learn enough with the Samboja animals to make recommendations for all centers.



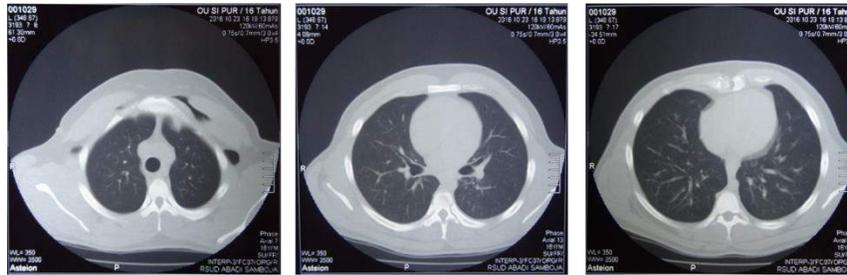
Logistics:

We needed a reliable portable gas anesthesia machine. We needed a reliable vehicle to transport the staff, equipment, and the orangutan. We needed no flat tires, deep mud or power failures. The hospital asked us to come late in the day and to cover the animal with a blanket so it would not be seen. The CT scan takes 15 minutes. (The entire process takes 4 hours)

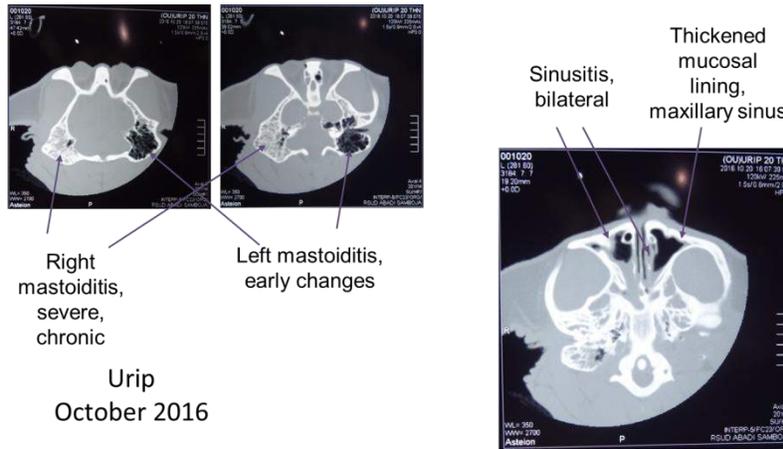
Case Study 1: Si Pur, a 17 year old male. Housed in Social Cage B. No history of respiratory disease except for recent mild, occasional nasal discharge. Has never had air sacculitis. Has never been heard coughing. Medical workup: Good body and coat condition, Nothing seen on rhinoscopy, WBC 8.49; HCT 34.74 (Oct ‘16), Lung wash done? No. Cultures taken? No. Thoracic auscultation: Normal. Throat sac palpation: Normal.



Si Pur, October, 2016 Normal lungs

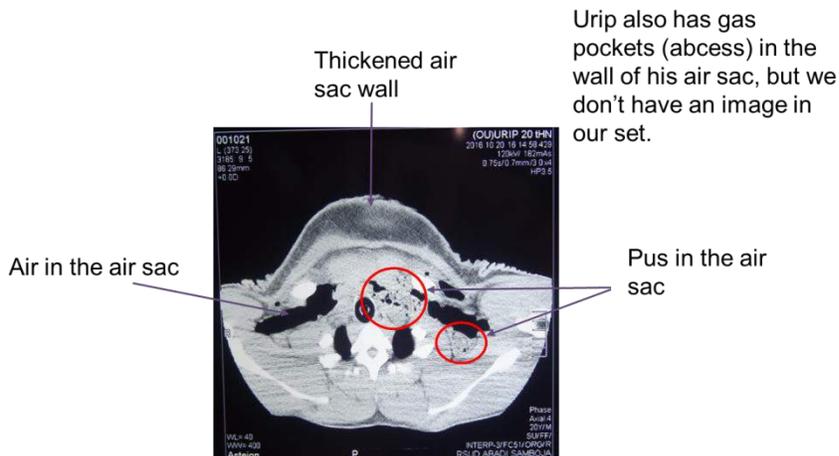


Case Study 2: Urip, a 19 year old male, housed in Individual cage. No history of respiratory disease except for recent mild, occasional nasal discharge. 1st episode of air sacculitis Oct 2016. Has never been heard coughing. Medical workup: Good body and coat condition, Nothing seen on rhinoscopy, WBC 4.37; HCT 31.31, Lung wash done? No. Cultures taken? No. Thoracic auscultation: normal. Throat sac palpation: heavy, thick air sac.



Urip
October 2016

Urip, Air Sacculitis



Urip,
October 2016

Urip also has anterior pleuritis, but we don't have an image of the lesion in our set



Normal in the upper lung fields

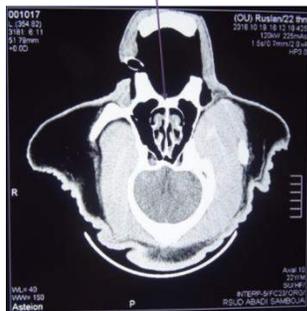
Starting to see infiltrates/pneumonia in middle lung fields

Infiltrates/pneumonia in the posterior caudal lung fields

Case study 3: Ruslan, 19 year old male, housed in Social Cage A. No history of respiratory disease, has never been heard coughing, 1st episode of air sacculitis June 2016. Medical workup: Good body and coat condition, nothing seen on rhinoscopy, WBC 14.82; HCT 35.75, Lung wash done? Yes. Cultures taken? Klebsiella pn. Pneumoniae, Thoracic auscultation: normal. Throat sac palpation: bigger, thick air sac.

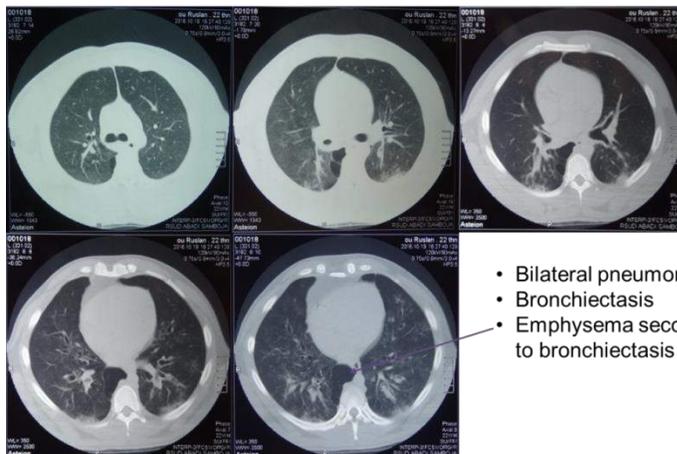
Ruslan,
October 2016

Sinuses are clear.
Chronic rhinitis,
bilateral



Ruslan also has mastoiditis, bilateral, chronic. We don't have an image of it in our set.

Ruslan,
Oct 2016



- Bilateral pneumonia
- Bronchiectasis
- Emphysema secondary to bronchiectasis

Case study 4: Pongi, a 22 year old male, housed in an Individual cage. History of respiratory disease includes nasal discharge, deep coughing, and headache. 1st episode of air sacculitis and pneumonia May 2013. Medical workup: Good body and coat condition, nothing seen on rhinoscopy, WBC 17.94; HCT 32.16, Lung wash done? Yes. Cultures taken? *E. coli*, Thoracic auscultation: **normal**. Throat sac palpation: marsupial closed.

Pongi,
October 2016



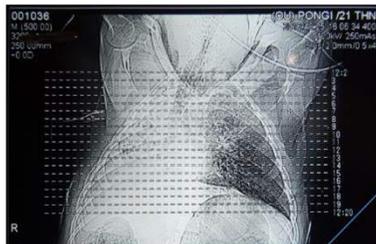
Mild mucosal thickening in the maxillary sinus. Otherwise the sinuses are clear.



Sphenoid sinusitis

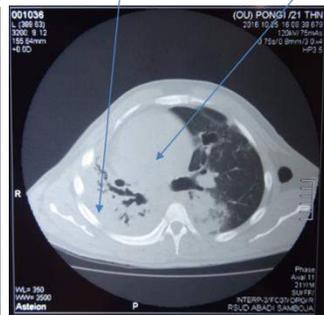


Normal mastoids



Pongi,
Oct 2016

- Consolidation of the right lung
- Shifting of heart, trachea to the right
- Pneumonia cranial left lung

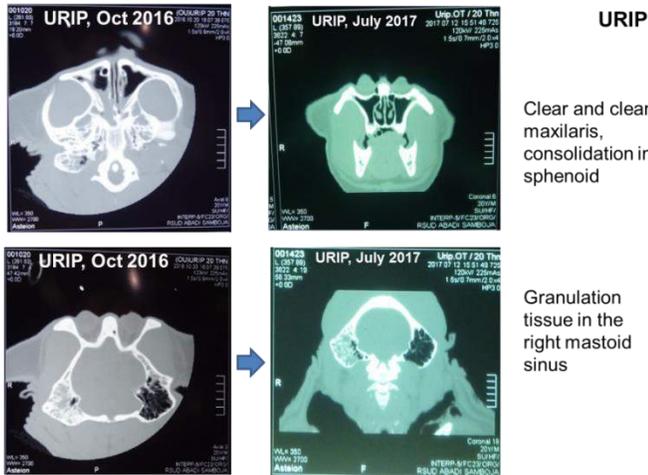


Findings of Study: Good job choosing cases for severity 1-4. There can be disease in any of the three parts of the tract without disease in the others (air sac without sinus/lung; lung without sinus/air sac/ etc.) Lung disease can be severe but silent (auscultation is normal, chest x-rays are normal or appear mild), animal looks healthy and alert (maybe coughs occasionally).

Treatment Strategy: Azithromycin 400 mg sid 3x/week / Levofloxacin 500 mg sid / Salbutamol inhalation 2.5 mg sid, in combination for 4-8 weeks. Cannot cure 100%??

Observed results: Nasal discharge stopped within a few days / Drainage of pus from the marsupial site stopped / Coughing decreased significantly / Behavior of headache went away / The orangutans seem happier.

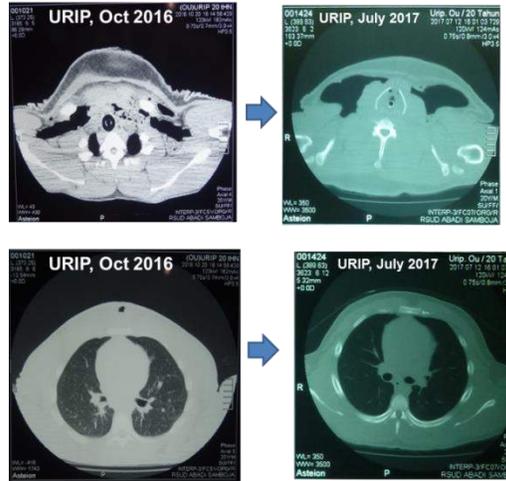
Measured results : Follow-up ct's



URIP

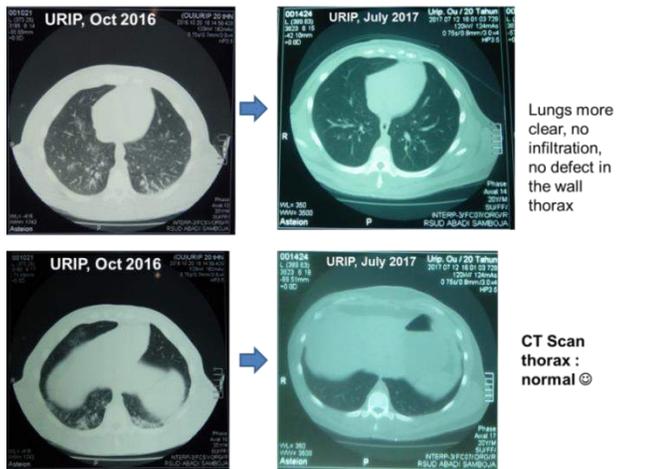
Clear and clean sinus maxilaris, consolidation in sinus sphenoid

Granulation tissue in the right mastoid sinus



normal thickness of air sac, no 'abses', no pus

Lungs looks clear, no infiltration



Lungs more clear, no infiltration, no defect in the wall thorax

CT Scan thorax : normal ☺

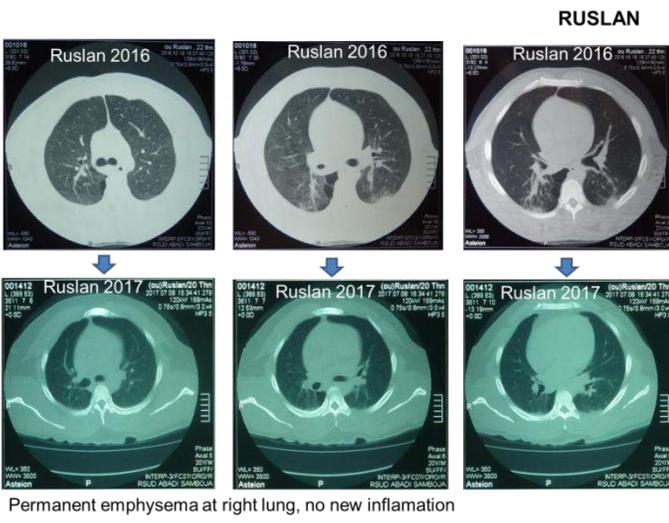
Measured results : Follow-up CTs



RUSLAN

Sinuses are clear. Chronic rhinitis, bilateral

Bilateral mastoiditis



RUSLAN

RUSLAN

Permanent emphysema at right lung, no new inflammation, no pneumonia ☺

Permanent emphysema at right lung, no new inflammation

Where to go from here? We only looked at 5 animals. We will evaluate and treat several other affected animals. Refine treatment protocols. Continue to train orangutans for nebulization. Perform additional before and after treatment CT's to properly assess efficacy of treatment.

At OVAG 2018, recommendations will hopefully be ready to share (or maybe in 2019), we will try to create a set of recommendations for the diagnosis and management of CRDO. We will publish the results. Create a CT atlas of respiratory lesions in orangutans. Buy stock in the company that makes azithromycin!!!

Discussion:

Give full treatment or choose the drugs on list of your presentation? Depends on the case, all the 5 orangutans in these cases received full drugs from the list shown in presentation. Is there any treatment scheme for these 5 orangutans? The treatments are based on the previous health results of the orangutans not on the CT Scan result, e.g. Urip and Ruslan are treated for air sacculitis. How long does it take from seeing the symptom to orangutan developing Pneumonia? Orangutans are smart and they cover the pain, so it is difficult to give the exact time, but once you see the orangutan with nasal discharge then you have to think about it and observe it cautiously. During fires, there is a respiratory and eye problem (eye irritation). In Nyaru Menteng a month after forest fires many orangutans showed air sacculitis problems. It is reported also that after forest fires the orangutans long call changes. In Singapore Zoo orangutans also get respiratory problems during forest fires.

Infectious Diseases Of Orangutans In Home Ranges And In Zoos

Joost Philippa and Rosalie Dench

(presenting), External Advisors to Borneo
Orangutan Survival Foundation

Abstract

This presentation is a summary of a book chapter recently submitted to Fowler's Zoo and Wild Animal Medicine Vol. 9, with the intention of highlighting the differences in infectious diseases encountered in orangutans within Indonesia and Malaysia, from those in zoo populations in other countries. Some of these differences are due to geographical and climatic factors, particularly for vector-borne pathogens. Effective vaccination and disease eradication programs in some countries have limited the incidence of certain pathogens and reduced exposure of zoo populations to these agents. Other factors include degree of human contact, size of population, population stability and susceptibility due to stress.

The major viral, bacterial and parasitic infections of orangutans are presented in tabular form, with an indication of whether it has been confirmed in the wild, in rehabilitant populations or in zoos elsewhere. Specific diseases of interest are discussed in greater detail.

Air Sacculitis: Prevalent in both zoos and rehabilitation centers but no published reports from the wild. There is a degree of individual susceptibility, but husbandry factors play a role including inhalation of fecal contaminants, crowding, and smoke pollution. In zoos most published cases are adults, but in rehabilitation centers the highest incidence is in juveniles (2-8 years), which may reflect the relative population structures.

Plasmodium: Malaria is the most common clinical infection diagnosed in orangutan rehabilitation centers, but rare in temperate zones where most zoos are located, due to the range of the Anopheles vector. Risk in captivity is increased due to population density (relative to the wild) most of which are at ground level, where there is a higher density of mosquitoes than in the canopy.

Arboviruses: These viruses, including Dengue, Japanese Encephalitis, Zika and Chikungunya, are also vector-borne and present in the orangutan home range countries but rarer elsewhere. Serological evidence of these infections has been found in orangutans but the viruses have never been isolated. It is known that these antibodies have a high level of cross-reactivity and so exactly which viruses are involved is unclear.

Hepatitis B: The prevalence of human HBV infection is relatively high in orangutan home ranges, and it is known that cross-species transmission can occur. Orangutans have genetically very similar HBVs, which appear to be non-pathogenic, but antibodies cross-react with human HBVs, so specific PCR is required to confirm the strain of HBV in a positive case. Measures should be taken to prevent zoonotic transmission.

Tuberculosis: Cases of TB have been reported in zoo and rehabilitant orangutans, but never in the wild. Determination of TB status is important both to zoos and rehabilitation centers. The potential for a latent state, and tendency for orangutans to react strongly to common diagnostics, complicates this process. Recent work suggests a comparative tuberculin skin test can be accurate for determination of TB status in orangutans.

Diseases of Interest are air sacculitis / malaria / arboviruses / hepatitis B / tuberculosis. Currently, there are 987 captive orangutans housed in 217 institutions worldwide. Within home ranges, more than 1000 animals are housed in (semi-captive) reintroduction centers. Limited information exists overall on orangutan diseases and it is important to know which

diseases are relevant to each situation. Different information is available with zoos often having access to better diagnostics. However, *in situ* centers have larger populations. The differences are due to pathogen and vector distribution at the various locations; stability and size of any given population; zoonotic pathogen issues; and susceptibility (regarding immune status and stress issues). There are 100 major pathogens (viral, bacterial, parasitic, fungal) that have been identified as confirmed in the wild, in rehabilitant populations, in zoos or elsewhere.

Air sacculitis is prevalent in both zoos and rehabilitation centers (as of yet there have been no published reports from the wild population). Susceptibility appears to be due to husbandry factors such as inhalation of fecal contaminants, crowding and smoke pollution. In rehabilitation centers the highest incidence is in juveniles (2-8 years), in zoos most published cases involve adults.

Malaria is the most common clinical infection diagnosed in orangutan rehabilitation centers and the vector is *Anopheles*. Susceptibility risk in captivity seems to be due to high population density (relative to the wild) and being at ground level where there is a higher density of mosquitoes than in the canopy.

Arboviruses such as Dengue Japanese Encephalitis, Zika, and Chikungunya are all vector-borne and present in orangutan home range countries. Serological evidence of these infections has been found in orangutans but the viruses have never been isolated. It is known that these antibodies have a high level of cross-reactivity and so exactly which viruses are involved is unclear.

Hepatitis B is highly prevalent (human HBV infection) in orangutan home ranges. Measures need to be taken to prevent zoonotic transmission. Orangutans have genetically very similar HBVs, which appear to be non-pathogenic, but antibodies cross-react with human HBVs. Specific PCR is required to confirm the strain of HBV in a positive case (whether simian or human).

Tuberculosis has been reported in zoo and rehabilitant orangutans, but never in the wild. Determination of TB status is important both to zoos and rehabilitation centers (especially if individuals in centers are being considered for release). Latent state, and tendency for orangutans to react strongly to TST, complicates diagnosis. This necessitates the need for multiple screening tests. There are recent guidelines available for accurate interpretation of comparative tuberculin skin test specifically for orangutans.

As there are important differences in infections in zoos and rehabilitation centers, they warrant understanding and careful interpretation of diagnostic tests. There is a lot we still don't know, especially about diseases of wild orangutans.

Discussion:

Considering the risk of getting malaria, this is another reason to support orangutans from centers to live high up in the trees so they can avoid mosquitos.

Case Studies:

Management for Albino Orangutan (*Pongo pygmaeus*) in BOSF Nyaru Menteng, Central Borneo

Fiet Hayu Patispathika, BOSF Nyaru Menteng

Abstract

Albinism is a genetic disorder characterized by a deficiency or absence of melanin, a pigment that affects the eyes, skin, and hair. Albinism can be total or partial. Health complications related to albinism: Vision and hearing defect, skin cancer, Hermansky-Pudlak Syndrome (HPS) (less common), Chediak-Higashi Syndrome (CHS) (less common).

Alba is a female albino orangutan, ± 5 years old. She was confiscated from people in Tanggirang village, Supang, Sei Hanyo, Kapuas Hulu, Central Borneo. Based on the stories, this orangutan was in the villager's field for ten days, and was cared for by the people for two additional days.

At the end of April 2017 the BOSF Nyaru Menteng team saved a five year old female orangutan (*Pongo pygmaeus*) from Tanggirang village, Supang, Sei Hanyo, Kapuas Hulu, Central Kalimantan. According to reports, the orangutan was adjacent to a garden area for 10 days, and was kept by residents for two days. Body condition was thin, weak, and slightly dehydrated. She had pale cream-colored skin, white to golden hair, and blue eyes. This orangutan is diagnosed with oculocutaneous albinism (OCA). This is the first case of albinism recorded in orangutans.



Alba

Intensive treatment was carried out by BOS Nyaru Menteng medical team to restore health. Initial health management conducted on Alba followed the new orangutan procedures for all arrivals to the reintroduction center, i.e., health check including body measurement, weight, fingerprinting, dental check, eye and ear check, chest X-rays, tracheal rinse, full blood examination (routine hematology and blood biochemistry) Serological Hepatitis B, microchip installation, cardiac examination (ECG), and ultrasound (ultrasound) and urinalysis check and fecal check. During the first 60 days, the orangutan was treated at the new orangutan quarantine facility.

During the quarantine period, this albino orangutan exhibited sensitivity to light and nearsightedness especially in bright light conditions. In addition to eye defects, albinism also affects hearing and leads to high susceptibility to skin cancer due to the absence of melanin.

A complete analysis of the health profiles of this albino orangutan, along with behavioral analysis, social relationships, and the genetic impact of albinism on genetic conservation of orangutans in general, is a consideration for making risk analysis for the future of Alba. For now the BOS Foundation will take care of the orangutan through the quarantine period, and then she will be incorporated into the forest school. In the future, she will live in a nature reserve managed by the BOS Foundation.



Alba's arrival:

Along with her condition mentioned above, Alba also had poor pupil reflex. Her left eye was swollen, and produced water (tears), the team massaged her eye and after 2 weeks the swelling reduced.

www.orangutan.or.id



X-ray



tracheal wash



Teeth check (M1)

Alba's tracheal wash :

- ✓ PCR *M. tbc*,
- ✓ Prep.ZN check,
- ✓ Aerobic bacterial Culture,
- ✓ *M. tbc* culture

www.orangutan.or.id



Blood check

- ✓ Full Blood Check (hematology and biochemistry) and Hepatitis-B serology.
- ✓ Hematology and biochemistry (routinely).
- ✓ Hematology results showed in normal range (checked 9 times).
- ✓ Biochemistry results showed that Potassium range is increased → pay attention → diet arrangement and blood check routinely.



- i. Ear and skin check,
- ii. Eyes check include :
 - eyes condition
 - fluorescens test,
 - pupil reflect,
 - eyes tension manually



Health screening...

www.orangutan.or.id



Temperature check



Ultrasonography (USG)



Microchip Implant



Finger print

Health screening...

www.orangutan.or.id



BEHAVIOUR ANALYSIS

www.orangutan.or.id



Behavioral Analysis: in hot weather, she climbed up a tree about 3 meters high. Then she climbed about 15 meters high. In a bright room she can see a distance of about 2 meters. In a dark room she can see about 4 meters.

Plans for Alba: Comprehensive and ongoing risk analysis of the health, behavior, social interaction to see the impact of albinism in orangutans. Genetic investigation: type of albinism, which genetic cause it, and to understand the dynamic of the population genetics. Finish quarantine; try to have her join with other orangutans in forest school. Hopefully she can be placed long-term in a natural sanctuary e.g. River island, or man-made island.

Discussion:

Is Alba's family known/identify? No. When people found Alba, she was alone in the forest. There is a plan to put Alba on the island with other orangutans. Question, what if she mates and has a baby? Probability of having albino offspring is small since cases require that both parents have albino gene. Also, when releasing her, put her in a new forest (not her forest of origin) to avoid mating/inbreeding with members of her family.

Cyst Ovary An Juvenile Sumatran Orangutan In Sumatran Orangutan Quarantine Center- North Sumatra

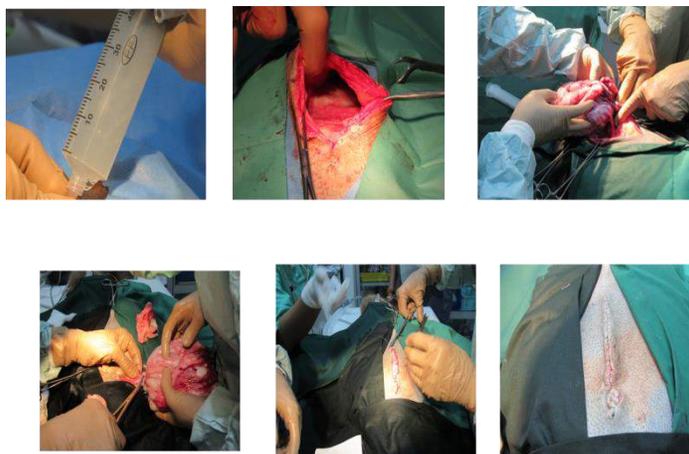
Meuthya (presenting), and Yenny Saraswati
Sumatran Orangutan Conservation Program

Abstract

A juvenile female Sumatran Orangutan (*Pongo abelii*) who has been confiscated from illegal pet in Southeast Aceh, with estimated age around 7 years old, arrived in quarantine on August 13, 2011 and she already been 5 years at the Sumatran Orangutan Quarantine Center. Since 2016, she seems less active, bloating on her stomach, and less eat as well. We done medical check on August 2016, and we found hard irregular mass on central abdomen, pale on her mucosa, always shown bending over. A large abdominal mass was identified during Ultrasonography examination, that was fluid filled. We done barium contrast Rontgen for intestine examination, but we didn't found any particular abnormalities from her intestine gut. Her blood picture shown raised tumors marker CA 19-9 and CA and anemic hypochrome microsite and indicated with systemic inflammatory response syndrome.

