GUIDELINES FOR TAPIR RE-INTRODUCTIONS AND TRANSLOCATIONS

IUCN/SSC TAPIR SPECIALIST GROUP (TSG)
Tapir Re-Introduction & Translocation Taskforce

May 2008

EDITORS

Patrícia Medici
Conservation Biologist M.Sc. Ph.D. Candidate

Research Coordinator, Lowland Tapir Conservation Initiative
IPÊ - Instituto de Pesquisas Ecológicas (Institute for Ecological Research), Brazil
Ph.D. Candidate, Durrell Institute of Conservation and Ecology (DICE), University of Kent, UK
Chair, IUCN/SSC Tapir Specialist Group (TSG)
Convener, IUCN/SSC Conservation Breeding Specialist Group (CBSG) - Brazil Network
E-mail: epmedici@uol.com.br; medici@ipe.org.br; epm5@kent.ac.uk

Paulo Rogerio Mangini
DVM M.Sc. Ph.D. Candidate

Associate Researcher, Lowland Tapir Conservation Initiative
IPÊ - Instituto de Pesquisas Ecológicas (Institute for Ecological Research), Brazil
Member, IUCN/SSC Tapir Specialist Group (TSG)
Member, IUCN/SSC Wildlife Health Specialist Group (WHSG)
E-mail: pmangini@uol.com.br; pmangini@ipe.org.br

Anders Gonçalves da Silva
Biologist - Geneticist Ph.D.

Postdoctoral Fellow, Unit of Biology and Physical Geography
University of British Columbia, Okanagan, Canada
Coordinator, Genetics Committee, IUCN/SSC Tapir Specialist Group (TSG)
E-mail: anders.goncalvesdasilva@ubc.ca

Leonardo A. Salas
Animal Population Biologist Ph.D.

Post-Doctoral Fellow, Redwood Sciences Laboratory
U.S. Forest Service - Pacific Southwest Research Station, United States
Member, IUCN/SSC Tapir Specialist Group (TSG)
E-mail: leoasalas@netscape.net; leonardo_salas@sbcglobal.net

AUTHORS

Patrícia Medici
Conservation Biologist M.Sc. Ph.D. Candidate

Research Coordinator, Lowland Tapir Conservation Initiative
IPÊ - Instituto de Pesquisas Ecológicas (Institute for Ecological Research), Brazil
Ph.D. Candidate, Durrell Institute of Conservation and Ecology (DICE), University of Kent, UK
Chair, IUCN/SSC Tapir Specialist Group (TSG)
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E-mail: epmedici@uol.com.br; medici@ipe.org.br; epm5@kent.ac.uk

Paulo Rogerio Mangini
DVM M.Sc. Ph.D. Candidate

Associate Researcher, Lowland Tapir Conservation Initiative
IPÊ - Instituto de Pesquisas Ecológicas (Institute for Ecological Research), Brazil
Member, IUCN/SSC Tapir Specialist Group (TSG)
Member, IUCN/SSC Wildlife Health Specialist Group (WHSG)
E-mail: pmangini@uol.com.br; pmangini@ipe.org.br

Anders Gonçalves da Silva
Biologist - Geneticist Ph.D.

Postdoctoral Fellow, Unit of Biology and Physical Geography
University of British Columbia, Okanagan, Canada
Coordinator, Genetics Committee, IUCN/SSC Tapir Specialist Group (TSG)
E-mail: anders.goncalvesdasilva@ubc.ca

Javier Adolfo Sarria Perea
DVM M.Sc.

Independent Researcher, Colombia/Brazil
Coordinator, Veterinary Committee, IUCN/SSC Tapir Specialist Group (TSG)
Member, IUCN/SSC Wildlife Health Specialist Group (WHSG)
E-mail: jasarrip@yahoo.com

Joares A. May Jr
DVM M.Sc. Candidate
Researcher, Pró-Carnívoros Institute, Brazil
Consultant, Lowland Tapir Conservation Initiative
IPÊ - Instituto de Pesquisas Ecológicas (Institute for Ecological Research), Brazil
Member, IUCN/SSC Wildlife Health Specialist Group (WHSG)
E-mail: joaresmay@ig.com.br

Ralph Eric Thijl Vanstreels
DVM B.S. Candidate
University of São Paulo (USP), Brazil
E-mail: ralph_vanstreels@yahoo.com.br

Leonardo A. Salas
Animal Population Biologist Ph.D.
Post-Doctoral Fellow, Redwood Sciences Laboratory
U.S. Forest Service - Pacific Southwest Research Station, United States
Member, IUCN/SSC Tapir Specialist Group (TSG)
E-mail: leoasalas@netscape.net; leonardo_salas@sbcglobal.net

COLLABORATORS & REVIEWERS

Adriana Sarmiento Dueñas, UNAL, Colombia & TSG Member

Alan Shoemaker, Permit Advisor, AZA Tapir TAG, United States & TSG Red List Authority

Astrith Rubiano, DVM Smithsonian Institution, United States & TSG Member

Benoit de Thoisy, DVM Kwata Association, French Guiana & TSG Member

Carlos Sanchez, DVM Smithsonian National Zoological Park, United States

Diego J. Lizcano, Universidad de Pamplona, Colombia & TSG Member

Elliot Handrus, Mountain View Breeding Center, Canada & TSG Member

Joe Flanagan, DVM Houston Zoo Inc., United States & AZA Tapir TAG

Juan Pablo Juliá, Universidad Nacional de Tucumán, Argentina & TSG Member

Keith Williams, Private Consultant, Australia & TSG Member

Kevin Flesher, Michellin, Brazil & TSG Member

Mathias Tobler, Botanical Research Institute of Texas, United States & TSG Member

Siân S. Waters, Conservation Zoologist, United Kingdom & TSG Member

Viviana Quse, DVM Fundación Temaikén, Argentina & TSG Member

Zoe Jewell & Sky Alibhai, WildTrack, Portugal

REVIEWED BY

IUCN/SSC Re-Introduction Specialist Group (