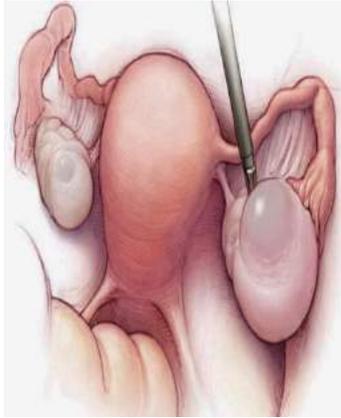
Exploratory laparotomy, after assembly of a surgical team, confirmed that the 700 gram cystic mass was associated with left ovary. Histopathology confirmed the left ovarian mass was an endometrium cyst. The right ovary seems normal, with diameter less than 2 cm. Recovery was uneventful and the orangutan was prescribed with antibiotic. Hormone therapy was not implicated. A month after surgery, she seems more active and less tendencies in her stomach. The main cause of the incident is still not known for certain.

Seroja, a young 7 year old female weighing 20 kg arrived at the center in August of 2011. In 2016 she appeared less active, had a very large abdomen and had little appetite. Initial test results: there was an irregular mass on central abdomen and the mucosa was pale. The large abdominal mass identified during ultrasonography examination showed that it was fluid filled. A barium contrast Rontgen for intestine examination was performed, but no particular abnormalities were found. Seroja's blood did show raised tumor markers CA 19-9 along with anemic hypochrome microsite, indicated with systemic inflammatory response syndrome. Laparotomy was performed to find out what was inside the abdomen. Laparotomy found a 700 gram endometrium cyst in the left ovary which was surgically removed.



Post-surgery treatment: Day 1 – 15: antibiotics 285 mg (Amocyclav syrup) / Day 1-5: analgesic (Meloxicam) 7.5 mg Maltofer ½ tab for multivitamin. She was kept in a single cage and her would was checked regularly. She is now healthy.

Conclusion: Germ cell tumors are uncommon in domestic animals but occasionally occur in female mammals. Ovarian teratomas have been reported in nonhuman primate species including the common marmoset (*Callithrix jacchus*), a vervet monkey (*Chlorocebus pygerythrus*), rhesus macaque (*Macaca mulatta*), crab-eating (*Macaca fascicularis*), pig-tailed macaque (*Macaca nemestrina*), Hamadryas baboons (*Papio hamadryas*), and an orangutan. The report in the orangutan is included in a tabulated list of primate neoplasms without histologic description. In women, cystic teratomas/dermoid cysts can occur at any age but have a propensity to be diagnosed during the reproductive years (age 20–40 years). Similarly, many diagnoses in nonhuman primates have been in relatively young animals, the previous case in an orangutan was an 11 year old female. Ovarian cysts are one of the most benign gynecological tumors. Cysts in the ovary appear as a fluid-filled bag like a balloon filled with water. Based on the level of ferocity, the cyst is divided into two: non-neoplastic and neoplastic. Non-neoplastic cysts are benign and usually deflate on their own after 2 to 3 months. Neoplastic cysts generally need surgery (but can depend on the size and nature of the cyst).



Owen, E 2005 Health Guidelines for Women

Ovarian cysts are caused by two disorder formations of the hormones in the ovarian and hypothalamic feedback mechanisms. Estrogen is a secretion that acts as a follicular hyper secretory response of hormonal stimulation. Use of stimulating drugs on ovulation can lead to hormone imbalance (Mansjoer,2000). Impaired balanced hormones can increase Luteinizing Hormone (LH) which can persist so as to cause an ovulation disorder(Lywellyn,2001). This case is an uncommon case in orangutans especially at a young age. One of the causes of cyst ovary cases is hormone imbalance. However, it is preventative.

Owen, E 2005 Health Guidelines for Women Jakarta: PT. Achievement Pustakaraya.

Prawirohardjo, S. 2002. Gynecology. Jakarta: Yayasan Bina Pustaka

Prat J. Female reproductive system. In: Damjanov I, Linder J (eds.). Anderson's pathology, Volume 2, 10th ed. St. Louis (MO): Mosby; 1996. p. 2231–2309

Gyimesi, Z. S., Forrester, J. W, Doering, D. L. Burns, R. B. and McManamon. (2015) Ovariectomy due to a dermoid cyst in an orangutan (*Pongo Pygmeus*) Journal of Zoo and Wildlife Medicine,46(1):167-170.

Discussion:

When the left ovary was removed, was the right ovary also taken out? No, because the right ovary was normal. At present, there is no treatment for Seroja. The right ovary is being monitored using USGS. Have the hormones already been checked? It is planned but has not as yet been conducted. Clinical signs: not active and is mostly lying down. No other symptoms observed

Chronic Septicemia Infection In A Male Orangutan “Momo”

Waluyo Jati, Sintang Orangutan Center

Abstract

Case study follow up on a case presented at OVAG 2016 on orangutan Momo who suffered clinical signs of illness after being moved to forest school. Laboratories results for Gram stain from pus sample showed cocci bacteria, Gram positive and blood morphology showed anemia, dehydration, chronic systemic infection. Momo died after 2 months of treatment.

Momo is an 8 year old male weighing 48 kg. In 2014 he was moved to the forest school in Tembak, Tempunak West Kalimantan. There are currently three orangutans showing similar symptoms in the forest school: swollen lymph glands on the neck, loss of appetite (with pain when swallowing), and fever.

1st case: “Digo”, a 3 year old female. She became ill in January of 2016. Action taken: 3 times drainage surgery in the lymph gland then treated with the antibiotic cefadroxil.

2nd case: “Inul”, a 10 year old female. She became ill in July of 2016. Action taken: 2 times drainage surgery in the lymph gland, and then treated with the antibiotics Ceftriaxone and Acetylcysteine. After 14 days of treatment, Inul died.

3rd case: “Momo”, an 8 year old male. Showed the following clinical signs: swollen lymph glands on the neck, loss of appetite (pain when swallowing), and fever. Action taken: open drainage surgery to allow pus o drain out from left neck lymph gland; fluid therapy, antibiotic treatment (combination Ceftriaxone and Enrofloxacin, Levofloxacin and Metronidazole), analgesic, multivitamin, anti-inflammatory, thorax and abdomen X-ray.

Laboratory results:

Test	Result
Blood Test express	Anemic, dehydration, chronic systemic infection
Thorax and Abdoment X-ray	Normal
Ziehl–Neelsen stain with Sputum sample	(-) negative
Gram stain from pus sample	Coccus Gram positive
Culture from blood sample	Not Grow

Momo’s condition fluctuates but did improved but he died 2 months after treatment. From blood morphology result was chronic septicemia, a bacterial infection. Since these three cases, better biosecurity protocols have improved and there have been no further outbreaks.

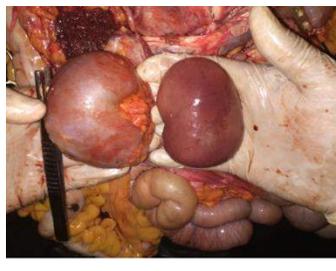
Momo’s Autopsy:



Hepar adhesion with abdoment wall



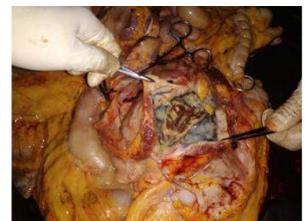
abdoment view



Swollen kidney



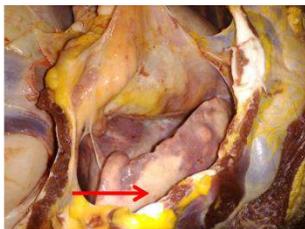
Hepatomegaly



Athropy, filled by pus, adhesion with the other organ and abdoment wall



Pus in Bronchus



Pulmo Hepatitition

Principals of Anesthesia Phase 1

Nancy Lung, Veterinary Advisor, Orangutan Species Survival Plan
Presented by **Javier Lopez and Ghislaine Sayers**

“Do I need to monitor every patient every time? No – only the ones you want to keep alive”

Motto from the American Society of Anesthesiologists to live by: “We safeguard those who sleep”.

Motto from the American Board of Anesthesiology: Vigilance - vig-i-lance – noun, the action or state of keeping careful watch for possible danger or difficulties.

What to remember: When you anesthetize an orangutan, you literally take its life into your hands. You have assumed 100% of the responsibility for keeping that animal alive and safe.

Of all the responsibilities you have every day, providing safe, efficient, and effective anesthesia is the MOST important one!! (None of the other responsibilities matter if the animal is dead). Meeting that responsibility takes commitment on

your part! Read, Learn, Ask questions, Practice, Experiment, Observe. Adjust protocols based on your experience. There is no one-size-fits all anesthesia protocol!! Every patient and every procedure is unique.

The Components of a Good Anesthesia:

- Low stress (don't want a catecholamine surge)
- Safe induction (protected from falling, quick access if needed)
- Stable cardio and pulmonary parameters throughout
- Proper ventilation
- Maintenance of ideal body temperature
- Maintenance of hydration
- Safe emergence (waking up)—no fall risk, head extended, padded, warm and dry

How to Achieve a Good Anesthesia?

Planning + Preparation + Execution = Success!!

How do each of you define success?

What are the goals of the procedure? (quick blood sample vs orthopedic anesthesia will have different anesthetic needs) / Review patient history / Review current health status of the patient / Choose the drug combination and doses best for the procedure / Choose the delivery route / Assign roles to staff—Always assign a primary anesthetist / What equipment will you need? / What could go wrong? / Are you ready?

Everything is directed by the primary anesthetist. Ensure all equipment is in good working order. Check darts and dart gun, leak-test anesthesia machine. Check stock of drugs, oxygen, emergency drugs. Prepare the patient (fasting, any pre-procedure medications). Communicate the plan to the medical and animal care staff. Be sure roles are clearly understood. Arrange transport, if needed. Prepare for unexpected events. Move the animal to the induction area.

Execution:

Procedure directed by the primary anesthetist. Dart quickly and accurately. Begin monitoring as soon as the dart hits (watch breathing and body position). Gain access to the animal as soon as it is safe. Position in lateral recumbency with chin extended. Monitor heartrate as soon as you can touch the animal. Maintain depth of anesthesia, hydration, body temperature. Cushion body parts. Lubricate eyes. Monitor throughout. Observe throughout recovery.

Orangutan Safety: (Remember, you are the KEY to safety!!!)

Dart in a small, low enclosure (cannot climb and fall). Position in lateral recumbency with chin extended as soon as you can (they breathe better and any pus in the air sac will not enter the ostia). Move on a stretcher or net (you can control their position). Avoid carrying by the limbs (strain on joints and ligaments). Use adequate drugs to avoid arousal. Do not use so much drug that you depress the heart and lungs!

Human Safety:

Educate all staff on proper protocols. Use good judgment on dart trajectory. Use drug combinations and doses that do not facilitate spontaneous arousals. Wrap the animal's hands (so if he wakes up he cannot grab anything).



Be Prepared to handle complications. Crazy things can happen!!!! Such as, trauma/fracture from a fall during induction, chin down, not moving air well, aspiration of regurgitated material, aspiration of air sac material, cardiac or respiratory

arrest, spontaneous arousal (**do not use xylazine**). **The best way to avoid complications is to plan, prepare and execute well.**

List all of the great things you see in this picture:



The orangutan is being kept warm and the head is supported. Oxygen supplementation is being supplied. Gas anesthesia is connected and can be used as needed. The endotracheal tube is inserted to an appropriate depth and is tied in place so it does not change depth during the procedure. The patient is being monitored by pulse oximetry and capnography. The eyes are kept closed to protect the corneas from desiccation. There is an anesthesia recording sheet to document drugs given, times, physiologic values and any complications. Strive for this Quality EVERY Time!!

ANESTHESIA Phase 2 The Equipment

The darting equipment:



The pistol or rifle: Store them flat, especially the barrels. Keep the barrels clean and dry inside. Maintain the rubber seals as needed. Will fail to hold pressure if very hot or very cold. If stored and used properly, these are mostly maintenance-free and last forever.

The darts: Why do dart failures happen? Sticky plungers (often result in partial injections). Improperly pressurized. Clogged needle. Understanding and properly caring for your darts will reduce the frequency of dart failures. Wash thoroughly with clean water. Chlorohexidine makes the plunger sticky. Lubricate the plunger with silicone oil or cooking oil—small drop. Move the plunger back and forth a few times to lubricate. Clean needles thoroughly and flush the needle to clear the hole

The blowpipe: Sticky plungers (often result in partial injections). Improperly pressurized. Clogged needle.

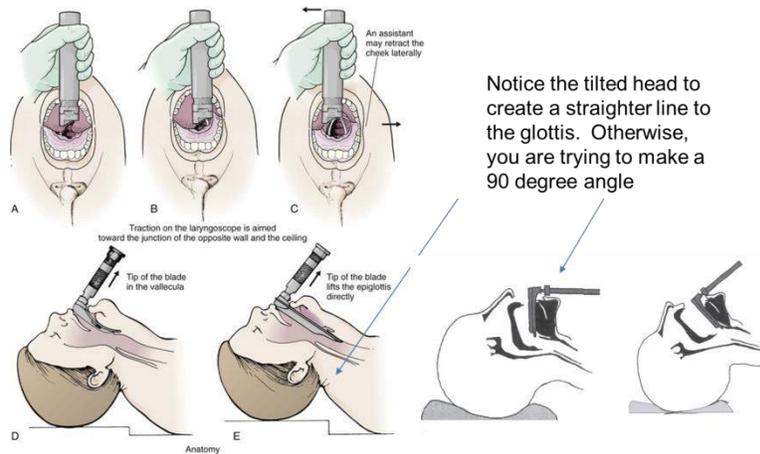
Laryngoscope - Straight and Curved Blades:

Which is better?



Personal preference: Straight is better for obese patients and when the patient is in lateral recumbency. Curved is better if you cannot tilt the head back very far when the patient is in dorsal recumbency.

Endotracheal Intubation: With the patient in dorsal recumbency

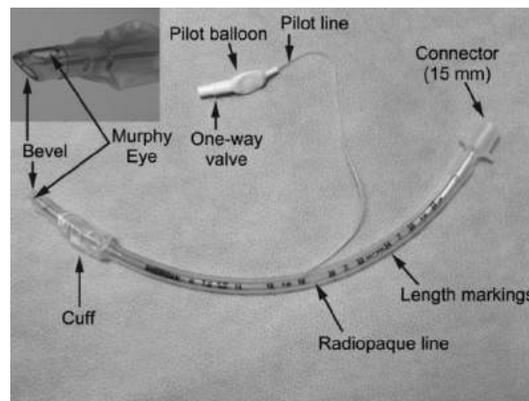


Endotracheal Intubation: With the patient in lateral recumbency

This method is MUCH easier and faster. It is Nancy Lung's preferred method. It is much easier to extend the neck to get a straight line to the glottis. You are looking and working forward rather than upside-down.

Lateral Intubation: Use stir-ups behind the canine teeth to open the mouth and extend the head/neck.

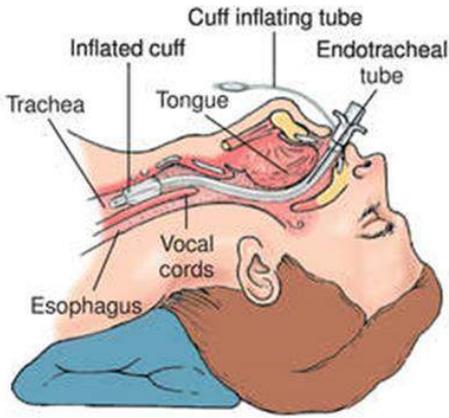
The Endotracheal Tube:



The Endotracheal Tube Cuff



It provides a seal so that you can give positive pressure ventilation. It provides a seal so that external liquids cannot be aspirated into the trachea. It IS NOT a tool for holding the ET tube in place! DO NOT Over-inflate the cuff!!



Pressure necrosis



General Things about Intubation:

Use the largest size tube that passes easily with lubrication. Only inflate the cuff enough to prevent leakage when doing positive pressure ventilation (the balloon should be soft). Do not pass the tube past the level of the tracheal bifurcation (carina). To ensure you are not past the carina, listen to the chest on both sides to be sure both lungs are being ventilated.

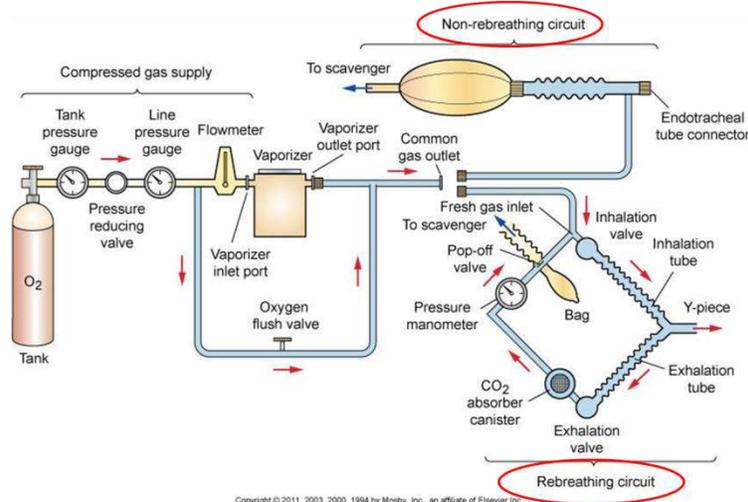
Orangutan-Specific things to know about intubation: The bifurcation is only about 6cm from the vocal cords. Don't go too deep.



Adult male: Size 10 or 11 ET tube, approximately 26-29cm at the teeth

Adult female: Size 8 or 9 ET tube, approx. 24-27cm at the teeth

The tube is hard to tie in on a flanged male—may help to go under the chin, then around the head, under the flange.



Some tips: Clean the darts with clean water as it does not need special cleaning items. Laryngoscope: if the neck can be extended (straight) use the straight laryngoscope. If the neck cannot be straightened (in Bahasa: diluruskan) use the curved laryngoscope. To put the laryngoscope in place, find your own technique - the one that you are most comfortable with, is easy and works for you. When doing intubation, do not go further than the carina (bifurcation trachealis). If on auscultation the left sound is okay, the right will also be okay, then you are in the correct way. If no sound in one of them that means that the intubation is going too far down.

Managing Patients on Gas Anesthesia:

Presented by **Ghislaine Sayers**

When the blood pressure drops, there is no sign that can be observed clearly so we must be cautious. When the blood pressure drops, the renal will be affected first, which could result in 50% of renal tissue damage.

Monitoring patient: Monitoring can be done by visual observation with your eye so there is no excuse that we do not have equipment/tools. Tools are just a supporting system; we can rely on our eyes. Good old fashion to monitoring with ear, eye and fingers. When the Pulse rate becomes weak, we need to correct the anesthesia. Pulse oximeter does not monitor heart rate/pulse rate, but rather measure air ventilation.

Day 4 – 26 July 2017

Life is Movement - Movement is life

Matthew Pead, Royal Veterinary College

For orangutans: Restore pain free movement / Restore function (for good quality of life) / Relieve pain and suffering during the repair process (physical and mental).

If you make a repair – you are altering that animal's life – so you therefore need to know the impact of repair to that individual.

Key stages: Recognize the problem, evaluate the various factors in treatment, execute procedures with technical skills, manage aftercare, and manage return to home environment. In order to evaluate the patient- all stakeholders (those that have contact with patient) have valuable opinion.

Observers? Trackers, wildlife rescue, nurses, vets. All have chances to observe the patient from different perspectives. You need to trust those that are around the patient as well as yourself. It is all about observation – who observes? What do they have to contribute? They all have a say, they all have a perspective.

Patient under sedation or anesthesia: Critical moment in the examination – gather all the previous observations, make a check list, Palpate bones / Manipulate bones / Check one side against the other (most injuries are one sided) – this is easy to do as you can compare the movement and identify a problem quickly / Evaluate for wounds – always be ready to treat at the time / Radiography (x-rays) if possible – especially needed if you are asking for advice – you need to send a radiograph – if that is not possible, then check the bones through comparison and take a video of that quick examination and send that.

Make a plan! Always needed to make decisions on a wild animal as there are so many variables.

A fracture assessment score is helpful to collect: 1) Biological factors: age, infection, energy of trauma, distance of fall etc., Is blood supply compromised? 2) Mechanical factors: post-operative loading (how much can or will you let the patient do), collateral limb damage? Other injuries? 3) Clinical factors: staff experience and skill, what is the post-operative plan, how do you get the patient to cooperate, how will the staff do what you want?

Score all these three: 1 – 10 (1 is worse, 10 is best) and come up with a composite score. Ex. Biological – 9 / Mechanical – 7 / Clinical – 7 = composite score of 7.5 (meaning likelihood of recovery is high). If score is low, then difficult to get patient back to full functionality. In such cases, euthanasia may need to be considered. This does not need to be a rapid decision, but you can get an idea of where you are going.

Fracture repair methods:

To judge the clinical section of the assessment you need to think about future repair. There are three basic ideas:

Conservative – choose not to intervene – no cost

External cooptation (casts, splints – no surgery) – low cost

Surgical – expensive and difficult (plates, screws etc., but does allow for patient to get full functionality – high cost but functionality is fastest

Summary: involve the whole team, make a plan to restore acceptable functionality.

Group Session: Team Setup

Everyone who is a vet surgeon should understand the bones and tissues of the body (anatomy questions can then be directed toward that person).

In 20 minutes, decide on a fracture assessment score for your patient. State problems and how you will help heal them: initial, fracture fixation, after care.

Case 1 – radius and ulna fracture (5 year old orangutan)

Case 2 – 20 year old female orangutan observed having difficulty using left foot

Case 3 – 15 year old orangutan observed not using his arm for 10 days – no visible wound (shot gun)

Case 4 – 15 year old orangutan male with grade 1 open tibial fracture – low energy trauma

(continued in session 2)

Case Studies Continued:

Post release medical Intervention in Sumatran orangutan (*Pongo abelii*)

Andhani WH– Frankfurt Zoological Society

Case studies from medical interventions of released orangutans at Jambi from 2013 to 2017. Injuries included ten wounds, two fractures, one fissure, and one dislocation. Medical interventions involving infectious cases included one herpes simplex virus, one pneumonia, and one salmonellosis.

Case 1: Salmonellosis: nursing female (3 months post release). Septicemia (fever: 39.5°C), Severe dehydration, anemic. Refused to eat for three days, and was unable to move. BCS 1 (body condition score – 1)



Treatment:

1st week, blood test: (+) 1/320 S Typhi H and 1/160 S Paratyphi AH (Widal test), anemia (20% RBC) and high WBC

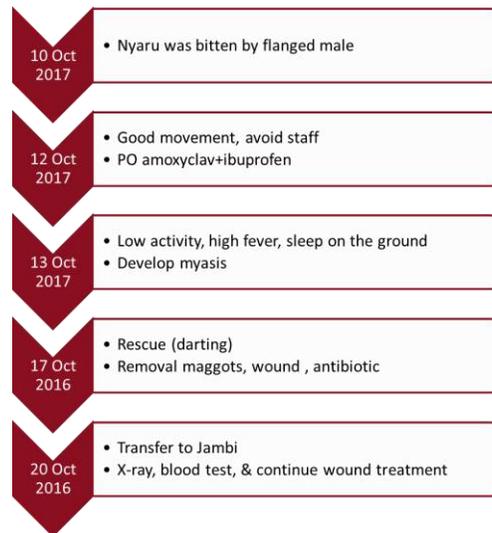
high AST and ALT, Uremia (-) dengue test, Oxygent was given during hypoxic condition, Ranitidine IV, Metronidazole IV, Ceftriaxone IV, Ketoprofen IM, Fluid therapy (saline/RL) + Furosemide IV → maintain hydration status, Made sure orangutan ate and drank normally everyday. Made sure orangutan urinate and defecated regularly.

2nd week: Ranitidine *via* darting, Ceftriaxone *via* darting, Increase appetite, 50% RBC, normal WBC.

3rd week: Multivitamin and protein supply. Increase appetite, 75% RBC, active, produce milk.

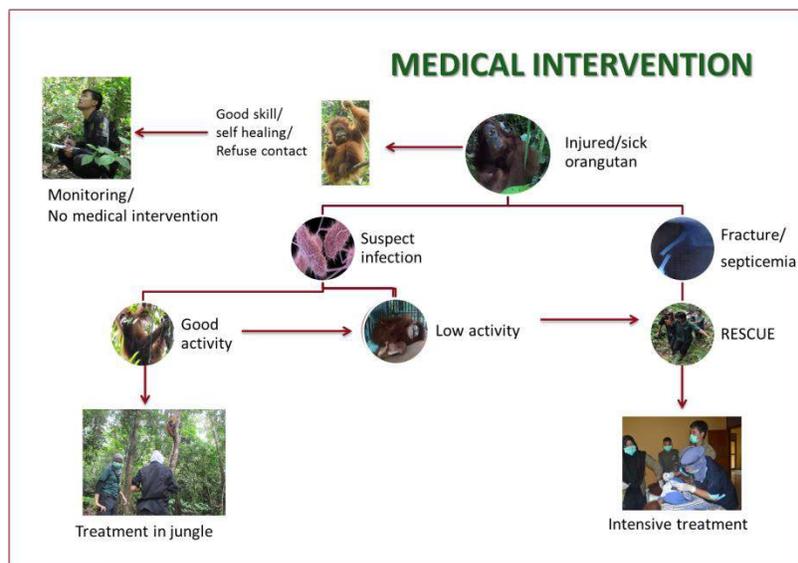
Complete recovery: 4 weeks. Healthy & active / BCS 2 / Good milk production

Case 2: Wound bite: 9 year old male. 6 months Post release, was bitten by an adult-flanged male. Infected wounds (>10) + severe myiasis. High fever: 39.5°C. Open fracture D4 & fissure D5 (right foot). Difficulty climbing, low activity, fever.

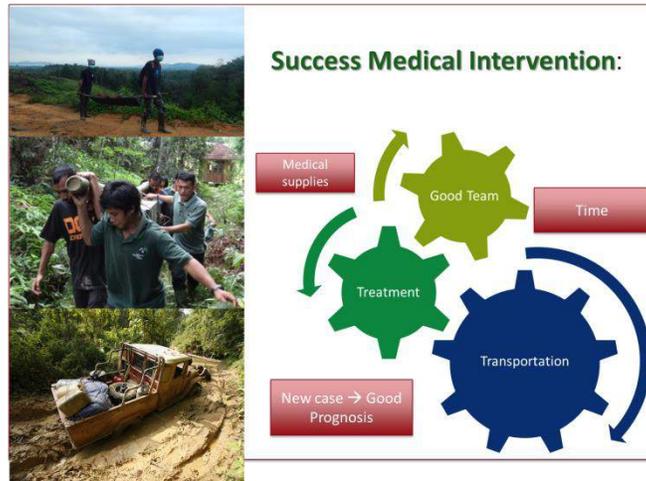


Treatment:

Debridement, clean wound, maggots removal, wound suturing. Blood test: High WBC, anemia, high AST, X-ray: fracture D4, fissure D5. Physical examination: 3 wounds to the left shoulder, 1 big wound on back, 2 wounds to the right arm, more than 4 wounds to the fingers and toes. Drugs given: Amoxyclav IM, Piperacillin-tazobactam + Metronidazole IV, fluid therapy (saline), Amoxyclav PO, Metronidazole PO, Tramadol /Meloxicam PO. Complete recovery in 3 months with complete wound closure. Good D4 function, good climbing and normal WBC.



Priorities: Case category (Fracture-Rescue) / Suspect infection (septicemia) / Post release under 2 years / Orangutan behavior & skill (<40% eating activity, lack climbing skill & nesting behavior) / Orangutan BCS (score 1) / Orangutan status (nursing female, infant) / Possibility of human conflict.



Important to remember:

Maintain: Oxygen supply (good air circulation) / Hydration - fluid therapy / Temperature / Handling or anesthesia? (Safety procedures)

Discussion:

Do you worry about drugs for a lactating female? Infant was already beginning to eat normal foods and was given additional milk so the decision was made to give drugs to the mom without impacting the infant too much. Broken limbs can come from lack of information about proper movement in the trees and lack of understanding – they should learn to climb on something that is breakable. The male was from Perth Zoo; he is currently in jungle school and is making good progress. He does not like to climb, team is trying to get him up in trees and will provide him with a friend – possibility of releasing soon.

Health Management of Ex-Tuberculosis Rehabilitant Orangutans in Orangutan Reintroduction Program - Nyaru Menteng

Lia Kristina – BOSF-NM

Tuberculosis (TB) is on the rise worldwide and is endemic to Indonesia. Confiscated orangutans that have been with humans have high rate of risk of infection. This then increases the risk to other orangutans once they enter a center as well as staff. Positive orangutans can never be released as “re-introduced individuals must be healthy and free of any captive-acquired disease that could endanger either the wild population or other wildlife at the reintroduction site” (Best practice guidelines for the re-introduction of great apes, IUCN, 2007).

Since 2006 the following tests have been run on orangutans: Tuberculin Skin Test / STATPAK * (Validation test) / Chest radiographs / Acid-Fast Bacilli Staining / PCR MTb / MTbc Culture.

At Nyaru Menteng, 14 were suspected which showed no clinical signs (-/+ TST, STATPAK, normal/abnormal chest radiography, + PCR MTb), and 14 tested positive with clinical signs (fever, coughing > 3 weeks, -/+ TST, STATPAK, Abnormal chest radiography, -/+ AFB, PCR, MTbc culture)

No one test can give a definitive answer so multiple tests must be correlated to diagnose TB.

Chest radiograph: The “typical” chest x-ray implicates infiltrates of the upper or lower lobes of the lungs with cavity formation. Needs Interpretation by human radiologist, but is not specific for diagnosing pulmonary TB.

Acid-Fast Bacilli staining, PCR MTb and MTbc Culture: Tracheal wash samples are collected and sent to a diagnostic lab in reference hospital / institutions (RS Persahabatan, Biofarma, Universitas Indonesia).

Diagnostic suggestions and recommendations for Non-Human Primates (Unwin *et al*, PASA,2009) :

ID Skin Test ¹	Prima TB Statpak ²	Thoracic Radiograph	PCR ³	Culture ¹	AFB ⁴	Recommendations
+	+	-	-	-	-	Strong suspect positive. Quarantine +/- Euthanase (once validated)
+	-	-	-	-	-	Quarantine. Retest in 2 months (full test range)
-	+	-	-	-	-	Quarantine. Retest in 2 months - CR or MAPIA Protocol above if comes back online
-	-	+	-	-	-	Test for other causes (infections, neoplasia) but quarantine in case aetiology and retest if other cause not found
-	-	-	+	-	-	PCR is very sensitive - CCNFM WITH LAB - must be able to differentiate between M. tb complex and other mycobacteria.
-	-	-	-	+	-	Quarantine for 6-12 months and retest. Positive - Euthanase
-	-	-	-	-	+	Quarantine - Retest in 2 months
+	-	If one or more of these are positive			+/-	Positive - Euthanase
-	+	If one or more of these are positive			+/-	Positive - Euthanase

Of the 14 suspected orangutans, one individual (Uni) developed active TB in 2010.

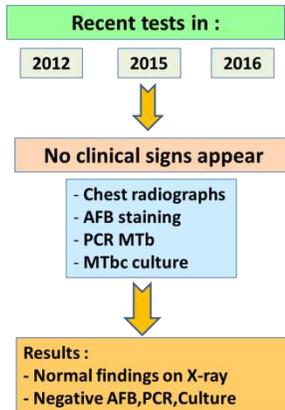
Health management protocols for TB:

1. Isolation Area: special TB area / No contact with wild animals / Limited access only: veterinary staff and assigned keepers
2. Medication: For 6-9 months, with drugs (Rifampicin (RIF), Isoniazid (INH), Pyrazinamide (PZA), Ethambutol (EMB), given in the intensive phase, screening every 6-12 months
3. Personal Preventive Equipment (PPE): gloves, masks, boots and overalls to be worn ONLY in TB-isolation area, equipment must remain in TB-isolation area
4. Sanitation & Disinfection: use Tuberculocidal detergent disinfectants, bleach/sodium hypochlorite, isopropanol, amyphenol, pheyphenol, ethyl alcohol, etc., waste disposed in incinerator
5. Educate veterinary staff and workers on TB and its effect on orangutans/human health, transmission routes and potential for transmission (human – orangutan / orangutan – human), PPE use **AND** health screening for workers every 12 months.

Nyaru Menteng, does not utilize the TST and STATPAK as initial test for TB in orangutans.

Limitations using :	
Tuberculin Skin Test (since 2014)	STATPAK (since 2010)
1. Less accurate in orangutans (high false-positive results)	This test was used in orangutans with (+) TST for validating its use as a screening test of TB in orangutans.
2. Higher concentration of tuberculin is used "Recommended doses using APPD (25,000 IU/ml) and BPPD (100,000 IU/ml) in orangutans (Dench et al, 2014)"	
3. Scoring between observers may vary (subjective)	This test is <u>inaccurate</u> for diagnosing TB in orangutans.

Health screening for 14 OUs since 2006 :



Suspected TB group → Free - TB group

Name	Sex	Origin	Date of arrival	Date of testing	TST	Chest X-Ray	Sputum PCR	Treatment
Longkong	M	OU Thailand	22-Nov-06	Apr 2007	-	-	+	Rimstar started on April 2007
				July 2010	APPD + BPPD +	-	-	
Tangar	M	OU Thailand	22-Nov-06	Apr 2007	-	-	+	Rimstar started on April 2007
				July 2010	BPPD +	-	-	
Guci	F	OU Thailand	22-Nov-06	Mar 2006	-	-	+	Rimstar started on August 2007
				Dec 2006	-	-	+	
Toka	F	OU Thailand	22-Nov-06	Feb 2007	-	-	+	Rimstar started on February 2007
				July 2008	APPD + BPPD +	-	-	
Jakson	F	PPS Petung Sewu Malang	13-Jun-08	July 2008	APPD + BPPD +	-	-	Rifampicin, Isoniazid, Pyrazinamide started on July 2008
				June 2010	BPPD +	-	-	
				July 2010	BPPD +	-	-	

Notes :

For Jakson, she was in close contact with orangutan TB-diagnosed in her origin place.

On 1st test, her pulmo auscultation sounded rough. One year after treatment, her auscultation became normal.

Rimstar (Rifampicin, Isoniazid, Pyrazinamide, Ethambutol)

These orangutans have spent 9 -10 years in TB area. From the 1st test until the recent test in 2016 they show no clinical signs of TB infection. They may have been exposed to *M. tuberculosis* complex but did not contract TB disease (TB Elimination, CDC, 2011). Negative result of AFB staining, PCR and Mtbc culture from the last screening tests (3x) indicate no infection of TB complex. These orangutans are now being considered to join the rehabilitation and release program. The planning for Free-TB group is to move them from ex-TB area, and put them in other cages. The problem now is due to lack of space, they are still in ex-TB area. They will be screened for the next 12-24 months, and then if continue clear, they will follow the rehabilitation program.

The plan for the diagnosed TB group which is now Ex – TB (Latent) group is to keep them in Ex-TB area, keep monitoring them and initiate health screening every 12-24 months. Currently the Ex-TB group is clinically stable, but there is always a risk of reactivation in the future. For now, the status is 9 unreleasable orangutans.

Ongoing issues: How long of a time frame will be required to take care of them? Depending on the results of the series of medical checkups for TB and if no clinical signs have appeared, can these individuals be classified as “TB free group”? How long does it take to determine whether they are free from TB? BOSF might not last forever, and these orangutans are unreleasable, the issue of finance is crucial for each individual. Is euthanizing the answer? What is the actual future consideration for this group?

Conclusions: With proper management protocols, we can prevent TB infection. Lack of proper diagnostic tools to detect latent and extra-pulmonary TB is the main challenge today. Free-TB group have a chance to join rehabilitation and release program. Ex-TB (latent) group remain in ex-TB area, but the future for this group is unclear.

Discussion:

They will retest 5 of those that have never showed signs of TB, if so, those 5 will re-enter the program? What is the group's opinion? If these are older orangutans, their learning curve is limited to be considered for release. Similar issues in Samboja Lestari which has a large population of TB orangutans. Wildlife TB Working Group made recommendation of a case in Thailand of orangutans to be returned to London but one was suspected positive to TB and was sent to NM.

Respiratory Infection In A Young Bornean Orangutan

Pakeeyaraj Nagalingam,
Wildlife Rescue Unit, Sabah Wildlife Department

Abstract

A 3 year old orangutan that was rescued a little less than a year ago, was found in a rigid/ stiff position with shortness of breath one morning. Emergency treatment was initiated and radiographs were taken. Increased radio-opacity in lung field was seen. Foreign body obstruction, diaphragmatic hernia and severe pneumonia were on differential list. The orangutan died several hours later. Postmortem findings revealed inflammation of pleura, severe pneumonia and enlargement of

lung lobes, mild gastritis, hepatomegaly, splenomegaly, ileitis. Traces of *Bukholderia pseudomallei* were found upon microbial cultures of heart and lungs.

The orangutan, Unico (*Pongo pygmaeus morio*), 3 years of age weighing 12 kg was rescued from a plantation on March 16, 2016. She followed some older orangutans into the forest and went missing for 5 days. When found (on February 3rd) she was kept in indoor nursery alongside 8 other orangutans for observation. She showed no clinical signs, but blood was taken and vital parameters were in the normal range. On February 5th she showed weakness and poor appetite, had low body temperature and preferred to lay on her stomach. The next day she was found in a rigid condition, gasping for breath, retching and continued low body temperature. She was put on oxygen and radiographs were taken. Her clinical signs were: reduced appetite, weakness, pale mucous membrane, sternal recumbancy, low body temperature, effortful breathing/gasping, retching and stiffness of limbs. Blood results were:

Analytes: units	Results	Ref Range *	Interpretation
Haemoglobin: g/L	81	90-143	Moderate Anemia, low haemoglobin
Hematocrit: L/L	0.23	0.275-0.476	
MCH: pg	18	18.5-28.0	
WBC: 10 ⁹ /L	45.2	4.08-25.40	Leucocytosis
Neutrophils: 10 ⁹ /L	38.9	0.92-14.17	Neutrophilia --infection/inflammation
Monocytes: 10 ⁹ /L	2.2	0-760	Monocytosis --sub acute/chronic infection
Chloride: mmol/L	90	98-115	Hypochloremia -- previous episode of vomiting/ diarrhea (metabolic alkalosis)?
Albumin: g/L	32	31-54	Albumin at low normal --on set of edema/hypoproteinemia?

*2018 - International Species Information System

Hepatitis ABC serology was negative. Meliodosis serology was also negative (<1:320).

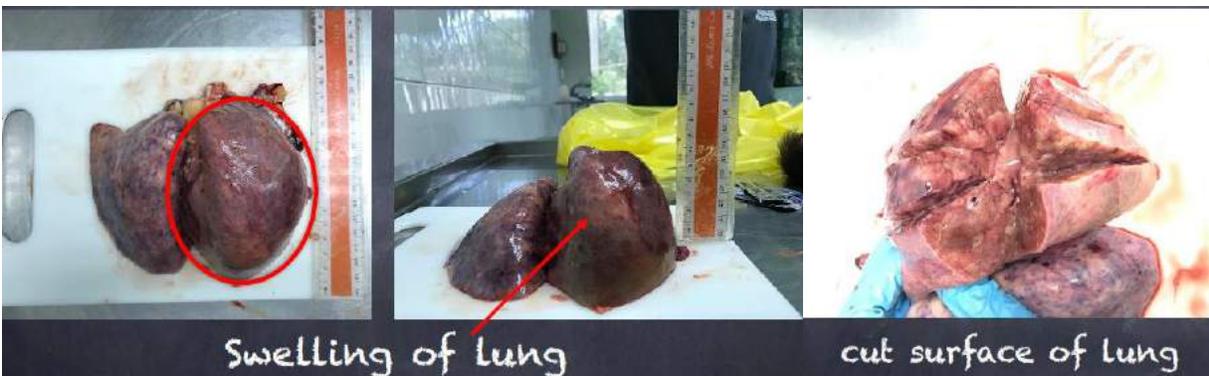
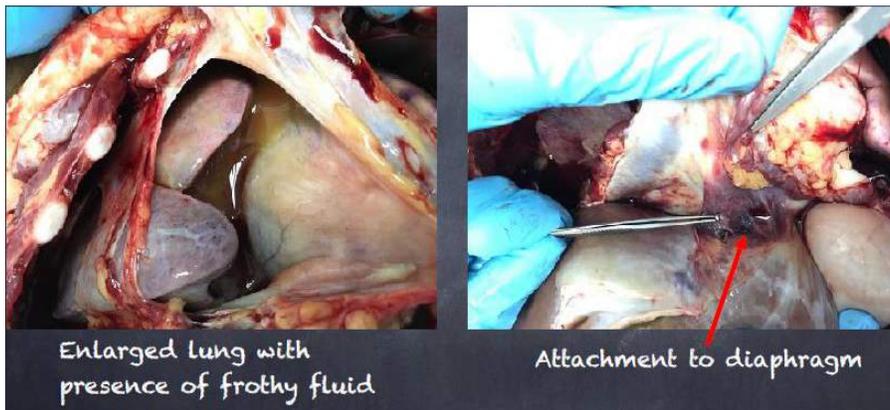
Differential diagnosis: foreign body obstruction, severe pneumonia, diaphragmatic hernia.

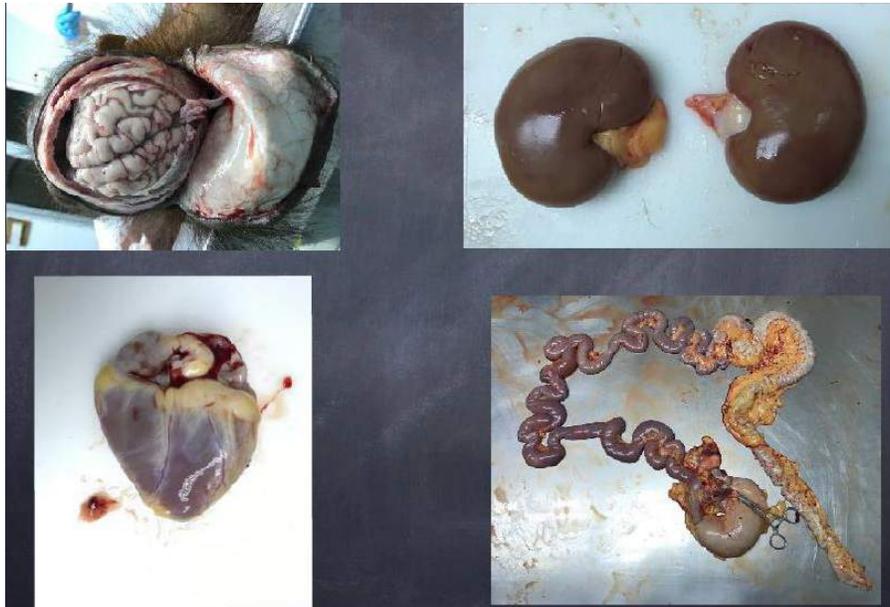


Treatment plan

Date	Medication	Dosage	Use/Indication
3.02.17	Oxytetracycline Ivermectin	20 mg/kg 0.03ml/kg	Broad spectrum antibiotics Dewormer
5.02.17	Intravenous Fluids (NS + Dulphalyte) Enrofloxacin Ketoprofen Hematofos warm water bag	500ml 5mg/kg 2.2 mg/kg 1.5 ml/animal	7 % Dehydration Broad spectrum antibiotic Antiinflammatory Hematinic Supplement Thermoregulation
6.02.17	Intravenous Fluids (NS) Enrofloxacin Ranitidine Tramadol Metoclopramide Oxygen Support Hematofos warm water bag	500ml 5mg/kg 0.5mg/kg 2mg/kg 0.5mg/kg 1.5 ml/animal	7 % Dehydration Broad spectrum antibiotic h2 blocker Pain Relief Prevent Vomiting Difficulty in breathing Hematinic Supplement Thermoregulation

She eventually died and post mortem was performed immediately. Post mortem findings were: pleuritic, severe pneumonia and enlargement, mild gastritis, hepatomegaly, splenomegaly and ileitis.





Cause of death: respiratory failure due to loss of efficiency of lung to carry oxygen and partial obstruction on airways causing depletion of oxygen supply top the body resulting in asphyxiation. Laboratory results: bacteriology results of lungs and heart - +ve *Burkholderia pseudomallei* (agent for melioidosis). Not classic melioidosis, perhaps unclassified in-apparent chronic infection form? Negative on serology but positive on culture (gold standard).

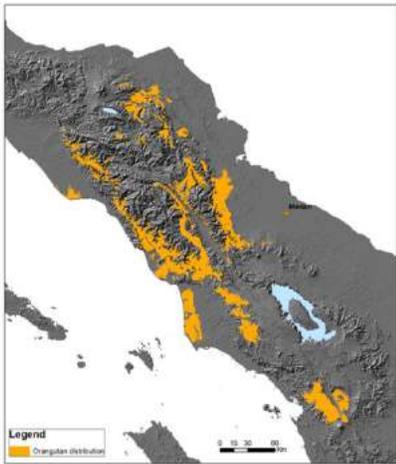
Discussion:

Most of the group has no experience with melioidosis so it was good to have this information. Does someone have experience with tetanus? Is it similar? WPU does do tetanus testing. It was not easy to test her, especially for x-rays – inconclusive. One human doctor thought something burst. In tetanus cases: (2) one survived, one died. Melioidosis is similar to TB and pneumonia. Tetanus is different: afraid of light, lock-jaw, different from melioidosis symptoms. In Samboja, there have been several cases of melioidosis, it is in Borneo too. Serology testing needed? Medical checks are done twice a year – even x-rays are taken. Human lab is used. There are many false positives as well as negatives. Human labs have that service. Can be sent as serum – they separate it themselves. No special media is required.

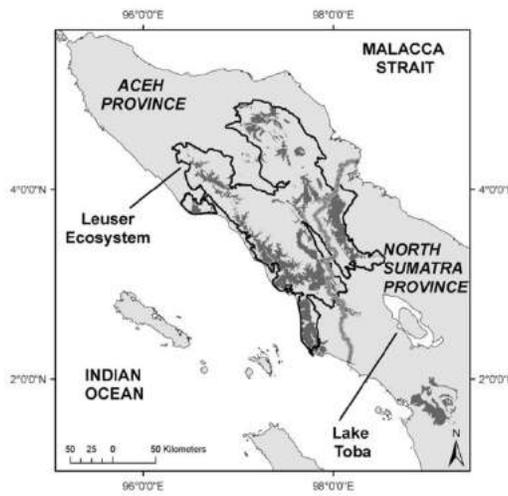
Introduction to Orangutan Conservation- lessons learned from Sumatran Orangutan (*Pongo abelii*)

Citrakasih Nente, OVAG, SOCP

Sumatran orangutan distribution status: 6,700 or +- 13,500 critically endangered orangutans.



(Singleton *et al.*, 2004)

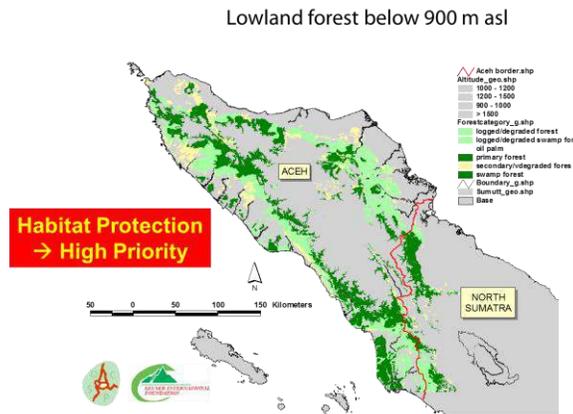
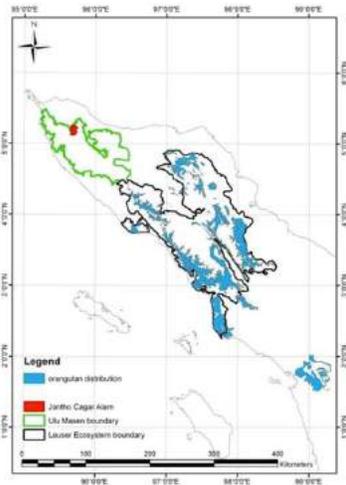


(Wich *et al.*, 2008)

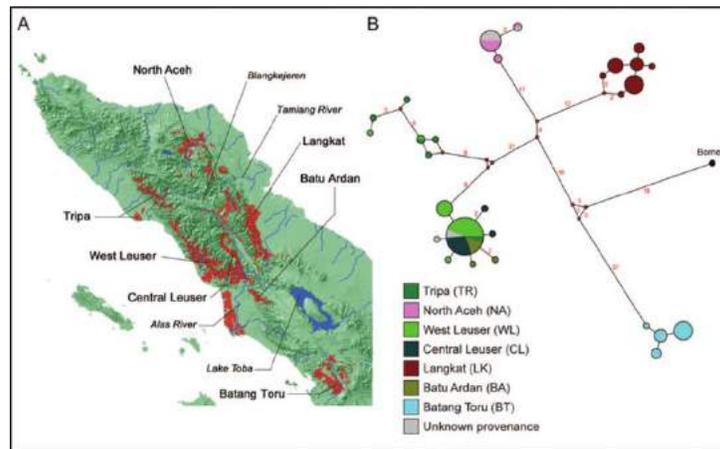
Has there been a population increase? Whichever number, habitat loss is continuing. Between 1985-1997, Indonesia lost its tropical forest of about 20 million ha (average: 1.5 million ha/year). In 1997 : 2.4 million ha/year. 1997-1998 : 5 million ha. 2009-2013 : 4.6 million Ha (FWI, 2014). 2015 (June-Oct 2015) : 2.6 million Ha (Ministry of Environment & Forestry, 2015).



75% of wild orangutans live outside of protected areas.

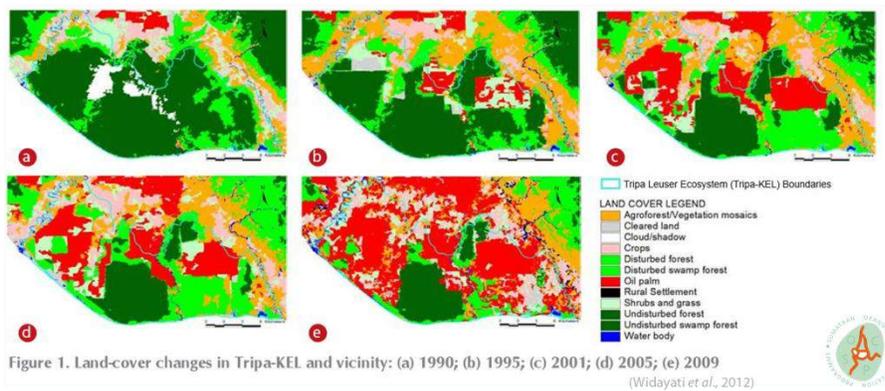


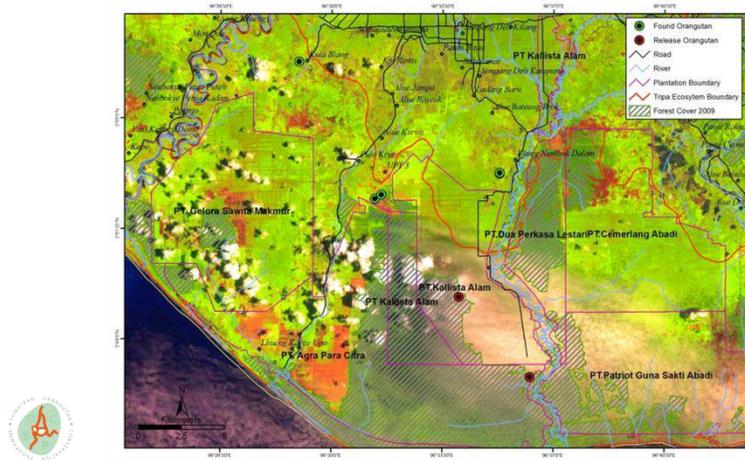
Tripa Forest background: Tripa is part of Leuser Ecosystem Zone (President Decree no 33/1998). In 2008 it was reported that the estimated orangutan population in Tripa was 280 orangutans (Wich *et al.*, 2008; Widayati *et al.*, 2012).



Problems in Tripa: Decreasing forest cover in Tripa Peat Swamp: 1990: 67,000 ha (65% of the area); 2009 : 19,000 ha (18 % of the area) (Widayati *et al.*, 2012).

TRIPA -LAND COVER CHANGES 1990-2009





The big problem? Oil Palm. In 2016 Indonesia's oil palm production: 35.5 million tons. In 2014 USD 12 billion (World Bank, 2015) / 2015 USD 16,95 billion (BPS, 2016) / 2016 USD 18.1 billion (BPS, 2016). Who is benefitting? The highest concentrated is in big companies (TuK, 2015), 85% goes to local elites & plantation developers, 15% goes to land claimant, land broker, tree cutters, slashers, burners, and oil palm farmers get 5% (World Bank, 2015).

Expansion of oil palm plantations per year: 2007: 7.4 Million Ha / 2010: 8.55 Million Ha / 2014: 10.2 Million Ha – 10.75 Million Ha (increase 25% from 2010) / 2015: 11.30 Million Ha. Expansion on average is 520.000 Ha/year = size of Bali. Impact: Land & Forest Fires (TuK 2015; BPS, 2015). Estimated cost of forest fires in 2015 was USD 16.1 billion (IDR 221 trillion). Who pays? Haze contributed to: 19 deaths, 500,000 cases of acute respiratory infection, 34 days of school closures (cost of USD 34 million), disrupted transportation (Sept-Oct) at a cost of USD 372 million, loss of agriculture and forestry at a cost of USD 8.8 million, and environmental, lost capacity of carbon storage; ecosystem services.

Peatland Overview:

PEATLAND-CARBON ACCUMMULATION

- VERY SLOW PROCESS
- 3.300 TONS/Ha CARBON STORAGE IN INDONESIA—NEEDS 11.000 YEARS



SYSTEM DISTURBED

RELEASE VERY QUICKLY!!



(CIFOR, 2015)—study before the forest fire

PEATLAND-CARBON RELEASE

- **HALF** OF CARBON STORAGE WILL BE RELEASED TO ATMOSPHERE OVER **100 YEARS** FOLLOWING CONVERSION TO OIL PALM PLANTATION— EQUIVALENT TO **2800** WORTH YEARS OF ACCUMULATED CARBON
- **2300 Ha** NEEDED TO ABSORB CARBON LOST OVER **100 YEARS** FROM JUST **ONE HECTARE** CONVERTED FOREST

(CIFOR, 2015)—study before the forest fire

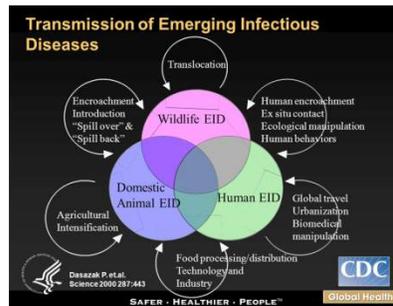


Why does a vet/biologist need to know about habitat?

ECOSYSTEM

- OIE : 60% human infectious diseases are zoonotic
- 75% EID are animal source
- Human-domestic animal-wildlife interface

(OIE)



Nature Conservation-Who Benefits? Act Now! #LoveTheLeuser / #LoveTheSea / #StartWith1Thing / #RacingExtinction / #BeforeTheFlood / #ConflictPalmOil

Movie: The Mahuze, Racing Extinction, Before The Flood, etc. www.sumatranorangutan.org & other conservation center websites. NBCNews_Orangutansdyingasdemandforpalmoil soars_t.flv

NEW: Small population south of Lake Toba classified as a new species or sub species, *Pongo tapanuliensis*.

Orthopedic Session Two (continued)

Matthew Pead, Royal Veterinary College

Case 1 – do not need radiographs every two weeks as it is a young animal...suturing should be below the skin surface so there is nothing for orangutan to pick at. Radius and ulna can fuse together. Supination and pronation can become impacted. Using pins is the most expensive method but may not be effective as orangutans can try to remove them.

Use of the arm **MUST** be encouraged. The more the limb is used, the better it will function. Do not let orangutan lose any dexterity.

Use of casting kit: can be a problem – casts get hard very quickly, but trying to take them off is difficult – must be an oscillating saw - \$1,100 US – but there is good news: Bosch EC oscillating saws are sharp enough and cost only \$90 US – need shorted radius semi curved (used for flooring) with 3 chargeable batteries – must be oscillating saw – not a circular saw. If correct saw is not available, make a split cast by slicing the cast before it sets, then put it together with gaffers tape.

Case 2: articular fracture –the whole joint can give way. There are a variety of casting techniques. Typically dealt with using a bone plate (\$1,600 US).

Case 3: gunshot wound – an external fixator, or Usplint is needed which starts at top of shoulder to elbow and back up. Many wrappings are needed so it does not get picked off...if the wound is closed, leave it alone.

Case 4 – open fracture

Discussion:

Matthew Pead set up a questions and answers board in lieu of discussion.

Fractures and Trauma – pain management: Animals are happier if they are not in pain – wild animals may not express it but may still be in pain – everything heals better if there is no pain – injection pre surgery (morphine or methadone) – if no

opioid, ketamine will work...drug addiction might be a factor. Step away from drugs on a 12 hour observation basis. Get pain scoring systems which are easy to adapt; (NSAID and non steroidal).

Bone cells communicate across prostaglandins – lots of literature can be found on this.

Antibiotics use: work clean. Wound kit: gloves, clippers.

Can we leave bone exposed? Cover exposed bone – should you cut it back? How soon can we get tissue stable? If it is not a major bone, cut it back.

Pelvis fractures- relatively few instances of this, the good news is that the pelvis is surrounded by muscle – will heal, watch out for disjunction of the pelvis.

Promoting bone growth: There is no substitute for autografts. It has amazing osteo conductive properties – do not wash with saline – you want cancellous bone – drill a hole in it scoop it out and stuff into the fracture.

Fewer germs in the field than in your hospital – re: amputation – needs precise reconstructive surgery.

Unstable pelvic fracture – decrease the potential space for bleeding (very hard to contain) – it will need fixation or it will keep bleeding – must be done quickly (within a few hours as it will keep bleeding). There may be other injuries with such a severe force trauma injury. Euthanasia may have to enter the conversation. Femoral fractures are difficult – look at foot position, if it is correct, leave it alone as most animals can cope with a 15% loss in anyone bone except humans...think conservatively.

Day 5 - 27 July

Developing a welfare assessment procedure in a zoo.

Nick Davis (presenting), **Lisa Holmes**
(Chester Zoo)

Zoos have a responsibility to meet the highest standards of animal welfare if they are to meet their primary roles for both educational and conservation. The recent WAZA animal welfare strategy (Mellor et al, 2015) highlights the need for monitoring the psychological needs of species, as well as their physical wellbeing. There is a zoo directive for this legislation, but how to do this? How should we measure animal welfare? Even after many years of scientific study it is still difficult to measure. There are many definitions of 'Animal welfare' but not one is agreed by all. There is now a scientific acceptance of physical and psychological needs of animals. There is also scientific evidence at many taxonomic levels. There are many methods, so which is best?

There are many parameters that can be assessed:

Physical assessment / Appropriate behavior patterns / Psychological assessment / Physiology /
Mortality rates / Morbidity rates / Environment

Ideally there should be a multi-functional approach, but, that is not always possible or practical. The most appropriate method will depend on context. What needs to be decided is what is most appropriate for a given situation, species and even individual.

Welfare assessments are already carried out in many ways:

Daily observations by care givers / Veterinary health examinations / Regular meetings to discuss / review cases /
Body condition scoring / Feather condition scoring

Ex. Body condition scoring for Bongo (Disney 2005)

Developed by Disney's Animal Kingdom - 2005

Score	1: Emaciated	2: Thin	3: Good	4: Fat	5: Obese
Outline Depictions					

Feather condition monitoring sheet (Chester Zoo):

Feather condition monitoring sheet									
Please add the corresponding score to each line to represent feather condition of the bird The overall score can then be used to monitor changes									
1	Skin exposed Here we could add a description to ensure there's no overlap between the possible scores								
2									
3									
4									
5	Perfect condition								
Filter can be used to look at specific birds									
Bird ID:	Date:	Scored by:	Head (including nape & throat)	Front (Breast, flanks, belly, vent)	Wings (including scapulars)	Back (mantle, back, rump)	Legs	Tail (including coverts)	Overall score
09	01/04/2017	W	5	4	4	3	3	4	27

There are many academic behavioral and physiological studies available. Also helpful are use of records e.g. mortality and morbidity rates as well as taxon relevant measurements e.g., environmental parameters for reptiles and amphibians.

Why do we need an animal welfare audit? Welfare audits have been used for a number of years in the livestock industry, shelters and lab settings e.g. AWAG (Honest & Wolfensohn 2010). They are used as a systematic method for assessment of welfare of animals. Assessments can be based on behavior, resources or records. They are rarely used in zoological collections in the UK.

Developing a welfare audit system:

Chester zoo has worked with BIAZA for the development of a systematic method for assessment of animals to address any welfare needs. This can be integral to ensuring the high level of welfare standards. Chester zoo is also in the process of trialing its own 'welfare audit' system.

The aims are to develop an appropriate system which can be implemented at least on an annual basis to accurately monitor changes in health and wellbeing of animals in zoological collections and to provide a means to assess an animals welfare at a particular point in time, identify priorities and give clear actions.

The principles are the need to provide sufficient information to identify potential welfare issues, ideally for individual animals, but be concise enough that caretakers have the time to complete them, the need to identify key taxa specific behaviors that could be significant to an individual's welfare' the need to identify key environmental requirements that are significant to an individual's welfare and relevant questions need to be incorporated and the process should include for all species.

Who should do this? Assessment can be done at different levels:

- Daily observations - Experienced handler/keeper
- Routine health checks – Vets
- Long term behavioral studies – Students
- Physiological parameters – Scientists / students
- Historic records e.g. mortality / morbidity - Registrar / manager
- Body scoring - Nutritionist / keeper
- Welfare audit ???

How often should this be done? The frequency of assessment should also be carefully considered in line with existing welfare monitoring tools by collections. Annual assessment as a guide but effectiveness would be impacted on the life cycle of animals e.g. mice vs elephants. If issues are found then this would likely lead to a more frequent assessment routine until improvement.

First steps: Collaboration with other institutions is key; however adaptations are likely to be required depending on the size of the collection and the range of species being assessed. Ensure all taxa are considered – will the process work for all species within classes or should the assessment include questions for specific orders. Consider how welfare needs may change over life cycle of rapidly reproducing species.

The BIAZA trial: Guidance notes written and agreed in advance / Scoring system / Completed by Team manager and separately by the keeper who spend most time caring for relevant animals.

Trial 1: Focus on smaller zoos: 3 elements... 1) Enclosure management; 2) Animal management;

Twycross Zoo
The World Primate Centre

Welfare Management Part 1 – Enclosure, Husbandry, Diet and Management

SPECIES: _____

STOCK: _____

ENCLOSURES: _____

Parameter	Defined Target	Current Situation	Assessment	Action Priority
State the indoor enclosure area (length (m) x height (m) x width (m))	NAF	NAF	Checked as item	Checked as item
State the outdoor enclosure area (length (m) x height (m) x width (m))	NAF	NAF	Checked as item	Checked as item
Does the area for retreat and flight meet the requirements for breeding animals set by the defined target?		Checked as item	Checked as item	Checked as item
Are the nest boxes, sleeping quarters or cubbing facilities for breeding animals set by the defined target available?		Checked as item	Checked as item	Checked as item
State the minimum and maximum temperature levels that fall within the enclosure.	Between _____ BSC: _____ min. °C	Between _____ BSC: _____ min. °C	Checked as item	Checked as item
State the minimum and maximum humidity levels that fall within the enclosure.	Between _____ BSC: _____ min. %	Between _____ BSC: _____ min. %	Checked as item	Checked as item
State whether or not the lighting required in the enclosure meets the defined target?	Checked as item	Checked as item	Checked as item	Checked as item
State whether or not the ventilation required in the enclosure meets the defined target?	VENTILATION SHOULD BE SUFFICIENT SO THAT THERE IS NOT AN EXCESS OF NOISY SMELLS AND THAT RESPIRATORY DISEASE IS NOT A RECURRENT PROBLEM	Checked as item	Checked as item	Checked as item
Are the condensation levels the same or lower than the defined target? If there is a supplementary water feature state whether or not the quality of water is	Low	Checked as item	Checked as item	Checked as item

Substrate for drinking hole	Checked as item	Checked as item	Checked as item	Checked as item
Are suitable substrates provided according to the defined target?	No poaching, pooling or excessive mud	Checked as item	Checked as item	Checked as item
Are dust levels the same level or lower than the defined target?	Low	Checked as item	Checked as item	Checked as item
Is bedding in sufficient quantities, clean and changed regularly?	Clean and readily available	Checked as item	Checked as item	Checked as item
Is bedding when provided according to the defined target?	No guidelines	Checked as item	Checked as item	Checked as item
Are visual barriers available according to the defined target, which can be used by all animals simultaneously?	Priority of visual barriers	Checked as item	Checked as item	Checked as item
Are key resources (food) distributed according to the defined target so all animals share goods equitably?	Food must be distributed evenly	Checked as item	Checked as item	Checked as item
Do noise levels fit within the defined target?	No excessive noise disturbance	Checked as item	Checked as item	Checked as item
State whether or not pest control, as specified in the defined target, is in place?	A programme should be in place	Checked as item	Checked as item	Checked as item
Can rotation of individuals according to the defined target be implemented?	Checked as item	Checked as item	Checked as item	Checked as item
Can restraint of individuals according to the defined target be implemented?	Checked as item	Checked as item	Checked as item	Checked as item
State whether or not the mechanical restraint devices specified in the defined target are available?	Checked as item	Checked as item	Checked as item	Checked as item
State whether or not the restraint devices specified in the defined target have been undertaken?	Checked as item	Checked as item	Checked as item	Checked as item
State whether or not the handling and unloading of crates can be completed according to the defined target?	Checked as item	Checked as item	Checked as item	Checked as item
State whether or not the requirements for food, care or basic care fits within the time set by the defined target?	Less than once every 2 years	Checked as item	Checked as item	Checked as item
State whether or not Zoonosis disease control, as specified in the defined target, is	A programme should be in place	Checked as item	Checked as item	Checked as item



Chester Zoo trial: Designed primarily for mammals: 3 elements... 1) General behavior; 2) Species relevant behavior; 3) Resources audit. Scoring 5 stage Likert scale (poor – excellent), completed by keeper spending most time with individual and Team manager. Completed on an individual basis where possible; provides a score that can be monitored over time.

Date: _____ Assessment conducted by: _____ Species: _____

Group / Individual (please circle) Individuals name/ID no: _____

Activity	Poor	Marginal	Fair	Good	Excellent	Comments
Locomotion/mobility	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Posture (non-locomotory)	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Feeding/foraging (appetite)	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Attitude towards other group members	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Attitude towards environment	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Physical condition	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Faeces/urine	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Animal-keeper interaction	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Visitor interaction	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

Date: _____ Assessment conducted by: _____ Species: _____

Group / Individual (please circle) Individuals name/ID no: _____

Primates	Comments					
Body score/condition?	<input checked="" type="radio"/>	<input type="radio"/>				
Self-directed behaviours	<input checked="" type="radio"/>	<input type="radio"/>				
Behaviour to watch	<input checked="" type="radio"/>	<input type="radio"/>				
Positive social behaviour	<input checked="" type="radio"/>	<input type="radio"/>				
Negative social behaviour	<input checked="" type="radio"/>	<input type="radio"/>				
Naturalistic behaviour	<input checked="" type="radio"/>	<input type="radio"/>				
Parental Care	<input checked="" type="radio"/>	<input type="radio"/>				
Reproductive Success	<input checked="" type="radio"/>	<input type="radio"/>				

Conclusions: A number of zoos are currently developing welfare audits so collaboration is key to prevent repetition and ensure appropriate consistency. Trials of different styles of system will help collections to choose a process that is both time efficient and effective. Graded 'scoring' scales enable staff to monitor more subtle changes in animal welfare. All species should be considered using a species appropriate approach. Can be very challenging when assessing large groups of animals. It is important that this become not just a box ticking exercise. Any issues raised following an assessment should result in clearly defined actions may require further investigation. May require ongoing assessment to monitor change.

Summary



Disney Animal Programmes (2005). Bongo body condition scores, Disney animal programmes, Lake Buena Vista, FL: Disney's Animal Kingdom

Honess, P., & Wolfensohn, S. (2010). The Extended Welfare Assessment Grid: A Matrix for the Assessment of Welfare and Cumulative Suffering in Experimental Animals. *ATLA* 38, 205-212.

https://www.researchgate.net/publication/45093613_The_Extended_Welfare_Assessment_Grid_A_Matrix_for_the_Assessment_of_Welfare_and_Cumulative_Suffering_in_Experimental_Animals

Justice, WSM., O'Brien, MF., Szyszka, O., Shotton, J., Gilmour, JEM., Riordan, P., Wolfensohn, S. (2017) Adaptation of the animal welfare assessment grid (AWAG) for monitoring animal welfare in zoological collections *Veterinary Record* Published Online First: 09 May 2017. doi: 10.1136/vr.104309

Mellor, D. J., Hunt, S. & Gusset, M. (eds) (2015) *Caring for Wildlife: The World Zoo and Aquarium Animal Welfare Strategy*. Gland: WAZA Executive Office, 87 pp.

Welfare Assessment of Zoological Animals

Sumita Sugnaseelan, OVAG, Universiti Putra Malaysia

Sumita was appointed by the Natural Resources Minister of Malaysia to evaluate zoos, rescue centers, and personal collections.

There are general principles which must be in place in order to impact welfare assessment: Animal welfare indicators must cover different approaches to welfare; be reliable, valid and practical. There is no animal welfare indicator that can be used on its own. Animal welfare assessment must include animal based factors as well as environment based factors.

Animal vs environment based factors:

Animal based methods have many advantages as they can measure the actual effect on the animals, can be used in different conditions and have higher validity.

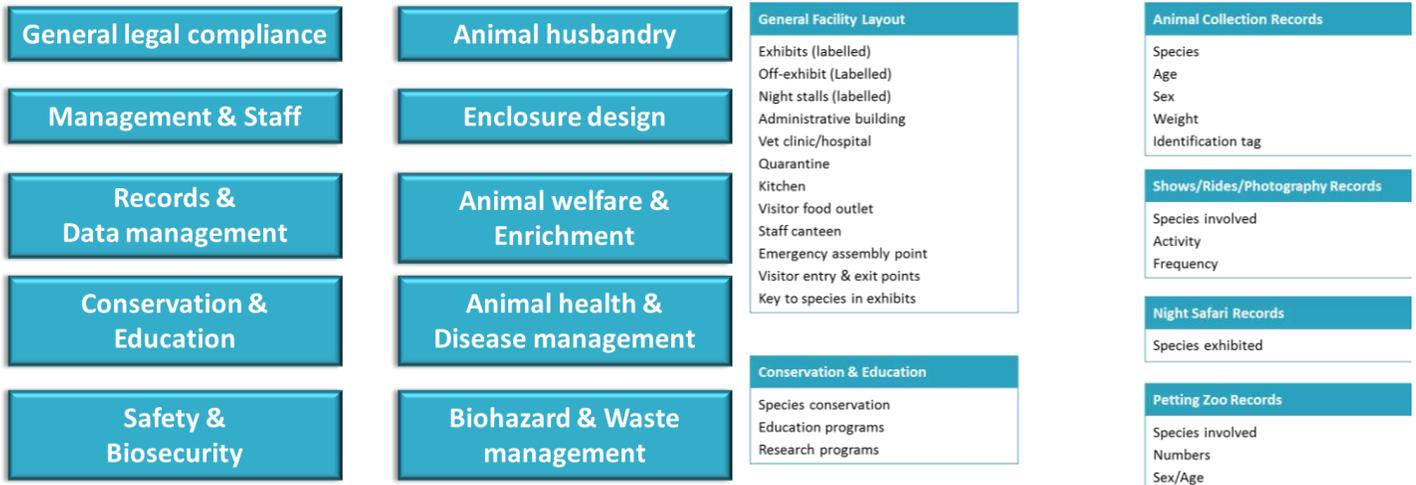
Environment based methods may be, however, useful in some circumstances; in most cases, they have higher reliability & feasibility than animal based methods.

Zoological facilities worldwide have to comply with many forms of legislation. The legal requirements are set by the relevant government body which are self-imposed by the governing body of the region in which the collection is located.

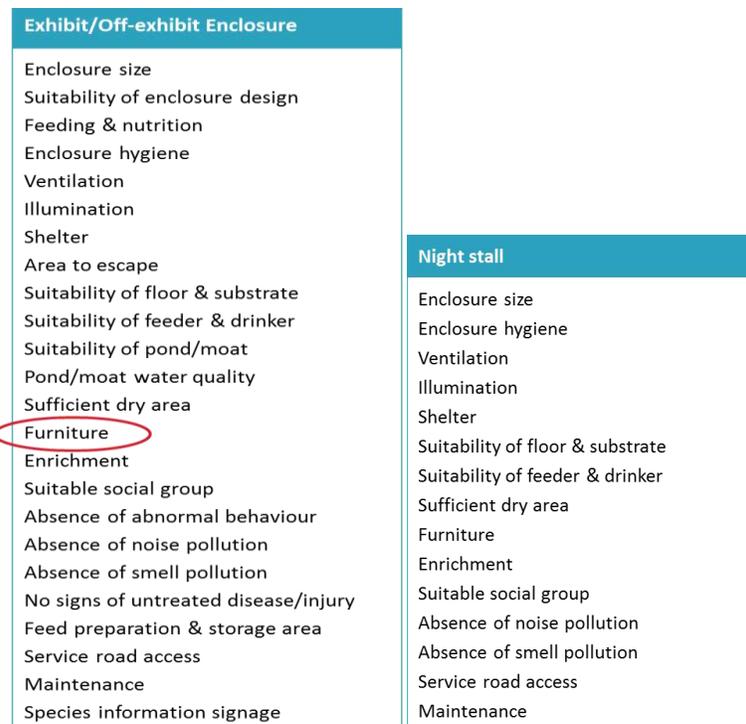
These vary within countries in which the zoological facilities are located. The issue of zoological animal welfare is the focus of both the government and local NGOs. The emphasis for providing proper care & husbandry to wild animals in captivity is of pivotal concern. In Malaysia, the Wildlife Conservation Act 2010 (ACT 716) has been put in place to supersede previous laws governing conservation, utilization, trade and welfare of captive wild animals.

Criteria for Assessment of Zoological facilities

Records and data management



Enclosure Design and Animal Welfare





- Exhibit/Off-exhibit Enclosure**
- Enclosure size
 - Suitability of enclosure design
 - Feeding & nutrition
 - Enclosure hygiene
 - Ventilation
 - Illumination
 - Shelter
 - Area to escape
 - Suitability of floor & substrate**
 - Suitability of feeder & drinker
 - Suitability of pond/moat
 - Pond/moat water quality
 - Sufficient dry area
 - Furniture
 - Enrichment
 - Suitable social group
 - Absence of abnormal behaviour
 - Absence of noise pollution
 - Absence of smell pollution
 - No signs of untreated disease/injury
 - Feed preparation & storage area
 - Service road access
 - Maintenance
 - Species information signage

- Night stall**
- Enclosure size
 - Enclosure hygiene
 - Ventilation
 - Illumination
 - Shelter
 - Suitability of floor & substrate**
 - Suitability of feeder & drinker
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 - Maintenance



Photo source: World Wide Web

Reuben Sharma

Safety and Biosecurity



Photo: Sumita S.

Exhibit/Off-exhibit Enclosure

- Barrier design – Escape prevention
- Barrier design – Animal safety
- Barrier design – Visitor safety
- Barrier design – Prevention of contact
- Caution signages
- Biosecurity control**
- Solid waste management
- Drainage & waste water run-off
- Pest & vector control
- Absence of harmful materials
- Emergency response protocol

Night stall

- Barrier design – Escape prevention
- Barrier design – Animal safety
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Enclosure Design and Animal Welfare

Exhibit/Off-exhibit Enclosure

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Night stall

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- Suitable social group
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Volunteers preparing treats for the elephants - Rice with brown sugar, papaya & cucumber. Members using the banana leaves to make the food packets.

Photo source: World Wide Web

Making enrichment products should be fast but the time the animal spends on it should be long.

Conclusion:

There is a lack of scientific data/publication to support legislation and/or guidelines related to zoo animal welfare. There are no internationally accepted criteria or guidelines for zoo animal management and welfare. The requirements for many species are still unknown. Special challenges for proper social groupings, enclosure design, nutrition, physiological requirements exist. More animal- and environment-based research should be conducted. Findings from these researches should be incorporated to support & strengthen existing/new legislation. No one set of behavioral responses can indicate reduction of welfare issues. Physiological parameters are considered to be objective measurements of animal welfare. Keep it simple, use scientifically well-defined measurements / normal ranges are either known or can be determined. Physiological measurements should be taken concurrently as behavioral observations can provide informative correlations to better extrapolate animal welfare assessment.

Important to remember: Once assessment is done, then the information must be shared with operators in a positive way, to allow for implementation.

Discussion:

These talks should highlight how we can share existing information, it is important to include people in the evaluation process for welfare, so it is always positive – not accusatory. Sumita made an offer to visit centers if they would like a pair of fresh eyes to see and assist – not to criticize, but to assist, all information is confidential. Singapore zoo had welfare assessment. What is the response in other zoos regarding changes to the environment or nutrition? Have they been enforced or does it take time? It can take time and money depending on the extent of the changes. Sumita is trying to upgrade the level of education for keepers in zoos. How can we achieve good welfare in rehabilitation centers as each center is different in how they manage their animals? Each place needs to be viewed individually. That is why it may be good to have an assessment done...this can be costly, but it is not only about money but your outlook, keeper training is very important. Enrichment in enclosures is a good beginning and does not have to be costly. Design in zoos seem to be important, but some enrichment items are fixed furniture...things need to change with great apes so built ins do not really work. Novelty is a better form of enrichment...putting browse in enclosures is good and not expensive...in zoos they like junk items...t-shirts, etc., but it does not really fit the natural concept of most zoos. For orangutans, nest building materials are needed. Giving them things that keep them off the ground is important. They are tropical forages, and their activity budgets are different, bulk feeding does not engage them in forest foraging, enrichment and food should align with natural activity budget of species; using different times, different locations. The benchmark should be trying to get natural behavior. Look at health and mental issues. Animals have timing cues they adapt to and begin to anticipate feedings etc., so needs to be staggered and ever changing. Technical changes are needed along with culture of how animals are viewed. Environmental enrichment encompasses many aspects of how you look after your animal. What are you providing above and beyond basic food and health care? Things need to be explained, not just demanded of. Inclusion is important. Gingers are a good forest food to incorporate.

Evidence Based Primate Medicine – The Gastrointestinal System

Steve Unwin, OVAG, Chester Zoo, IUCN

PART One. Primate Gastrointestinal System (GIT): Physiology and anatomy and the microbiome. The focus will be on the preventative aspects of GIT disease – Physiology and anatomy of the normal primate gut, the gut microbiome, and disease management, focusing on fluid therapy for recent arrivals or critically ill animals and dietary management. Please visit: www.primatemicrobiome.org

PART Two. Gastrointestinal Disease Management: Clinical sign focus. Response to: Dysphagia, halitosis and drooling, regurgitation vs vomiting, constipation/tenesmus, diarrhea/melena, anorexia/ weight loss, abdominal effusion, and acute abdomen.

PART Three Diagnostics: Physical, CBC/ blood biochemistry/ urinalysis, parasites, bacterial culture, cytology, radiography and beyond, digestion and absorption tests, and biopsy.

PART Four. Emergency Management: Malnutrition and Fluid Therapy.

PART Five. Cases: What's your diagnosis and how will you clinically manage.

Of these five parts, only parts One and Four will be covered now. Next year the more specific parts Two, Three and Five will be covered. For parts One and Four, it is expected veterinarians can demonstrate/be able to: an understanding of normal gut function; an understanding of dysbiosis and its potential management; and provide appropriate therapy in acute cases of dehydration and malnutrition.

Part One: Understanding of normal gut function/physiology and anatomy and the microbiome.

We have touched on aspects of gastrointestinal issues through OVAG in the past, such as the BCS (Body Condition Score) project presented by Winny in 2013 and the nutrition and anatomy presentations in 2011. Since then, a lot of research has been conducted looking at the situation of dysbiosis in NHPs, and how this not only affects day to day health and potentially promotes opportunistic infection, but also how it might be an issue for release back to the wild.

ORANGUTAN
BODY CONDITION SCORE (BCS)

Created by Winny P, dvm
win.pramesywari@gmail.com

BCS 1

- Spine, shoulder and hip bones are prominent
- The ribs are clearly visible
- Very concave belly
- Dull hair
- Prominent cheek bones
- Sunken eyes and thickened eye bags

Note: commonly happen to OU with severe ill or require intensive treatment.



BCS 2

- Spine, shoulder and hip bones are visible
- The ribs are faint
- Concave belly. It can be bloated and hard if OU consumes a lot of leaves, bark, or cambium.

Note: need body weight gain. Common when not fruit season.



BCS 3

- The spine and hip bones are faintly visible.
- The ribs are not visible, but can be faintly if OU raise its hands.
- Flat stomach.

Note: ideal BCS but need weight gain before release as energy reserve during adaptation process.



BCS 4

- Hip bones are not visible
- The ribs are well covered
- Rounded belly

Note: ideal BCS for release, has fat deposit for energy reserve during early adaptation process.



BCS 5

- Fat deposit covers throughout the body
- Hip bones are covered by fat deposit
- The ribs are well covered
- Bloating belly

Note: obesity, need weight loss

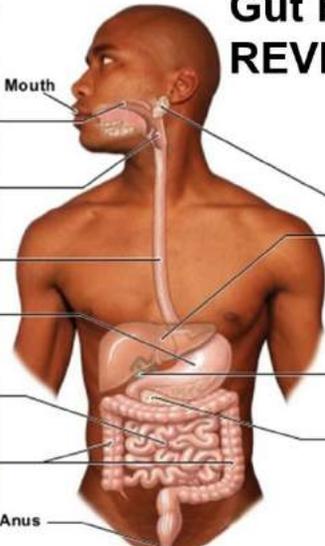




No matter the ape species, the FUNCTION of each part of the gut is similar, even if the anatomy does vary a little.

Components of the Digestive System.

Major Subdivisions of the Digestive Tract	
Oral Cavity, Teeth, Tongue	Mechanical processing, moistening, mixing with salivary secretions
Pharynx	Muscular propulsion of materials into the esophagus
Esophagus	Transport of materials to the stomach
Stomach	Chemical breakdown of materials by acid and enzymes; mechanical processing through muscular contractions
Small Intestine	Enzymatic digestion and absorption of water, organic substrates, vitamins, and ions
Large Intestine	Dehydration and compaction of indigestible materials in preparation for elimination



Gut Function REVIEW

Accessory Organs of the Digestive System	
Salivary glands	Secretion of lubricating fluid containing enzymes that break down carbohydrates
Liver	Secretion of bile (important for lipid digestion), storage of nutrients, many other vital functions
Gallbladder	Storage and concentration of bile
Pancreas	Exocrine cells secrete buffers and digestive enzymes; endocrine cells secrete hormones

© 2013 Pearson Education, Inc.

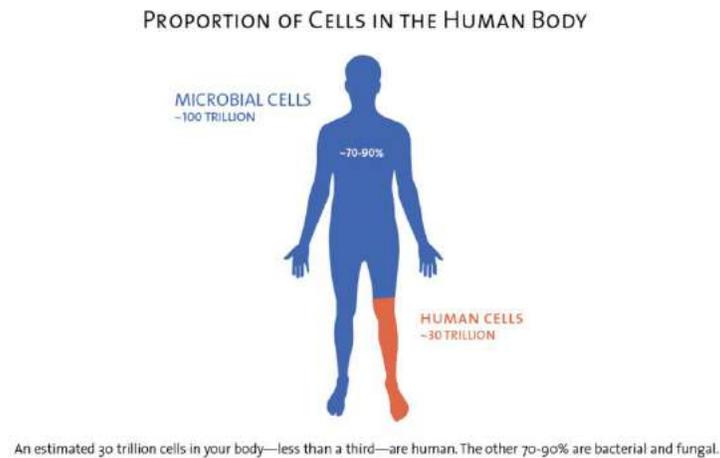
Background Information:

<https://www.youtube.com/watch?v=1X8p0vhsWRE> A TED-ed animation. From the microbes in our stomachs to the ones on our teeth, we are homes to millions of unique and diverse communities which help our bodies function. Jessica Green and Karen Guillemin emphasize the importance of understanding the many organisms that make up each and every organism.

<https://www.youtube.com/watch?v=HIYZGKSoQzw> Human Dysbiosis. Most people's gut bacteria levels are out of balance and it's creating lots of health problems! Your (and your orangutan's) gut bacteria has a huge effect on your immune system.

<https://www.youtube.com/watch?v=znnp-lvj2ek> A Ted-ed animation investigation into what causes antibiotic resistance.

You are more your microbiome than you are you!



Dysbiosis refers to your gut microbiome in particular. There are three categories: Loss of beneficial organisms; expansion of pathobionts or potentially harmful microorganisms, and loss of overall microbial biodiversity, all of which can occur simultaneously. There is mounting evidence that an intimate interplay exists between the gut microbiota and the development of diseases, including obesity, Crohn's disease and ulcerative colitis, diabetes, nonalcoholic fatty liver disease, Kwashiorkor and many others. Many factors affect the microbiome but diet, gastrointestinal motility and medication history most strongly shape it. Strong association between Western lifestyle and dysbiosis – high in fat and animal based proteins and low in plant-based fiber – makes more susceptible to infection and general disease. Can this affect the animals like orangutans under our care? Does this make them more susceptible to gastrointestinal disease?

Red shanked douc langurs and Howler monkeys are folivorous, consuming a diet that is poor and difficult to digest. Graph 1 here indicates their wild diet microbiomes are highly divergent, captivity causes them to converge towards the same composition. This is true despite the highly distinct wild diet, gut physiology, and geographical location of the two species, and is true across three independent zoos in three countries.

Graph 2 – the two most dominant gut bacterial groups are Bacteroides and Prevotella (Bacteroides greater in Westernised lifestyles). The high relative abundance of Bacteroides seen in both captive NHPs and Westernized humans is suggestive that captivity moves captive NHPs in the same direction along the Bacteroides gradient as does Westernisation in humans.

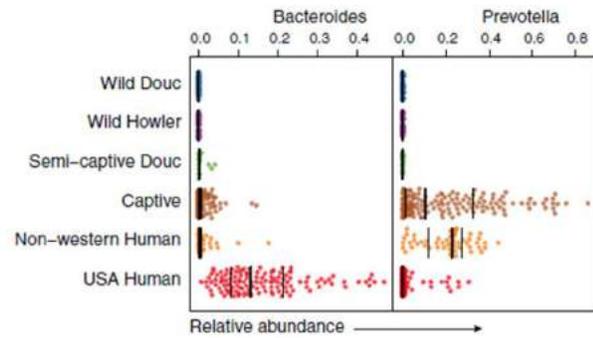
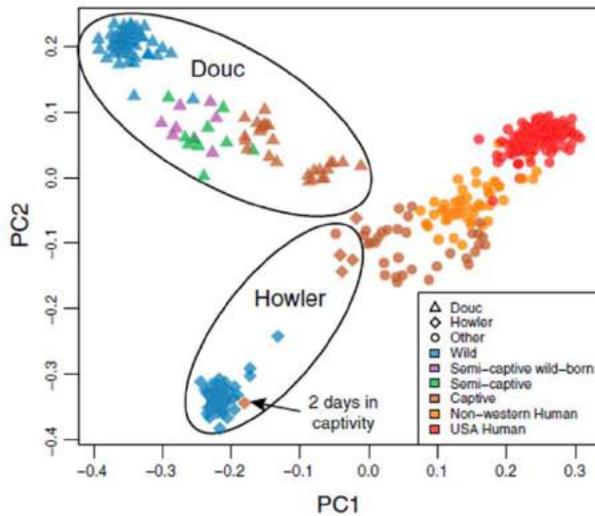


Fig. 5. Captive primates acquire *Bacteroides* and *Prevotella*, the dominant genera in the modern human gut microbiome. A bee swarm plot of the arcsine square root relative abundance of bacterial genera *Bacteroides* and *Prevotella*, the two dominant modern human gut microbiome genera, shown in wild, semicaptive, and captive NHPs, as well as in non-Westernized and Westernized humans. As populations shift toward the captive state, their microbiomes become colonized by dominant human gut bacterial genera.

Captivity alters the biome – characterized by loss of diversity. Microbiome convergence: highest risk factor is not antibiotic use, rather reduced dietary plant based fiber. This convergence partially parallels modernization in humans. We don't know yet whether the microbiome perturbations we observe contribute to captive primate disease or are merely a consequence of gastrointestinal disease caused by other factors. By leveraging the study design the researchers were able to rule out geography, host genetics, antibiotics exposure, birth in captivity as primary determinants of the captive primate microbiome. Primary driver of microbiome perturbation was highlighted as loss of dietary plant fiber. (this loss of microbiome diversity is also seen in Westernized humans).

Good nutrition and protecting the gut microbiome as a constantly evolving process - but removing sugary fruits, investing in more fibrous vegetables, browse (and fruits) is a good place to start. However a big issue is fruit and vegetables produced for human consumption are high in sugar.

Annual Feeding Programme Sumatran orang-utan			
Updated: January 2016			
Species Information	PHOTO		
Sumatran orangutan <i>Pongo abelii</i>			
Feeding strategy: The Sumatran orang-utan is an omnivore. In the wild, they feed on fruit such as rambutans, jackfruits, lychees, mangosteens, mangoes, figs. Young shoots, bark, insects and woody lianas. Occasionally they will eat bird eggs and small vertebrates (MacDonald, 2001).			
Est. weight: Male: 60 – 90 kg Female: 40 – 50 kg Est. energy: Male: 6733 - 9002 kJ Female: 5037 - 5909 kJ			
DIET DESCRIPTION (per animal)			
Feed ingredient	Male Qty	Female Qty	Std. measure
Pellet (30% of total diet)			
Old World Monkey Pellet - Mazuri	700g	500g	
Fruit (30% of total diet, selection of following items)	700g	500g	
Apple Pear			
Banana Orange			
Grapes Seasonal soft fruit			
Veg (30% of total diet, selection of following items)	700g	500g	
Carrot Tomato			
Red/green pepper Spinach			
Celeriac Sweet potato			
Green beans Celery			
Peas Fennel			
Runner beans Parsnips			
Cabbage Lettuce			
Forage (5-10% of total diet)	250g	150g	
FOOD PREPARATIONS		Quantity as fed to 7 Sumatran orang-utan. The bucket on right is fed to both this group and 4 gibbons sharing enclosure	
<ul style="list-style-type: none"> Fruit is chopped in half or served whole. Diluting juice is mixed and served in jugs through bars. Other food items fed include broccoli, beansprouts, onions, ready brek, willow, maize. 			

Species Diet Sheets are for internal use only and not for onward distribution without permission from the zoo's trademark. The information has been obtained from numerous sources believed to be reliable and Chester Zoo has made a diligent effort to provide a complete and accurate representation of the data. All users of this information are strongly recommended to consult with the authors if doubts related to interpretation.

Annual Feeding Programme Bornean orang-utan			
Updated: January 2016			
Species Information	PHOTO		
Bornean orangutan <i>Pongo pygmaeus</i>			
Feeding strategy: The Bornean orang-utan is an omnivore. In the wild, they feed on fruit such as rambutans, jackfruits, lychees, mangosteens, mangoes and figs. Young shoots, bark, insects and woody lianas are also eaten. Occasionally they will eat bird eggs and small vertebrates (MacDonald, 2001).			
Est. weight: Male: 60 – 90 kg Female: 40 – 50 kg Est. energy: Male: 6733 - 9002 kJ Female: 5037 - 5909 kJ			
DIET DESCRIPTION (per animal)			
Feed ingredient	Male Qty	Female Qty	Std. measure
DAILY			
Pellet (30% of total diet)			
Old World Monkey Pellet - Mazuri	600g	510g	
Fruit (30% of total diet, selection of following items)	600g	510g	
Apple Pear			
Banana Orange			
Grapes Seasonal soft fruit			
Veg (30% of total diet, selection of following items)	600g	510g	
Carrot Tomato			
Red/green pepper Spinach			
Celeriac Sweet potato			
Green beans Celery			
Peas Fennel			
Runner beans Parsnips			
Cabbage Lettuce			
Forage (5-10% of total diet)	230g	170g	
FOOD PREPARATIONS		Quantity as fed to four orangutan	
<ul style="list-style-type: none"> Fruit is chopped in half or served whole. Diluting juice is mixed and served in jugs through bars. Other food items fed include broccoli, beansprouts, onions, ready brek, willow and maize. 			

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Part Four. Emergency Management – Malnutrition and Fluid Therapy:



<https://qz.com/545672/orangutans-are-losing-both-health-and-habitat-to-palm-oil-fires/>

http://www.thecambodiaherald.com/off_beat/fat-malaysian-orangutan-put-on-diet-2714

Management of severe malnutrition is divided into three phases. These are:

Initial treatment: life-threatening problems are identified and treated, specific deficiencies are corrected, metabolic abnormalities are reversed and feeding is begun.

Rehabilitation: intensive feeding is given to recover most of the lost weight, emotional and physical stimulation are increased.

Follow-up: The continued physical, mental and emotional development of the animal must be ongoing, coupled with records of the process being maintained. A typical time-frame for the management of a primate with severe malnutrition is shown in Table 1.

Activity	Initial Treatment		Rehabilitation Weeks 2-6	Follow-up Weeks 7-26
	Days 1-2	Days 3-7		
Treat or Prevent				
Hypoglycaemia				
Hypothermia				
Dehydration				
Correct electrolyte imbalance				
Treat infection				
Correct micronutrient deficiencies	Without iron		With Iron	
Begin feeding				
Increase feeding to recover lost weight ('catch-up' growth)				
Stimulate emotional and sensorial development				

Tests that may be useful	Result and Significance
Blood glucose	Glucose concentration <54 mg/dl (3 mmol/l) is indicative of hypoglycaemia
Examination of blood smear by microscopy	Presence of malaria parasites is indicative of infection
Haemoglobin or packed-cell volume	Haemoglobin <40g/l or packed-cell volume <12% is volume indicative of very severe anaemia
Examination and culture of urine	Presence of bacteria on microscopy (or >10 leukocytes per high-power field) is indicative of infection
Examination of faeces by microscopy	Presence of blood is indicative of dysentery Presence of Giardia cysts or trophozoites is indicative of infection. Can also check for other amoeba's.
Tests that are of little or no value	
Serum proteins	Not useful in management, but may guide prognosis
Electrolytes	Rarely helpful and may lead to inappropriate therapy

Signs of dehydration and/or septic shock that are reliable in an animal with severe malnutrition	
History of diarrhoea	An animal with dehydration should have a history of watery diarrhoea. Small mucoid stools are commonly seen in severe malnutrition, but do not cause dehydration. An animal with signs of dehydration, but without watery diarrhoea, should be treated as having septic shock.
Thirst	Drinking eagerly is a reliable sign of "some" dehydration. In infants this may be expressed as restlessness. Thirst is <i>not</i> a symptom of septic shock.
Hypothermia	When present, this is a sign of serious infection, including septic shock. It is <i>not</i> a sign of dehydration.
Sunken eyes	These are a helpful sign of dehydration, but only when the sunken appearance is recent.
Weak or absent radial pulse	This is a sign of shock, from either severe dehydration or sepsis. As hypovolaemia develops, the pulse rate increases and the pulse becomes weaker. If the pulse in the carotid, femoral or brachial artery is weak, the animal is at risk of dying and must be treated urgently.
Cold hands and feet	This is a sign of both severe dehydration and septic shock. It should be assessed with the back of the hand.
Urine flow	Urine flow diminishes as dehydration or septic shock worsens. In severe dehydration or fully developed septic shock, no urine is formed

Causes of Diarrhea in primates:

Dietary –fruits, Food poisoning Chronic inflammatory bowel disease

Psychogenic Infectious – examples include: Bacteria examples - Shigella dysenteriae/ flexneri mild to dysentery, Salmonella typhimurium, Campylobacter coli, jejuni, Yersinia enterocolitica/pseudotuberculosis E.coli, Clostridium difficile Aeromonas. Protozoal examples - Entamoeba histolytica, Balantidium coli, Giardia spp. Nematode examples – Enterobius, Trichuris, Necator, Ancylostoma. Viral examples – Adenovirus (often respiratory disease too) Cytomegalovirus, Coxsackivirus, Rotaviru, Hepatitis A.

DIARRHEA CONTROL:

What is diarrhea? It is characterized by increased frequency and excess water content. It leads to loss of large volumes of fluids which can lead to dehydration if intake of fluids is not adequate. Leads to loss of electrolytes ie sodium, potassium and bicarbonate.

Small bowel: Large volume / Malodorous / Unformed/liquid / Minimal mucous / Loss of body weight

Large bowel: Increased urgency and frequency / Tenesmus (straining) / Small volume / Mucous / Frank blood

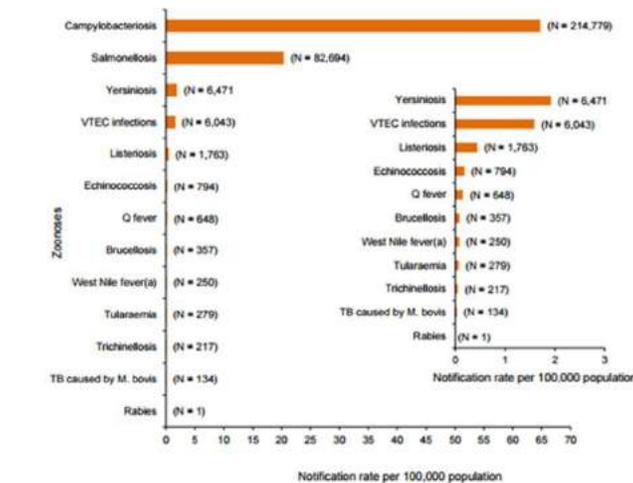
Excess intake: Excess fat / Usually vomit

Maldigestive: Decreased absorption of nutrients because of impaired digestion / Pancreatic insufficiency / Bile acid deficiency / Following GI surgery / Lactase deficiency

Malabsorptive: Mucosal or sub mucosal disease impairing normal absorption / Sodium transport mechanisms affected / Exudation of blood, mucous and protein into lumen due to damage ie ulcerative colitis

Secretory: Increased secretion of water and electrolytes without damage / Bacterial toxins / Mechanical obstruction

Remember most infectious causes of diarrhea and gastrointestinal disease in orangutans is zoonotic. This graph highlights the top zoonotic infections in the EU. The top 4 are all enteric infections, and campylobacteriosis and salmonellosis are also very common in orangutan. It is likely they are infected from human sources.



The physiological process during diarrhea: In the normal healthy intestine, there is a continuous exchange of water through the intestinal wall –in humans up to 20 liters of water is secreted and very nearly as much is reabsorbed every 24 hours -this mechanism allows the absorption into the bloodstream of soluble metabolites from digested food. In a state of diarrheal disease the balance is upset and much more water is secreted than is reabsorbed causing a net loss to the body which can be as high as several liters a day. In addition to water, sodium and other minerals are also lost (see table 1). The body's store of sodium (in the form of sodium ions Na⁺) is almost entirely in solution in body fluids and blood plasma, i.e., extra cellular (ECF)-by contrast 98% of the body's total potassium (K⁺) is held within cells i.e. intra-cellular (ICF). The concentration of Na⁺ in the extracellular fluid has to be held to within close limits (135-150 mmol/l) for the proper functioning of the body. As mentioned above sodium concentration is normally precisely controlled by the renal function, however in a state of dehydration water is conserved by anuria (no urine production) and the sodium regulation cannot work effectively. Thus continued diarrhea causes rapid depletion of water and sodium, which is to say a state of dehydration. If more than 12% of the body's fluid is lost death occurs. In a state of diarrheal disease much more water is secreted than is reabsorbed causing a net loss to the body which can be as high as several liters a day. In addition to water, sodium and other minerals are also lost.

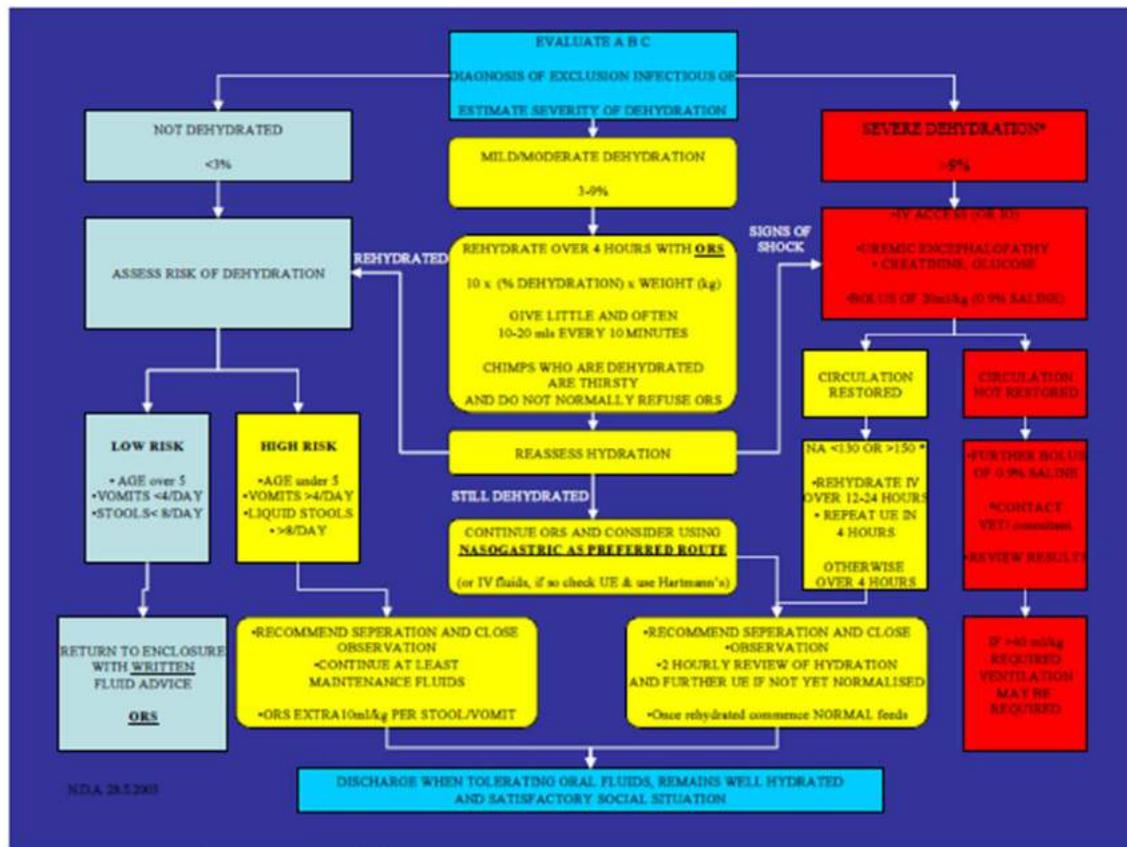
Simple giving a saline solution (water plus Na⁺) by mouth has no beneficial effect because the normal mechanism by which Na⁺ is absorbed by the healthy intestinal wall is impaired in the diarrheal state and if the Na⁺ is not absorbed neither can the water be absorbed. In fact excess Na⁺ in the lumen of the intestine causes increased secretion of water and the diarrhea worsens. If glucose (also called dextrose) is added to a saline solution a new mechanism comes into play. The glucose molecules are absorbed through the intestinal wall unaffected by the diarrheal disease state -and in conjunction sodium is carried through by a co-transport coupling mechanism. This occurs in a 1:1 ratio, one molecule of glucose co-transporting one sodium ion (Na⁺). It should be noted that glucose does not co-transport water -rather it is the now increased relative concentration of Na⁺ across the intestinal wall which pulls water through after it. Several other molecules apart from glucose have a similar capacity to co-transport Na⁺ including amino acids (e.g. glycine) dipeptides or tripeptides. The absorption of these molecules may occur independently of each other at different sites -thus their effect can be additive. Research is currently being carried on to utilize these additive effects to develop a multi-component "Super ORS". Starch is metabolized in the intestine to glucose and therefore it has the same properties of enhancing sodium absorption, however it has an added advantage that it has less osmotic effect, which would act to pull water back into the lumen of the intestine.

Oral Rehydration Therapy (ORT): Acute diarrhea normally only lasts a few days. ORT does not stop the diarrhea, but it replaces the lost fluids and essential salts thus preventing or treating dehydration and reducing the danger. The glucose contained in ORT solution enables the intestine to absorb the fluid and the salts more efficiently.

If the animal is drinking, ORT alone is an effective treatment for 90-95% of patients suffering from acute watery diarrhoea, regardless of cause. This makes intravenous drip therapy unnecessary in all but the most severe cases.

What the diarrhea looks like? Color / consistency / blood? / mucus? / odor / when / where / how much / how often and for how long

BRISTOL STOOL CHART		
	Type 1 Separate hard lumps	Very constipated
	Type 2 Lumpy and sausage like	Slightly constipated
	Type 3 A sausage shape with cracks in the surface	Normal
	Type 4 Like a smooth, soft sausage or snake	Normal
	Type 5 Soft blobs with clear-cut edges	Lacking fibre
	Type 6 Mushy consistency with ragged edges	Inflammation
	Type 7 Liquid consistency with no solid pieces	Inflammation



Clinical Sign	Some dehydration	Severe dehydration	Incipient septic shock	Developed septic shock
Watery diarrhoea	Yes	Yes	Yes or no	Yes or no
Thirst	Drinks eagerly	Drinks poorly	No	No
Hypothermia	No	No	Yes or no	Yes or no
Weak or absent radial pulse	No	Yes	Yes	Yes
Cold hands and feet	No	Yes	Yes	Yes
Urine flow	Yes	No	Yes	No
Mental state	Restless, irritable	Lethargic, comatose	Apathetic	Lethargic
Hypoglycaemia	Sometimes	Sometimes	Sometimes	Sometimes

Principles of fluid therapy: Fluid therapy is based on an assessment of the degree of dehydration present. Principles are as follows:

- No dehydration- If diarrhea is present, but urinary output is normal, the normal diet may continue with fluid intake dictated by thirst. High osmolality fluids such as undiluted juices should be avoided, and maintenance oral electrolyte solution (Na 45-60 mmol/L) offered "ad libitum."
- Mild-If symptoms and signs are limited to decreased urinary output and increased thirst, mild dehydration is suspected. Assessment and treatment under close supervision are indicated. Rehydration consists of ORS or maintenance solution 10 mL/kg/hr with reassessment at 4-hour intervals. Early refeeding is recommended. Extra ORS or maintenance solution (e.g., 5-10 mL/kg) may be given after each stool if diarrhea persists.
- Moderate-If at least two of the following signs, sunken eyes, loss of skin turgor ("tenting" of abdominal skin lasting less than 2 seconds), or dry buccal mucous membranes are present, moderate dehydration is diagnosed and rehydration consisting of ORS 15-20 mL/kg/hr with direct observation and reassessment at 4-hour intervals. If dehydration is corrected, therapy for ongoing losses and maintenance are continued as outlined above. If not, treatment is repeated as indicated by clinical signs or symptoms.
- Severe-If, in addition to signs of moderate dehydration, there is rapid breathing, lethargy, coma, a rapid thready pulse or "tenting" of the skin lasting more than 2 seconds, severe dehydration and shock are present. Blood pressure should be measured. Prompt intravenous therapy is indicated with rapid infusion of saline plasma or colloid sufficient to replete blood volume (10-20 mL/kg over 30 minutes may be necessary). Intraosseous infusion should be used if an intravenous line cannot quickly be inserted.

NB: There are two main types of volume expanders: crystalloids and colloids. Crystalloids are aqueous solutions of mineral salts or other water-soluble molecules. Colloids contain larger insoluble molecules, such as gelatin; blood itself is a colloid.

Which fluids to use for...:

Condition	Loss	Fluid Used
Haemorrhage	All blood components	MILD –colloids (crystalloids) SEVERE –(fresh) whole blood
Dehydration (not drinking enough)	Water	NaCl 0.18% + dextrose 4%, dextrose 5% (KCl 10-20 mmol/L added after 2 days)
Vomiting	Water, H ⁺ , Na ⁺ , K ⁺ , Cl ⁻	NaCl 0.9%, Ringers (KCl 10-20 mmol/L added after 2 days)
Diarrhoea	Water, HCO ₃ ⁻ , Na ⁺ , K ⁺ , Cl ⁻	Oral fluids, LRS (KCl 10-20 mmol/L added after 2 days)
Severe vomiting and diarrhoea	Water, HCO ₃ ⁻ , Na ⁺ , K ⁺ , Cl ⁻	Colloid + LRS
Peritonitis	Plasma + ECF	Colloid + LRS
Gut Obstruction	Water, HCO ₃ ⁻ , Na ⁺ , Cl ⁻	Colloid + LRS + NaHCO ₃
Urethral obstruction	Retention of H ⁺ , K ⁺	NaCl 0.9% + dextrose 5%

Human function is the same as orangutan function. The TED video on gut microbiome is human based but relates to other animals as well. You may be causing problems due to lack of understanding of a species' gut biome

Research has looked at geography, genetics, antibiotic exposure, births in captivity, and loss of dietary fiber. High degree of gastrointestinal issues, but nothing to attach it to, so could be changes in their microbiome. So for orangutans, they should have similar microbiome as those in the area where they will be released.

Malnutrition deals with under and over nourishment. Both can be severe. This was developing with WHO: form for treatment and prevention – only to treat malnutrition, hypoglycemia, etc. Blood glucose monitor is very useful to have at centers. There is a rapid test on filter paper (a color change system) that most human doctors have, this can be useful if you cannot get sample to a microscope. These are things that can be assessed fairly easily. Get the animal to drink!!!

Stool samples: anything away from the normal can be described as diarrhea. Increasing loss of water can get serious very quickly. Next year, we can spend more time on this and it would be helpful if vets send gastro intestinal cases to Steve before next year's workshop.

Indonesian Slow Loris Conservation

Wendi Prameswari – IAR Indonesia- Bogor



When the orangutan and the slow loris met – and no one was eaten

5 May 2014 / **Jeremy Hance**

*In 2004 and 2012, scientists recorded rare encounters between two very different primates: southern Bornean orangutans (*Pongo pygmaeus wurmbii*) and Philippine slow loris (*Nycticebus menagensis*). But in neither case did the Bornean orangutan appear to attempt to kill the slow loris for consumption, which Sumatran*



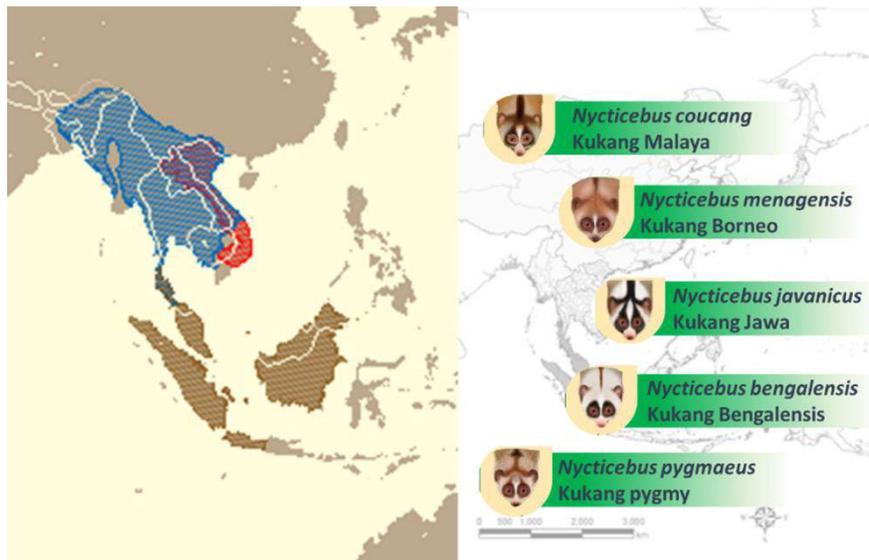
GREEN

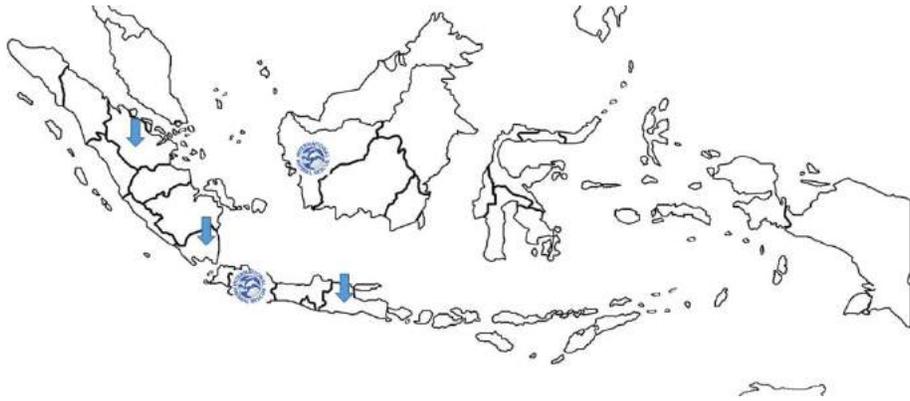
02/07/2012 03:28 pm ET

Orangutans Eat Slow Lorises When Plants Are Scarce, Research Suggests (VIDEO)

Sumatran Orangutans are primarily vegetarians, but more evidence has emerged that some of the primates actually have a taste for meat.

A female named Yet, only the fifth individual orangutan to be observed eating meat, was filmed devouring one of





There are 5 species of slow loris in Southeast Asia – Thailand, Cambodia, Viet Nam, and throughout the islands of Indonesia. Video was shown on slow loris and the deadly animal trade.

Slow loris belong to the Strepsirrhini primate group are solitary, nocturnal, arboreal and venomous (can cause anaphylactic shock). Their food preferences are: Gums, insects, nectar, fruit, small reptile and birds. Their habitat : primary and secondary lowland forest, gardens, and plantations. They are protected by Indonesian Law UU No 5 1990 and PP No 7 1999; CITES: Appendix I; IUCN : Critically endangered (Javan loris); Vulnerable (Sumatran and Kalimantan). Their major threats : Illegal trade (pet, mystic) and habitat distruction.

Since 2008, more than 700 slow lorises have been rescued. They came from law enforcement and when surrendered by their owner. They are wanted as pets and are number 2 on the list of the primate wildlife trade (Wildlife Crime Unit). 74% of slow loris kept as pets have dental problems and 50% have hypocalcemia and metabolic bone disease. Teeth are cut before sale, leaving animal open to infection. In this condition, they can only survive for 6 months with their owner. Information from law Enforcement: Common problems are bite wound infections followed by bacterial infection (*Pseudomonas aeruginosa*); Malnutrition and dehydration; Acute respiratory problems; and Acute diarrhea.

Health Check at IAR (upon arrival):

Physical examination / X-ray---bullets, fracture, MBD / Dental check--extraction/refilling / Blood check / Morphometric / Tuberculin test / Microchip / Deworming / Genetic sample / Quarantine for 6 weeks

Rehabilitation Process:

Nutrition: high fiber, low sugar (gums, vegetables, insects, egg, vitamin D); Behavior observation; Health check and parasite control; routine check for bodyweight and random fecal checks.

Release:

Release candidates should be healthy, have good dental condition, behavior assessment and a radio collar. For habitat assessment: Habituation (min. 2 weeks). More than 300 individual had been released on Java since 2010.

Monitoring:

Behavior observation, home range, food / Behavior assessment / Remove the collar after 3-6 months. Problems and challenges: Monitoring during the night and natural factors such as weather conditions topography, vegetation and predation.

Education and awareness:

The Power of Social Media / Campaigning / Crowdfunding

Challenges in the future:

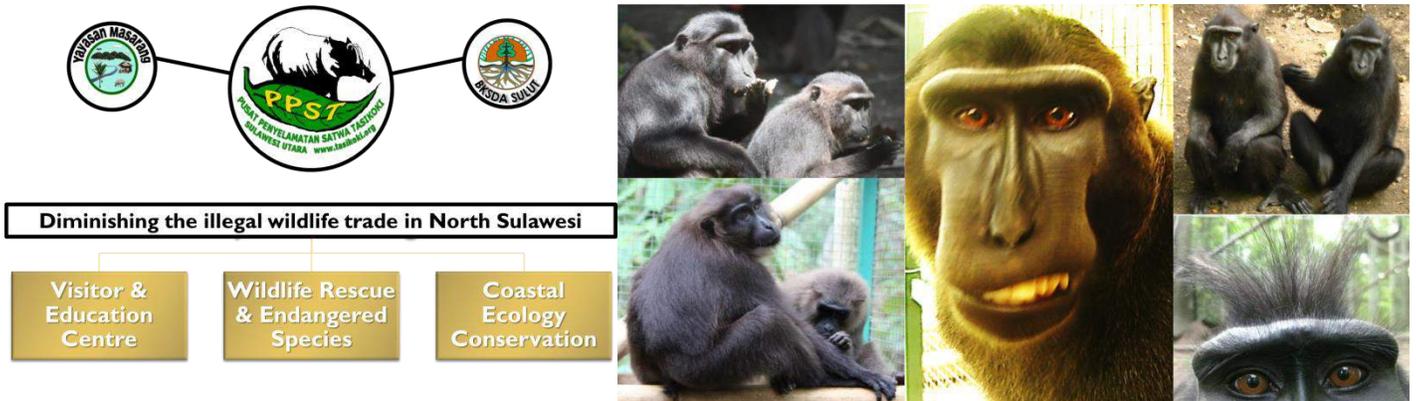
The Loris Lover Community purchase slow loris on line; while there is less market display, there is more online trade! More habitat protection is needed (especially on Java!); there is limited information about the number of Slow lorises in the wild; there is limited genetic information (IAR started genetic testing in 2015); and the need for sanctuaries.

Sumatran orangutans seem to eat slow loris but that has never been recorded in Borneo orangutans. When they are forced to move higher than their normal habitat, it is too cold and they die.

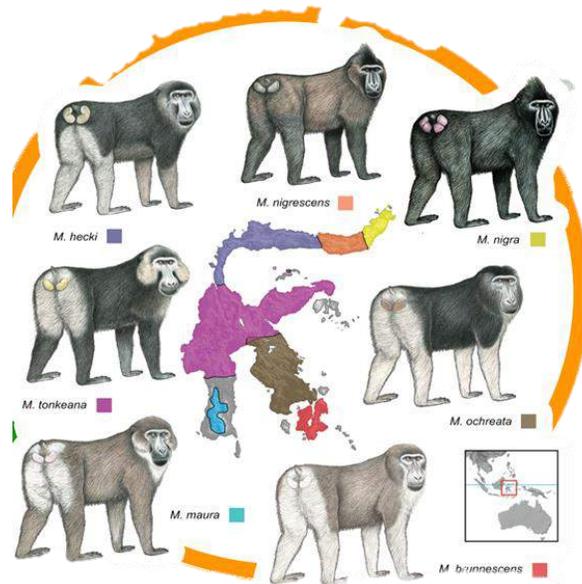
Sulawesi Macaques: Methods and Challenges for Rehabilitation of Confiscated Monkeys in North Sulawesi

Simon Purser, Manager, Tasikoki Rehabilitation Center, Sulawesi

PUSAT PENYELAMATAN SATWA TASIKOKI



Sulawesi macaque pose challenges for introduction as they move in large groups. At the Tasikoki center, the process is: Quarantine, treatment, nutrition, evaluation of physical condition and mental condition, group socialization, rehabilitation of natural behavior and preparation for release. Sulawesi is home to 14 primate species, 7 tarsiers and 7 macaques. The macaques are: *Macaca maura* (endangered), *Macaca tonkeana* (vulnerable), *Macaca hecki* (endangered), *Macaca nigrescens* (vulnerable), *Macaca nigra* (critically endangered), *Macaca ochreata* (vulnerable), and *Macaca brunnescens* (vulnerable).



At Tasikoki:

Macaca nigra ♀

Macaca nigra ♂

Adult >5 thn					Juveniles <5 thn		
1 Abe	11 Bobby	21 Briko	30 Raj	40 Batman			
2 Lela	12 Chan	22 Cowok	31 Zen	41 Meimoo			
3 Tambio	13 Jet leen	23 Marke	32 Luke	42 Batbit			
4 Pokol	14 Teten	24 Boy	33 Lembe	43 Ira			
5 Yoan	15 Uyot	25 Onkey	34 Asik				
6 Agustus	16 Deepak	26 Piu	35 Mous				
7 Asin	17 Franko	27 Anwar	36 Nino				
8 Onyet	18 Made	28 Rachmat	37 Manggis				
9 Isman	19 Budoh	29 Ray	38 Kacang				
10 Jacki	20 Sungokong		39 Mochi				

Adult >5 thn			Juveniles <5 thn		
1 Jain	11 Monik		20 Asap		
2 Al-jamat	12 Vespa		21 Janet		
3 Kampus	13 sTienkie		22 Gina		
4 Asam	14 Zeus		23 Jinet		
5 Manis	15 Sinam		24 Mohab		
6 Madu	16 Paso				
7 Ireng	17 Maya				
8 Cantik	18 Puja				
9 Gipsy	19 Wau				
10 Mikki					

Indonesia has a huge amount of biodiversity, but Wallacea has a larger amount, the next after the Amazon. There is no other rescue center in all of Wallacea except for Tasikoki. Quite a variety of wildlife comes in from Indonesia as well as the rest of southeast Asia. In the Philippines, thousands of wildlife is exported there but it is illegally identified as being bred within the Philippines. It is actually taken from Indonesia. Also, many go through to Java from the eastern part of Indonesia.

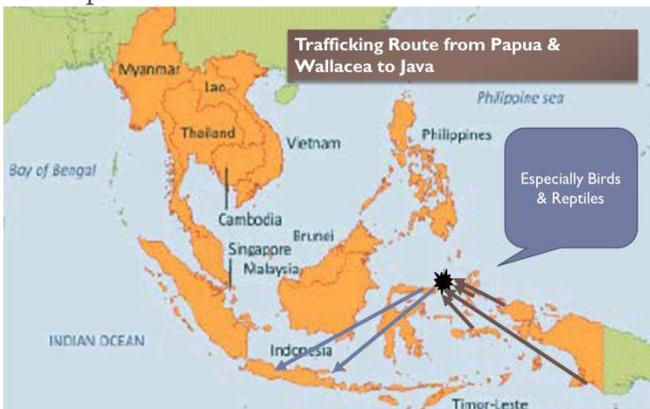
North Sulawesi : Wildlife Trade Hotspot



Export of Indonesian Species



North Sulawesi : Wildlife Trade Hotspot



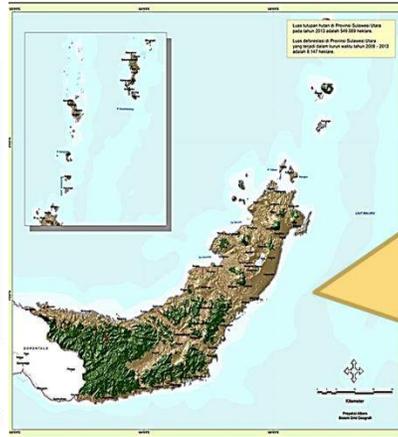
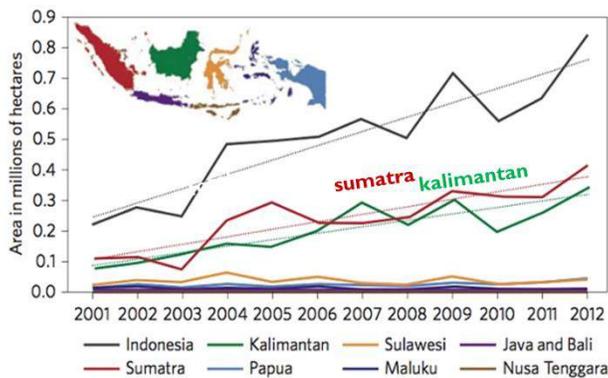
HABITAT LOSS & BUSHMEAT TRADE



With continuing diminishing habitat macaques are forced into sub-standard areas where it is difficult to survive, they can recover quickly. There is also the issue of the bush meat trade.

Deforestation North Sulawesi

Indonesia Deforestation vs. Economy

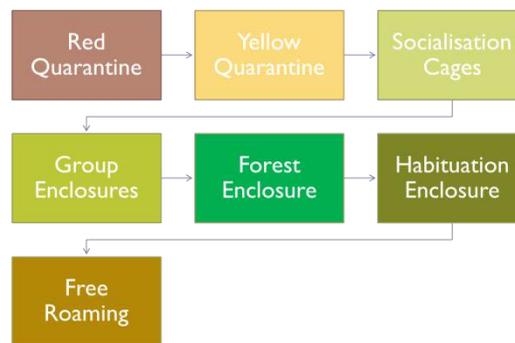


>30%
NATURAL
FOREST
LOSS SINCE
1960's
 Mainly for
 Coconut, cloves,
 nutmeg and gold
 mining

Macaque populations can recover quickly from incidental bushmeat hunting if there is good and undisturbed habitat. Habitat fragmentation and degradation is prevalent and a main proponent to crop-raiding conflict issues. Currently there are no sites deemed suitable for return-to-the wild for *Macaca nigra*.

Releasing is a challenge as hierarchies are displayed, and it is difficult to set up proper groups.

Quarantine Phases to Release



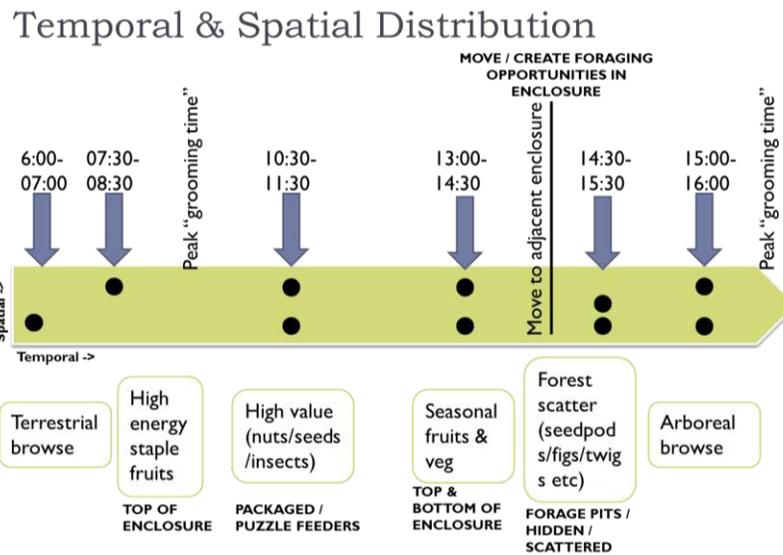
Clinical examinations: General examination from head to toe / Stabilization, fluid therapy where necessary / Tend to any immediate issues (e.g. tether wounds) / Samples for disease screening / Clean fur and skin / Prophylactic de-worming / Tagging with microchip

Health screening protocols: In-House Lab / Urinalysis / Endoparasites / Ectoparasites / Blood glucose / Swabs/Smears (ears, oral, faecal, blood) / TB TST (MOT) Right Eyelid / Outsourced Blood Screening (Human Lab) / TB Blood Test / Routine Hematology, Kidney and Liver function, etc. / Hepatitis A, Hepatitis B, Hepatitis C / Outsourced Blood Screening (Primate Lab) / Simian Immunodeficiency Virus (SIV) / Simian T-Cell Leukemia Virus (STLV) / FTA Card DNA sample

Vaccine and treatment protocol: Bathe fur/skin, if necessary with diluted flea/tick shampoo / Tetanus vaccination / Rabies vaccination (if requested) / Vitamin booster injection, electrolytes / Rotation of different anthelmintics during first 6-8 weeks / Tagging; Insert Microchip.

Behavioral assessment and cues: Personality profiling for group forming / Survival Critical Behaviors / Foraging skills and successful feeding behavior / Align with "natural" activity budget / Group Cohesion, Socio-positive proximity / avoidance / Reproductive behavior / Males; sexually active, dominance plays / Females; reproductively receptive, social plays / Predator avoidance / "Natural" locomotion and terrestrial/arboreal budget, adequate choice of resting spots, etc.

Promoting foraging behavior: Align with natural activity budget temporally and spatially / Slow down the food delivery process / As much food as possible in form of “enrichment” / Food provision in arboreal area as well as ground scatter and throughout the height of the enclosure / Foraging pits of dry leaves and twigs / Decomposing bamboo, logs, coconut palm fronds (termites, ant nests and other insects).



Reproduction: Afforded those scheduled for release / Afforded for species on the KSDAE priority list for conservation. No contraceptive methods available other than gender separation. Tend to work with bachelor groups as there is a bias on males in rescues. For group stabilization, need multi-male, multi-female group composition, breeding inevitable. Mothers are able to demonstrate ability to raise young pre-release. Infant fatality low, but does happen.

Release: Forest habituation phase: Matriarch group and juveniles/babies / Alpha and adult male group.

Forest habituation phase 1: Females and juveniles in forest habituation enclosure first (4-8wks) / Learn that is where they sleep and eat (develop sense of territory), adapt to local forest foods / At the moment the females are released, the males are brought into the habituation enclosure / Female group can be closely followed and monitored while they discover their territory but remain close to the males.

Forest habituation phase 2: Following 4-8wks assessment of female group capability to forage independently, males are released / Monitoring is done at a greater distance for safety, while males learn from the matriarch group where to forage and the alpha begins to re-establish his leadership role.

Summary: Quarantine Phase 60-90 days / Diet adaptation and body score improvement phase 30-60days / Socialization phase 10-20 days / Group cohesion and rehabilitation phase 45-90 days / Total 9 months (minimum) approximate time to be ready for release from time of rescue.

Forest research camp: Logistical accessibility, but fairly remote / Off-the-grid self-sustainable / Monkey-proof.

Methods and Challenges for Return to the Wild of Confiscated Monkeys in North Sulawesi: Overview

Tasikoki Wildlife Rescue Centre is situated in North Sulawesi, working in close collaboration with local authorities in a strategic location to tackle wildlife smuggling from various parts of Indonesia to the Philippines.

Sulawesi has 7 endemic macaque species, of which the *Macaca nigra* is critically endangered due to wide scale habitat loss, fragmentation and degradation across its limited range and added pressure from persecution as crop pests and hunting for bush meat consumption. A number of orphaned macaques end up in the live pet trade and confiscated or handed over to Tasikoki Wildlife Rescue Centre.

This short presentation describes the methods of quarantine and rehabilitation of macaques in preparation for their eventual return to the wild. A suitable habitat condition for release work is one of the major barriers for *M. nigra* reintroduction. Nearer term opportunities may exist for *M. nigrescens*. Sulawesi macaques at Tasikoki: Maura: 7,2; Tonkeana: 3,0; Hecki: 13,11; Nigrescens: 10,5; Nigra: 43, 24.

Destination for 'unfit' macaques: Sanctuary care? Move on to zoos? Euthanasia of endangered and protected species is not an option in Indonesia.

The IUCN SSC Primate Specialist Group Section on Small Apes: International Collaboration to Conserve Gibbons and Siamang

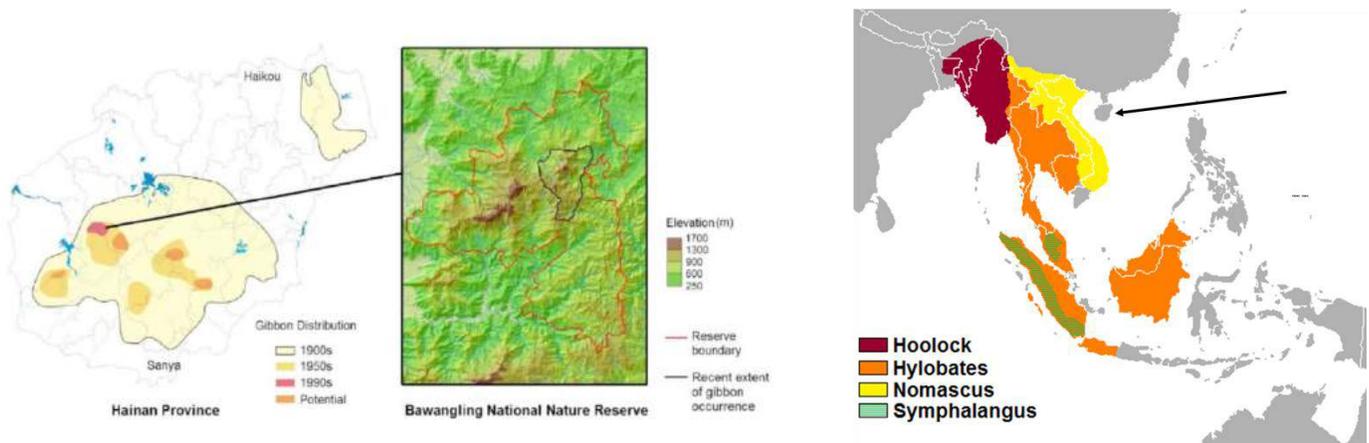
Susan M. Cheyne, Borneo Nature Foundation, IUCN Small Apes, Vice Chair

Abstract

Email: section.small.apes@gmail.com

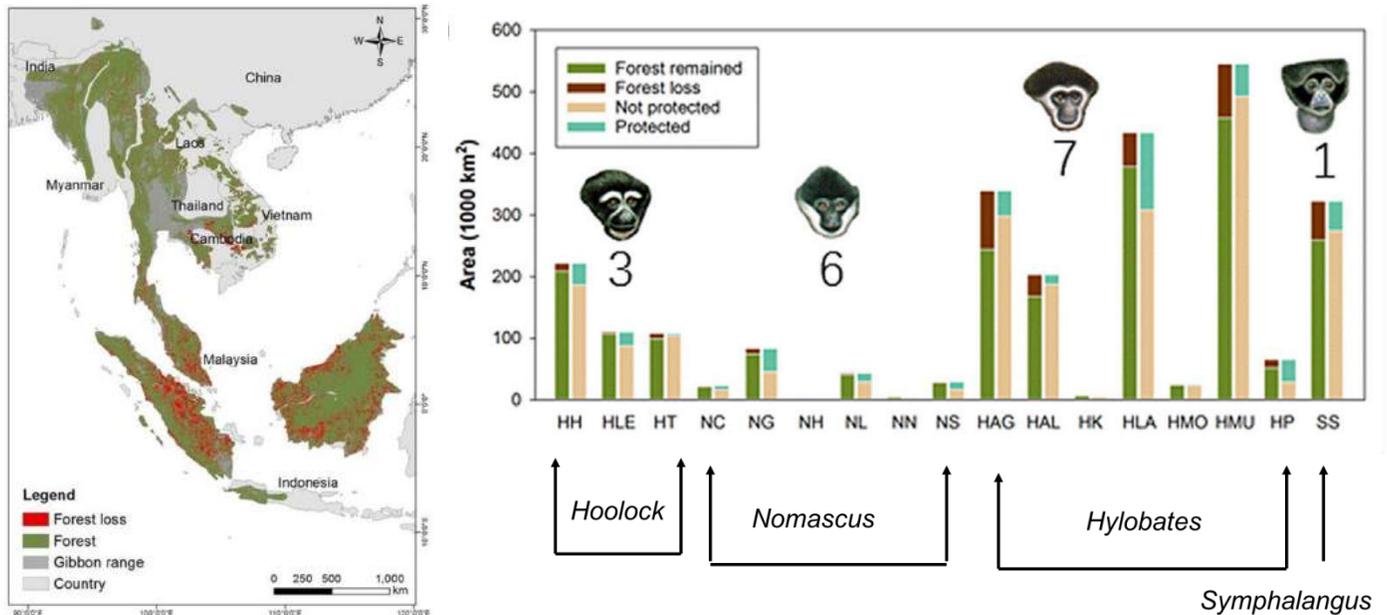
The Gibbon Specialist Group, otherwise known as the IUCN SSC Primate Specialist Group's Section on Small Apes (SSA) is a group of gibbon experts from around the world that individually and collectively work to conserve gibbons. The SSA was set up in 2011 because of the serious threat of extinction that gibbons face globally. Of 20 recognized species of gibbon, all are threatened with extinction on the IUCN Red List of Threatened Species, with four listed as Critically Endangered, fourteen as Endangered and one as Vulnerable. The major threats to gibbons include loss of habitat and hunting pressure, often for the wildlife trade. The SSA is a group of more than 80 gibbon experts globally, with a shared vision of conserving the world's gibbons. The SSA contributes to gibbon conservation through: 1) Strengthening coordination among gibbon conservation projects worldwide; 2) Increasing awareness of scientifically-sound practice in gibbon conservation; 3) Providing IUCN-endorsed guidelines to conservationists, field scientists and decision makers; 4) Developing Conservation Action Plans that clarify priorities in gibbon conservation for practitioners, decision makers and donors; 5) Ensuring the IUCN Red List of Threatened Species as a decision tool is thorough and up-to-date and 6) Providing direct technical support to implementing projects engaged with gibbon conservation and 7) Providing a platform for sharing of veterinary knowledge and skills and assessing emerging diseases specifically for the small apes. Through collaborations with in situ projects, rescue centers and sanctuaries and ex situ zoos, the SSA works on the basis of sharing information and expertise. Key actions and outputs include workshops and technical skills meetings, Best Practice Guidelines, working groups on trade and disease and outreach through social media.

The small apes section on specialist groups within the IUCN has only been around for 6 years. It has just announced a new species of gibbon called the Skywalker Gibbon and is only found in China and Myanmar (Mark Hamill has actually tweeted about this). It has not yet been assessed by the IUCN Red List. The most endangered gibbon (possibly primate) in the world is the Hainan gibbon (*Nomascus hainanus*) with only 22-25 individuals in the world; there are none in captivity.

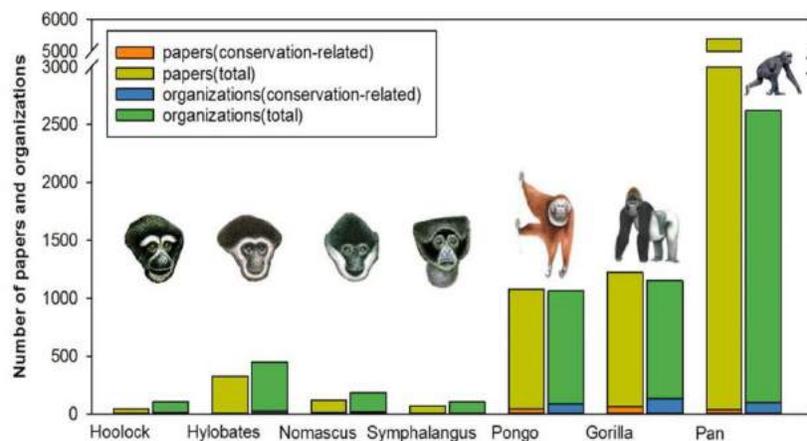


One island has one national park of 16 square kilometers and holds 20 species of gibbons. The IUCN small apes group has 80 gibbon experts, sharing expertise and knowledge. Why is a section on small apes needed? Because there are 20 recognized species of gibbon in 10 countries (4 genera): 4 are Critically Endangered; 14 are Endangered; 1 is

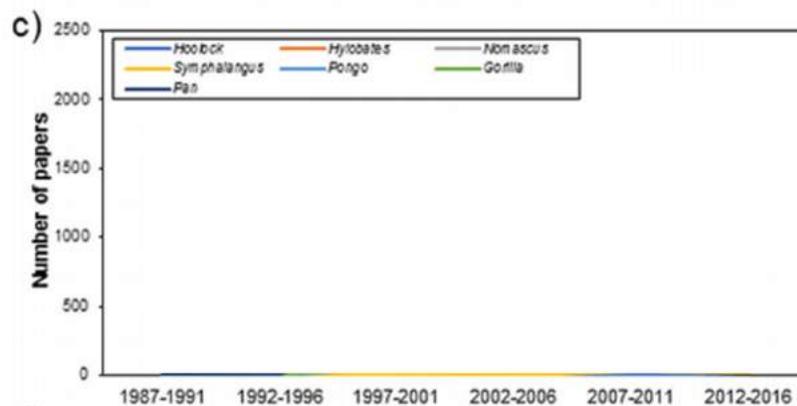
Vulnerable; and 1 is listed as Data Deficient. The IUCN Section on Small Apes (SSA) is a group of more than 80 gibbon experts globally, with a shared vision of conserving the world's gibbons. All habitat countries are represented. As they are so wide spread, there are different conservation issues as environments vary greatly. The image below shows forest loss between 2000 and 2014, calculated based on the Global Forest Change map (Hansen et al., 2013).



Forest loss and protected areas within each species' range (HH: *Hoolock hoolock*; HLE: *H. leuconedys*; HT: *H. tianxing*; NC: *Nomascus concolor*; NG: *N. gabriellae*; NH: *N. hainanus*; NL: *N. leucogenys*; NN: *N. nasutus*; NS: *N. siki*; HAG: *Hylobates agilis*; HAL: *H. albibarbis*; HK: *H. klossii*; HLA: *H. lar*; HMO: *H. moloch*; HMU: *H. muelleri*; HP: *H. pileatus*; SS: *Symphalangus syndactylus*) based on the World Database on Protected Areas (UNEPWCMC, 2016). Numbers of species in each genus are indicated below the illustration. Indonesia has 9 species of gibbons, the most of any country in the world.



There are publications and author affiliations for seven ape genera between 1986 and 2016. Conservation related papers (i.e. refine on Environmental topic) are marked with different colors. Publications were searched by scientific names of all species in each genus included in the Web of Science Core Collection (www.isiknowledge.com).



Above are publications per genus from 1986 to 2016. Publications are aggregated in 5-year blocks.

The mission for SSA: 1) Strengthening coordination among gibbon conservation projects worldwide; 2) Increase awareness of scientifically-sound practice in gibbon conservation; 3) Provide IUCN-endorsed guidelines to conservationists, field scientists and decision makers; 4) Develop Conservation Action Plans that clarify priorities in gibbon conservation for practitioners, decision makers and donors; 5) Ensure the IUCN Red List of Threatened Species as a decision tool is thorough and up-to-date; and 6) Provide direct technical support to implementing projects engaged with gibbon conservation. There is a communications team to help the vice-chair gather and disseminate stories about gibbons across social media.

Actions and plans 2017-2018: SSA Working Groups: Executive Committee: 11:6 / Captive Working Group: 9:4 / Vet and Disease Working Group: 7:3 / Funding Working Group: 6:2

Gibbons and rehabilitation: Most rescue centers have had, or currently have, gibbons. Gibbons require specialist vet treatment and behavioral rehabilitation – not the same as orangutans. Gibbons do not go to forest school as they would run away! The Enclosure Design Tool would be perfect for gibbons in captivity because of that. Another difference between orangutans and gibbons is gibbons do not make nests - they do not need to as they have ischial callosities.



Snowy (owa Java, Javan gibbon (*Hylobates moloch*).

Dehydrated, diarrhoea, not eating, lethargic.

Shot by air rifle 28 times.

Rescuing Gibbons:

The 4 years old pictured above did not survive.

Gibbons and Health: There is a lack of knowledge about gibbon health issues and diseases. Malaria – unknown issue / TB – unknown issue / Hepatitis B – is there a wild gibbon strain? / Herpes simplex – kills gibbons (as far as we know) / Emerging diseases ?????

Even non trained vets, can do a basic quick evaluation of health of an individual. There are high rates of Hepatitis B, but it is not known if it is a wild strain or human. Any Hep B gibbon cannot be released as it is not known yet if it exists in the wild. If a gibbon has herpes it will be dead in 72 hours. Emerging diseases is of concern because of increased proximity to humans and we do not know the implications.

What is known from literature (mainly labs and captive)

What is known from the wild....

Viruses	Parasites
Herpes simplex	<i>Ascaris</i>
Hepatitis B	<i>Baylisascaris</i>
Hepatitis D	Malaria
Gibbon Ape Leukemia Virus	
Bacteria	Other Diseases
<i>Shigella</i>	Cerebral Infarction
<i>Streptopharagus pigmentatus</i>	Myocardial Fibrosis

Parasite Taxa	% Preva		
	Orangutan	Gibbon	Langur
Nematodes			
<i>Ascaris lumbricoides</i>	16%	30%	17%
<i>Enterobius vermicularis</i>	25%	7%	8%
<i>Strongyloides</i> sp.	19%	13%	13%
<i>Trichostrongylus</i> sp.	44%	10%	5%
<i>Trichuris trichuria</i>	6%	0%	28%
Hookworm sp.	56%	47%	28%
Unidentified helminth	22%	23%	22%
Trematodes			
<i>Schistosoma mansoni</i>	0%	10%	10%
Protozoa			
<i>Entamoeba coli</i>	22%	40%	57%
<i>Entamoeba histolytica/dispar</i>	9%	23%	52%
<i>Balantidium coli</i>	0%	17%	47%
<i>Blastocystis hominis</i>	0%	0%	12%
<i>Troglodytella abressarti</i>	50%	10%	0%
Unidentified protozoan	13%	17%	3%

What we know from rehabilitation centers....

Pathogen	
	Mycobacterium app. (tuberculosis)
	Plasmodium hylobati
	Temidens spp
	Trichuris spp
	Strongyloides fuelleborni
	Brugia malayi
	Brugia pahangi
	Human herpes virus 1
	Hepatitis b virus
	Human herpes virus 4
	Cercopithecine herpes virus 5
	Balantidium volii
	Lymphocryptovirus spp
	Necator spp
	Human herpes virus 2
	Ascaris spp
	Paranstrongylus cantonensis
	Cryptosporidium spp
	Trichostrongylus spp
	Simian foamy virus

There are 33 diseases that affect gibbons:

Disease/Bacteria/Virus (32)	Wild	Captive	Literature
<i>Ascaris spp</i>	X	X	X
<i>Balantidium coli</i>	X	X	
<i>Baylisascaris</i>			X
<i>Brugia malay</i>		X	
<i>Brugia pahang</i>		X	
Cercopithecine herpes virus 5		X	
Cerebral Infarction			X
<i>Cryptosporidium spp</i>		X	
<i>Entamoeba coli</i>	X		
<i>Entamoeba histolytica/dispar</i>	X		
<i>Enterobius vermicularis</i>	X		
Gibbon Ape Leukemia Virus			X
Hepatitis b virus		X	
Hookworm sp.	X		
Human herpes virus 1		X	
Human herpes virus 2		X	
Human herpes virus 4		X	
<i>Lymphocryptovirus spp</i>		X	
<i>Mycobacterium spp.</i> (tuberculosis)*		X	
Myocardial Fibrosis			X
<i>Necator spp</i>		X	
<i>Parastrongylus cantonensis</i>		X	
<i>Plasmodium hylobati</i>		X	
<i>Schistosoma mansoni</i>	X		
<i>Shigellosis</i>			X
Simian foamy virus		X	
<i>Streptopharagus pigmentatus</i>			X
<i>Strongyloides fuelleborni</i>	X	X	
<i>Ternidens spp</i>		X	
<i>Trichostrongylus spp</i>	X	X	
<i>Trichuris spp</i>		X	
<i>Trogloidyrella abassarti</i>	X		

OVAG and SSA: There is no coordinated vet forum for gibbon projects. The SSA hopes to work with OVAG to bring gibbon vets from in situ and ex situ organizations to the annual OVAG meeting. Identify actions to tackle emerging diseases in wild and captive gibbons and siamang. The SSA will ensure this meeting is regularly attended to ensure maximum knowledge exchange for gibbon vets. The hope is that gibbon vets can join OVAG to learn from orangutan vets (dealing with fractures, triage, etc.). Many orangutan centers deal with gibbons so this exchange would be both ways. Support is needed for looking at what diseases occur in wild and captive gibbons. Information on gibbons is very scattered as they exist in a much broader area than orangutans.

Gibbon projects which have vets exits in: Indonesia / Malaysia / Thailand / Cambodia / China / India / Vietnam

A Best Practice guide was developed with virtually every gibbon location. Free to download these guidelines and the summary (in multiple languages). Guidelines based on best practice – even information on translocation. Full Guidelines are in English. Summary guidelines in: Bahasa Malaysia and Khmer (Cambodia). Coming soon (August 2017): Bahasa Indonesia, Chinese, and Thai. Free to download from SSA website. Section.small.apes@gmail.com / www.gibbons.asia

Please get in touch if you want to join the section on small apes.

Gibbon vets will be invited next year. Using OVAG as a way of sharing information across all species of wildlife.

Discussion:

What is troubling is that many orphan gibbon babies coming into SWD areas. Some respiratory ailments are quite common. Air sac problems in orangutans can be compared to siamangs with their throat sacs. There is increasing trade in young gibbons. There is a new article published on gibbon hep virus. Steve will give to Susan. For lesser apes, there are also NGO's working within Java – Where are macaques released? There is a closed off section of forest for their use. This assists in establishing group cohesion. Little as possible human intervention. Prior to their final release site. They are released in groups. Parasites in wild vs captive ...are meds removing valuable gut bacteria? For slow loris,

deworming is once a month – then after only when there is a case and again before release, if level of parasites are in normal range, no deworming. In macaques, parasite load is high as they have been in contact with other animals and have been around humans, so the meds are high because of that. In gibbons, no deworming all along the reintroduction process, but only as needed so deworm first, then before release – regarding deworming -with gibbons the males and females are transported separately, then they must reacquaint themselves before release. Steve is advisor for Sulawesi macaques in Europe – so good to get together and share info with Tasikoki – what do they naturally carry? There is a huge data gap for both gibbons and macaque's.

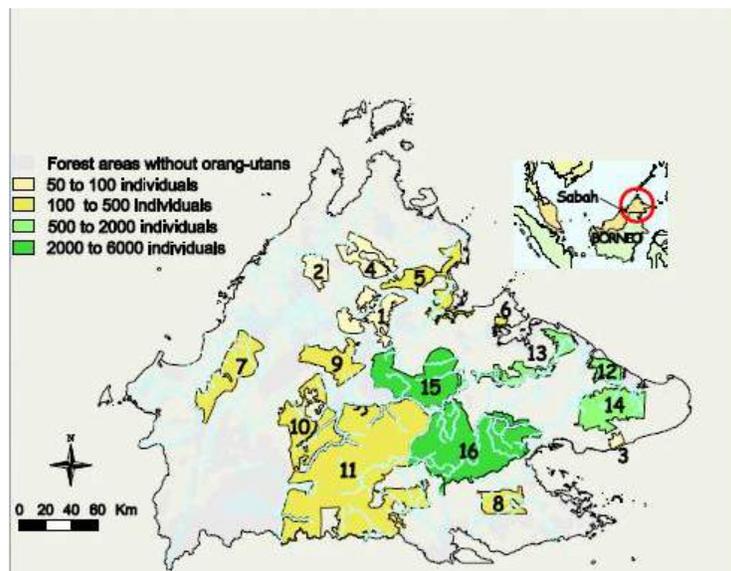
Orangutan On The Edge – Protecting Orangutans in Sabah's Mixed Use Forest

Isabelle Lackman and Felicity Oram,
Hutan-Kinabatangan Orangutan Conservation Programme

The Hutan-Kinabatangan Orangutan Conservation Programme has been operating in Sabah for 19 ½ years. It has been successful because of the range of partners they have been able to gather working together.

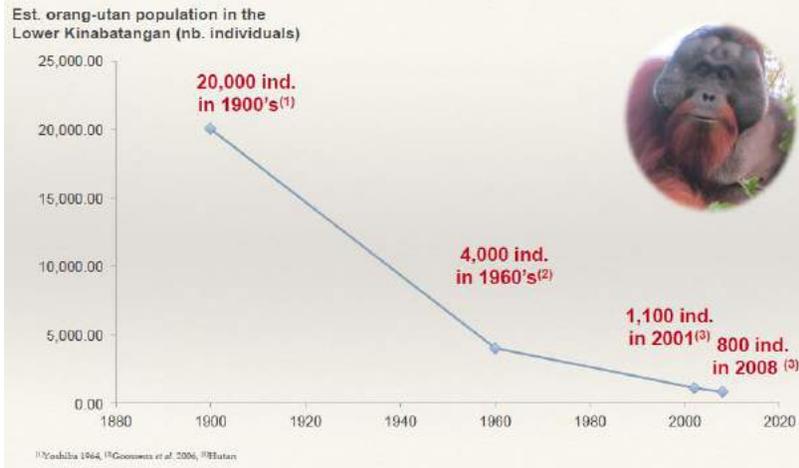


In Sabah there are about 11,000 orangutans in 16 separate sub-populations.



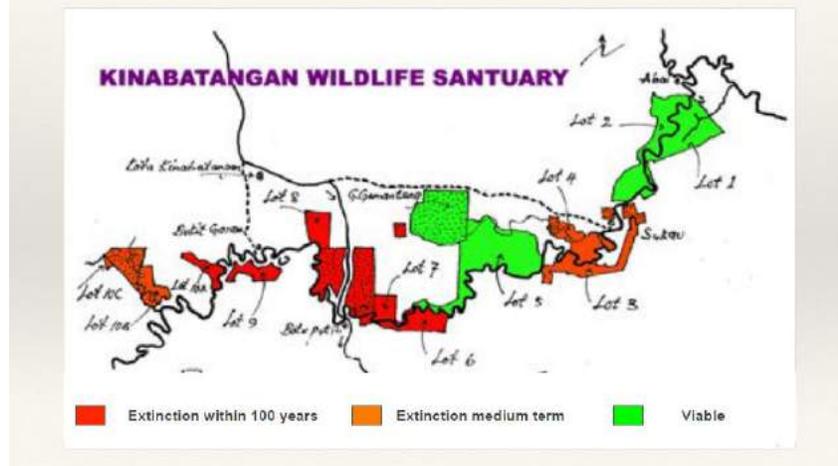
Ancrenaz, M. et al. Aerial Surveys Give new estimates for orangutans in Sabah, Malaysia. *PLoS Biology* 3, e3 (2005)

Brief history of the Kinabatangan orang-utans



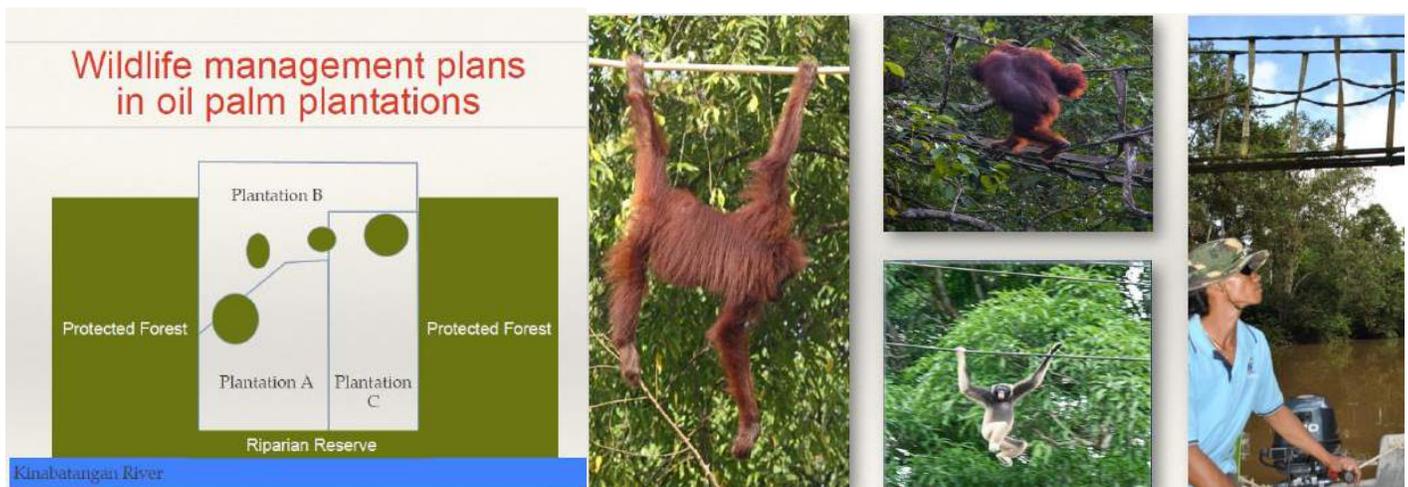
Orangutans living in the Kinabatangan region are thriving in regenerating degraded forests which are worth protecting.

Genetic study of Kinabatangan orang-utan population



There is a new study that has begun which is looking at how orangutans make use of the oil palm. Part of that work involves promoting tolerance of orangutan use of oil palms among the local population.

Another key part of continuing the Kinabatangan orangutan population is the building of bridges that act as corridors.



Another partnership is between wild research and rehabilitation centers. Sharing research on wild orangutans can be of immense help to rehabilitation centers. Research sites can provide valuable information on: foods wild orangutans consume; behavioral development milestones in young orangutans; post-release monitoring protocols and long term survival assessment (follow techniques, time budgets, feeding, social, resting behaviors etc.; share state and province wide population survey data and trends in order to evaluate suitable releases sites; environmental constraints in wild orangutans (forest patch size, food availability, buffers, etc.; new findings on social organizations and social constraints in wild populations (understanding male strategies, social flexibility, male/female releases, resource competition, etc.

This partnership works two ways as rehabilitation centers can also assist research sites. Rehabilitation centers can: exchange information on origins of rescued orangutans to help identify hotspots and provide disease information; help to non-invasively assess health of studied orangutans specifically for factors influencing observed behaviors, self-medication studies; participate in wild orangutan population management plans highlighting sanitary aspects on the local, state/province, and country levels; engage in joint awareness programs and public communication and engagement; become members of RSPO (Roundtable on Sustainable Palm Oil).

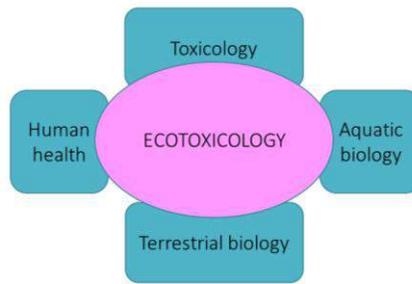
The hygiene issue is of particular concern as in 2012 a Hutan reforestation staff member became ill and was in intensive care for two weeks before they were diagnosed as having leptospirosis. Thirty-two Hutan staff members were tested at a local clinic (IgM tests). Eighteen tested positive (given doxycycline), five were hospitalized and though a report was sent to Sabah Health Department (SHD), the outbreak was not declared. Seven Hutan field sites were tested by the Sabah Health Department and 21 samples were taken from river, water tanks and soil. Pathogenic leptospira was detected at one site. The order was given to abandon that site. SHD also tested 80 villagers (blood tests) and 33 village houses (water tanks and soil). The results of that testing were not available. The Department of Veterinary Services tested dogs, cats and chicken in the villages, those results were not available either. SHD then requests Hutan to capture small mammals at field sites for testing – again, those results were not made available. SHD did give awareness talks on leptospirosis at village community hall. When a third test at Hutan site was conducted, the site was clear and work resumed.

Ecotoxicology in Southeast Asia: An overview of pollutants in our environment

Lesia Thompson, Hokkaido University

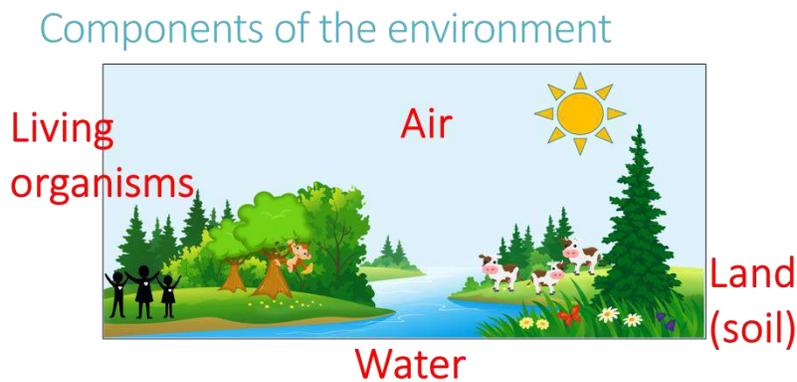
Human health problems: Many environmental health problems persist in the region. Air pollution / Inadequate safe drinking water / Undernutrition / Growing electronic waste problem. These problems may also affect animals and the environment (Suk 2016).

What is ecotoxicology? Ecology: Biology about relations of organisms to one another and to their physical surroundings. Toxicology: Science about the nature, effects, & detection of poisons. It is the study of the effects of toxic chemicals on biological organisms. Affects: Population / Community / Ecosystem / Biosphere.



Why should we care about toxicology? Many problems affect our environment and wildlife! Such as: Habitat destruction / Wildlife pet trade / Bush meat / Infectious diseases / etc. Of course we care about these things. But usually the problem isn't simply due to one cause, it is multifactorial. Toxicology is: Often undetected and under-reported; is extrapolated from other species, including humans; is multi-factorial: with other chemicals, and/or with other disease etiologies.

What elements do you think we should consider when thinking about ecotoxicology? Air (atmosphere) / Surface waters (hydrosphere) / Land surface (principally soil) / Living organisms (biosphere).



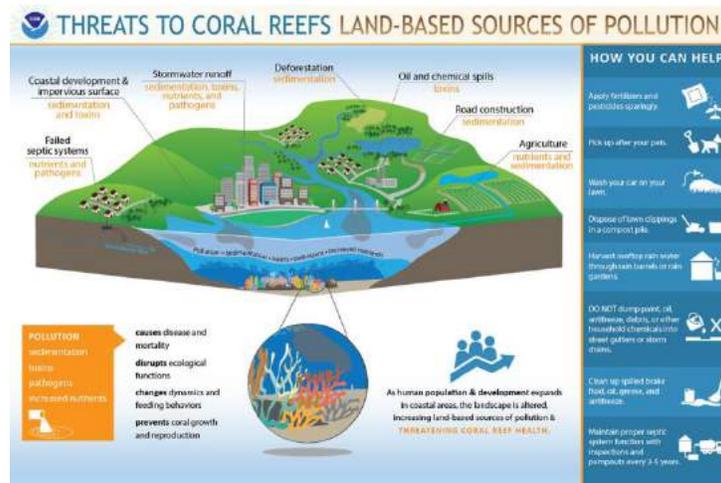
Origin of pollutants: Agriculture / Manufacturing processes / Environment / Enter ecosystem *via* Waters / Land / Atmosphere along with Potential for long-range movement.

Entry into surface waters: Sewage, commercial premises, nuclear power stations, runoff from land, aerial spraying, dumping at sea, release from oil rigs, shipwrecks.

Land contamination: Waste dumping, pesticide applications, insect disease vector control, application of sewage to agricultural land, flooding, precipitation from air as dust or droplets or in rain/snow

Discharge into atmosphere: Chimneys (domestic or industrial), internal combustion & jet engines, pesticide applications, refrigerators, aerosols.

E.g. coral reefs: Jakarta Bay, Indonesia. Local coral reefs are degraded & marine resources heavily exploited. Decline mainly due to pollution and overexploitation (Baum *et al* 2016).



Some toxicological issues: Global distribution: especially *via* waterways & the air / Biodegradation: toxins may degrade to become safer OR may become more toxic / Bioaccumulation: within an individual over the course of its lifetime / Biomagnification: persistent chemicals accumulate in organisms at higher trophic level / Species differences: in accumulation, distribution, metabolism & excretion (ADME); sensitivity to toxic effects.

Major classes of pollutants:

Organic pollutants

- Hydrocarbons (PAHs)
- Polychlorinated biphenyls (PCBs)
- Organochlorines (OCs)
- Organophosphates (OPs) e.g. DDT
- Carbamates
- Pyrethroids
- Neonicotinoids
- Detergents
- Pharmaceuticals & personal care products e.g. ethinylestradiol (EE2), beta blockers

Heavy metals & metalloids

- Cadmium
- Lead
- Arsenic
- Mercury

Radioactive isotopes

Gaseous pollutants

- Ozone, CO₂, sulfur dioxide

Nanoparticles

POPs (persistent organic pollutants): they are found in the environment worldwide, and accumulate in food chain (mainly in fatty tissue of animals) e.g. dioxins. Stockholm Convention bans or strictly controls use of POPs. Dioxins: 419 identified but only 30 significant toxicity (TCDD most toxic).

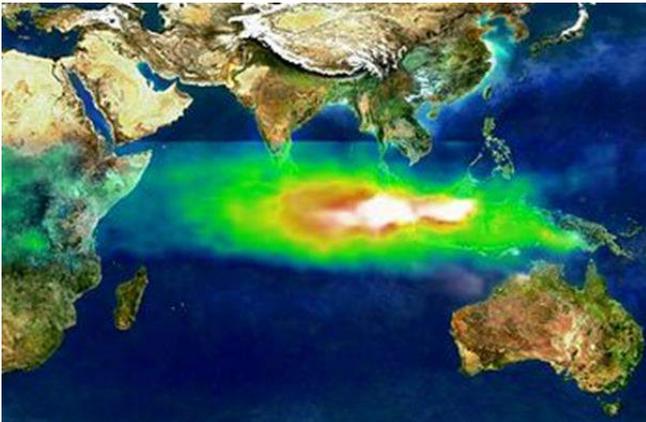
Toxic effects: Exposure / Contact / Inhalation / Ingestion with food/water. Effects depend on the organism as there are species differences. Also there can be interactions between multiple pollutants. Aquatic organisms are usually sensitive biomarkers for ecosystem health. Some studies focus on mammalian species (including non-human primates!) to assess human health risk.

Water: Sources of pollution: Runoff – agricultural land, industry / Pesticides, sewage (including pharmaceuticals) / Mining / Waste e.g. plastics (especially in oceans), micro plastics. Consider the nature of chemical pollutants - Hydrophilic is carried by the water. Hydrophobic is carried in sediments or biota...potential for global dissemination. River Citarum, Indonesia is “One of the most polluted in the world” (Telegraph, 2014). Textile factories use dyes and chemicals, including lead, arsenic and mercury; plastic, packaging etc. Some other rivers tested also did not meet water criteria class I.

Air pollution: Sources: Cars / Industry / Fires – home fires, landfill fires, forests, agricultural land, peatlands & palm oil plantations / Coal. Effects: Respiratory disease, including cancer / Particulate pollution leading to low birth weight / Impaired brain development in the young, and cognitive decline in the elderly.

World Health Organization (WHO) guidelines for air quality: Measure particulate matter / Contain many chemicals e.g. Cu, Fe, K, Ni, S, Si, V & Zn / PM_{2.5}, PM₁₀ / Smaller size is associated with more severe respiratory disease / Young children (<5y.o.) most vulnerable / Other chemicals: e.g. ozone, NO₂, SO₂ (Patel *et al* 2016; Pereira *et al* 2016).

1997 Southeast Asian haze: Fires in Kalimantan & Sumatra. Air pollution: atmospheric particulate matter > national ambient air quality standards. Countries affected: Indonesia, Singapore, Malaysia, Thailand, and Brunei. Health effects: Respiratory symptoms / Eye & skin irritation / Reduced visibility leading to impaired transportation. Economic damage: estimated US\$ 1 billion (Indonesia alone) / Decreased quality of life, loss of biodiversity & atmospheric impacts.



https://en.wikipedia.org/wiki/1997_Southeast_Asian_haze Air pollution over SE

Asia in October 1997: 3,000,000 km² area

Repeated hazes: E.g. September 2015, 6 Indonesian provinces declared a state of emergency. Cause: illegal slash-and-burn which spread in dry season leading to forest fires especially in Sumatra and Kalimantan which contain large areas of combustible peatland. It is drier when El Niño conditions are present, so fires spread more.

Pollutant Standards Index (PSI): > 350 = “hazardous” on 2 Oct 2015, recorded 1,801 in Central Kalimantan.

Counter-measures: Firefighting: dump water on fires; cloud seeding aircraft; retention basins / Mitigation of health effects: face masks, O₂ cylinders.

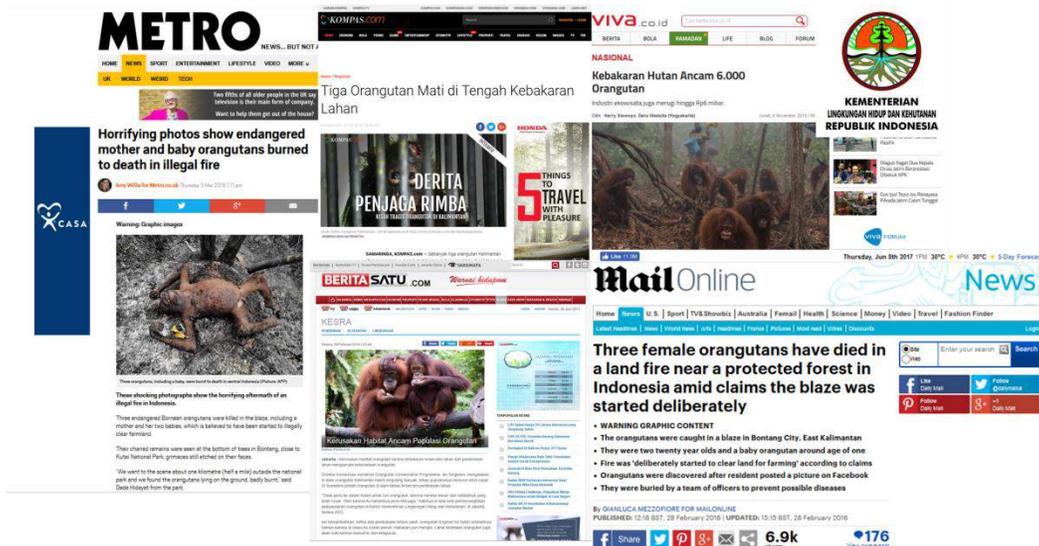
What toxins can be produced by fires?

Toxin	Effect
Carbon monoxide	Carboxyhemoglobin → oxygen depletion
Polyaromatic hydrocarbons (PAHs)	Respiratory disease, carcinogenic
Dioxins ^a	Skin lesions, altered liver function, impaired immune system, developing nervous system, endocrine system, reproductive functions, cancer. Wasting syndrome.
Burning synthetic polymers (plastics) → hydrogen cyanide, inorganic acids	Respiratory damage. Skin/eye irritation. CNS & myocardial effects. Metabolic acidosis.
Acrolein ^b	CVS, haematological, ocular, respiratory
Heat stress	-
Oxygen depletion	-

^a Mainly by-products from industry, but can result from volcanic eruptions & forest fires. Especially with incomplete burning of waste during incineration.

^b From burning trees/gasoline/oil, also pesticides & manufacture of other chemicals. *Burcham 2017

Acute single high dose dioxin leads to wasting syndrome, delayed death in 1-6 weeks. Chronic/sub-chronic exposure dioxin is harmful especially during developmental stages including fetal, neonatal and pubescent stages. E.g. cleft palate, hydro nephrosis, disturbances in tooth development and sexual development as well as endocrine effects. Smoke generated in structural fires from products composed of carbon and nitrogen contains various concentrations of hydrogen cyanide. Commercial products made up of materials such as wool, paper, cotton, silk and plastics may produce hydrogen cyanide when they burn. Hydrogen cyanide is formed when natural fibers, such as wool and silk, and synthetic polymers, such as polyurethane and nylon, are not completely consumed during a structure fire. These materials are used in insulation, floor coverings, and other construction materials and furnishings that may be present in a building. <http://www.firehouse.com/article/10502165/hydrogen-cyanide-the-real-killer-among-fire-gases> Hydrogen cyanide is associated with the burning of plastics, especially if the fire is hot and in a confined space.



Impact of forest fire and haze pollution on wildlife: Reduced pollination after fires leading to lack of fruit / Reduced vocalizations, e.g. long calls, recorded in wild orangutans / Increase in coughing during haze (Singapore Zoo). Delay (one month) before a rise is seen in respiratory disease, e.g. air sacculitis. Strong correlation with smoke pollution. Diseases caused by forest fires are mostly acute respiratory infections, skin burns, eye irritation and starvation-related.

Considerations: Wild animals are very sensitive to fire and would likely have moved away from the area before the disaster occurred. Data and information are mostly based on news from media and the orangutan rehabilitation center that conducted the evacuation. No reports or evidence (e.g. remains of a dead body) of mass death by fire in a population of wild animals within the burned areas. Studies need to be carried out to determine the effect of fire & haze, & long-term impacts. Even though habitat has been damaged, there has been no study on the population decrease caused by forest fire. No integrated assessment has been carried out on the impact of smoke and wild fires on wildlife. Disease, indirectly caused by forest fire, has been detected in wildlife rehabilitation centers.

Heavy metals: Most common toxic heavy metals: Lead (Pb) / Mercury (Hg) / Cadmium (Cd) / Arsenic (As)

Metal	Route of entry	Toxicity	Suspected carcinogen
Arsenic	Inhale, ingest	Irritation respiratory system. Liver/kidney damage. Appetite loss, vomiting.	Yes
Cadmium	Inhale, ingest	Lung/liver/kidney damage. Irritation respiratory system.	Yes
Lead	Inhale, ingest	CNS/lung/liver/kidney damage. Appetite loss, vomiting.	No
Mercury	Inhale, ingest, absorb via skin	Irritation respiratory system. Lung/liver/kidney damage.	Yes

NIOSH: Institute of Occupational Safety and Health, ACGIH: Conference of Governmental Industrial Hygienists

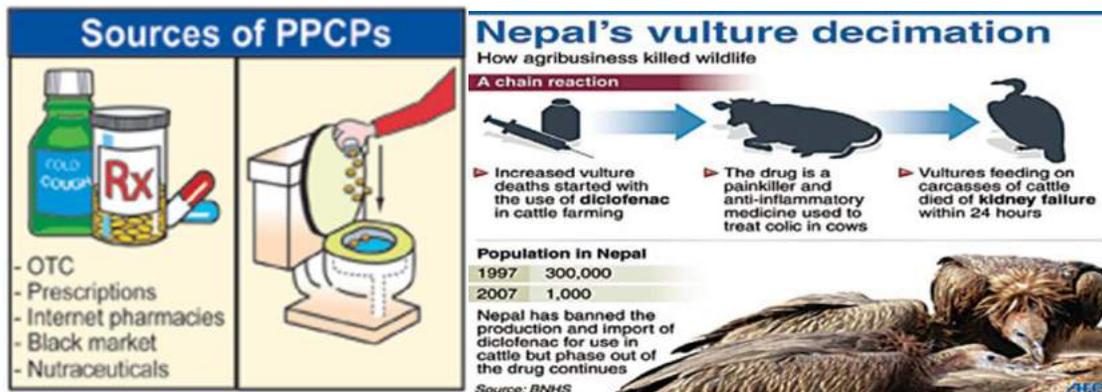
Sources of heavy metals: Industrial activities / Commercial fertilizers / Animal manures / Metal-based pesticides / Deposit in surrounding water and soil. Taken up by plants, fish and eaten by animals/people (Ong *et al* 2016; Poon *et al* 2016).

Reduction: Regulation of improper use of agrochemicals / Continuous monitoring of heavy metals in plants (e.g. those for human consumption) (Saha *et al* 2016).

Coal: 40% of lowland forest in Kalimantan & Sumatra cleared in the past 15 years. Deforestation is mainly for timber, palm oil plantations, pulpwood and mining. Coal mining: Indonesia is the largest coal producer in the world. More than 80% of coal is exported. Most coal mining is in Kalimantan and Sumatra, through open cast mining. Effects: Major infrastructural projects (roads/railways) are implemented, contributing to deforestation. Water contamination by minerals/heavy metals unearthed during mining.



Pharmaceuticals: Pharmaceuticals and personal care products as pollutants (PPCPs): Pollution from pharmaceuticals in surface and groundwater is becoming recognized as an environmental concern: Prescription & over-the counter therapeutic drugs / Veterinary drugs / Fragrances / Cosmetics / Sun-screen products / Diagnostic agents / Nutraceuticals (e.g. vitamins).



Effects of PPCPs: E.g. Endocrine disrupting chemicals, such as synthetic estrogens (e.g. EE2 from oral contraceptive pills & hormone therapy) which has a potential risk of interference with reproduction and development in both people and animals (Fang *et al* 2016). E.g. Synthetic progestins which act as anti-androgens leading to feminization in fish (Siegenthaler *et al* 2017). E.g. 4-MBC in sunscreen: teratogen in fish, influences muscular and neuronal development (Li *et al* 2016).

Remediation: Containment: E.g. Deep geological disposal for high level radioactive waste / Separation. E.g. Phytoremediation / Degradation. E.g. Incineration; photo-catalytic reaction; bioremediation using microbes. Reduce/stop source of contamination / Prevent access to the contamination / Prophylactic treatment? / Therapeutic treatment?

Wildlife: Undetected & under-reported / Often not mortality incidents / Morbidity e.g. increased susceptibility to infectious disease or reduced fertility / Chemical mixture exposures / Contamination check / Blood, tissues, teeth, hair, feathers / Chemical analysis &/or biomarkers / Sentinels for One Health.

Chemical mixture exposures (Stanley, p171-172): In the field, living organisms are exposed to mixtures of pollutants, and questions arise about possible interactions between the components of mixtures. When chemicals are tested during an environmental risk assessment, they are usually tested individually. Very rarely are mixtures tested. In the absence of evidence to the contrary, it is normally assumed that the toxicity of mixtures of compounds will be additive, i.e. the toxicity of a mixture will approximate to the total toxicities of its individual components.

This is often the case, and several types of environmental chemicals share a common mode of action which behave this way, e.g. Ah receptor-mediated toxicity caused by mixtures of coplanar PCBs & dioxins. However, in a small but significant number of cases toxicity is potentiated when organisms are exposed to mixtures & the level of toxicity is substantially greater than additive. The best known cases involve interactions at the toxicokinetic level, where one compound inhibits the detoxification of another or one increases the rate of activation of another.

Wildlife as sentinels? A study used analysis of hair to determine lead and mercury levels (and stable isotope analysis) in macaques at Swoyambhu temple in Kathmandu, Nepal. Non-invasive detection method / Low levels of mercury / Lead higher in young animals. "Macaques are similar to humans both physiologically and behaviorally. ...ecologically associated with humans. ...come into contact with anthropogenic toxicants...and might be appropriate sentinels for human exposures to certain toxic materials." (Engel *et al* 2010).

Toxicology in animals (especially wildlife) is far behind knowledge and treatment of toxicology in humans. Often need to extrapolate from human medicine. There is a need to perform testing for diagnostics and surveillance.

Administration of quiz – second time – evaluation sheet for OVAG – IUCN Reintroduction Guidelines Questionnaire

Review of Post It Notes Wall!

Waste management – how to cope? Medical waste (needles are destroyed) but the rest of the waste is burnt in the incinerator, not thrown in public areas. Sometimes needles and other medical waste are sent to the local hospital for disposal – but a fee is asked for the service. Visitors often add to the waste – in some centers, garbage is separated and kept in a separate area and a medical company comes to pick it up to deal with.

TB procedures for diagnosis – is it enough for the culture or stain and chest x ray? The stain is not sufficient enough with low sensitivity; same for chest x-rays – PCR is good and samples last for that, culture timing might be an area of concern. There is plenty of resources for TB on the Google Drive site for OVAG. We will contact everyone in the last week of August to let everyone know where the materials are and how to log on to it.

An area of concern is getting a good lab as some centers are quite far from a good facility. Sintang is getting ready for its first release and want to be certain that orangutans are healthy and ready to go. If diff to get sputum, there are other tests that can be done to try to get an accurate assessment for the presence of TB. Work together with local hospital or clinic for assistance regarding TB as it affects the human population and WHO is very willing to assist with orangutan TB cases and diagnoses.

Anesthesia is used only if individual is deemed able to handle it. If possible, there are other tests rather than sedation if you feel it is too risky,

Suggestion for future... course in wildlife medicine for vets in the field is not available here yet – but possible in the future. Chris will try to talk to folks in America and arrange for medical kits as well as field training. Snake bites? The best cure is car keys – get in the car and go.

Chris gave away gifts to 5 volunteers who spend a lot of time in the forest. Scenario: Chris is walking along in the forest with a machete and he is breaking the trail...but Chris is clumsy and he sliced his elbow and leg and then he fell down a cliff and femur is sticking out – massively bleeding and he fell on a stick piercing his groin. The 5 volunteers assist.

Sumita announced and promoted the 10th annual International Meeting for Asian Society of Conservation Medicine to be held October 20-23 2017. Reuben Sharma is the organizing chairman. He would like to invite everyone to Kuching for this conference. Abstracts were due by end of August (ascm2017/borneo.com). We had two OVAG vets attend! Next year the same conference is in Bali and it would be good to have a presence in Nairobi in 2018 and we may be able to get funding assistance.

OVAG committee meeting – OVAG committee only

Certificate distribution and conference dinner.



July 23-27 Jogjakarta, Indonesia



Section Four

May 2017



BIAZA
BRITISH & IRISH ASSOCIATION
OF ZOOS & AQUARIUMS

Award Winner



Conservation

presented by the BIAZA Council to

Chester Zoo

for

Orangutan Veterinary Advisory Group (OVAG)

A handwritten signature in black ink, appearing to be 'P. ...', positioned above a dotted line.

Chair, BIAZA



Gold Award

Appendix 2 – Evaluations

MARKS	Question	Answer	Pre workshop (0) as a %	Post workshop (0) as a %	Pre workshop (1/2 mark) as a %	Post workshop (1/2 mark) as a %	Pre workshop (full mark) as a %	Post workshop (full mark) as a %	Improved, worsened, no change	Significant difference?
1	2 Define 'biosecurity'	Similar to: Protocols designed to reduce the risk of pathogen transmission	7	5	29	25	20	22		
2	2 Which of the following are components of a disease or pathogen contingency plan?	THEY ALL ARE A. A list of people and organisations to contact in a disease outbreak, and why they must be contacted. B. Biosecurity protocols C. Methods of disease transmission and management strategies to reduce transmission D. A map of your facility E. background information on the disease of concern	10	11	17	11	30	30		
3	2 List ways pathogens and disease can be transmitted. (as many as you can).	Faecal-oral, direct contact, Aerosol, indirect (soil/ water/vector), body fluids	2	1	40	36	16	15		
4	2 For each answer to question 3, describe one way of how you can break that transmission	Hygiene (hand washing), PPE, etc	9	5	18	25	30	23		
5	2 Define disease risk	Similar to: Disease Risk is the likelihood of the occurrence and the magnitude of the consequences (severity) of a pathogen entering a population – for this you need a vulnerable population and the possibility of exposure, to a particular pathogen.	17	12	23	28	17	12		
6	2 What does epidemiology study	Epidemiology is the study of disease in populations. Makes trends, allows spread prediction and allows management. Wildlife spread to human/ domestic and vice versa. Transboundary spread etc.	9	7	34	30	14	15		
7	1 In 1 sentence, suggest when it is reasonable to consider euthanasia of an orangutan.	Open answers	5	4	N/A	N/A	52	47		
8	3 What is the orangutan social system in the wild; in a zoo; in a rehabilitation centre		14	18	34	30	9	4		
9	3 What do orangutans eat in the wild; in a zoo; in a rehabilitation centre		4	1	41	38	12	13		
10	2 How many unique orangutan behaviours can you list?		30	19	15	25	12	8		
11	2 List the following types of investigative studies in order of result reliability, with the most reliable first	C. Systematic review, E. Meta-analysis, D. Randomised control trial, A. Cohort Studies, G. Case series, F. Single Case report, B. Expert Opinions, textbooks, personal experience and the internet	39	43	18	9	0	0		
12	2 What are the top 5 sources of information you would make use of when faced with a medical issue you need to investigate	Open Answers	5	2	21	14	31	35		
13	2 Which of the following are essential in the treatment of open fractures?	A and B - they would have to present a rationale for C. D and E could be used but are not essential	14	16	26	19	5	9		
14	2 Which of the following fracture repair systems can provide stability against all of the forces acting on a comminuted (multi-fragment) mid diaphyseal radius and ulna fracture?	B and D for sure, C under the right circumstances A and E should not really be used on their own	15	4	26	31	5	9		

14	2	Which of the following fracture repair systems can provide stability against all of the forces acting on a comminuted (multi-fragment) mid diaphyseal radius and ulna fracture?	B and D for sure, C under the right circumstances A and E should not really be used on their own	15	4	26	31	5	9		
15	2	Check all of the following that are TRUE about the purpose of a cuff on the end of the endotracheal tube	B and E	14	4	21	28	10	12		
16	1	When monitoring an orangutan under anaesthesia, which of the following would you most like to see?	D	23	17	N/A	N/A	22	25		
17	2	Check ALL of the following that are TRUE regarding orangutan respiratory disease	C and D	8	2	19	14	18	28		
18	3	List AT LEAST 3 ways to investigate pathogens in the living individual.	a mark per investigation type	9	2	7	7	28	35		
19	3	(a) List the reasons for putting samples in formalin when doing a post mortem (b) List sampling methods other than 'in formalin' during a post mortem	Photos to histology. Bonus points if mention multiple aliquots.	7	3	27	30	11	11		
20	3	A. How should you test for Tuberculosis? B. Provide a differential diagnosis list for other pathogens with similar clinical signs to TB.	As many modalities as possible – culture and PCR currently most recommended. Other respiratory pathogens and chronic causes of weight loss.	1	1	34	23	10	20		
	43	Before 1-12 N=58 13-20 N=46. After 1-12 N=52 13-20 N=44									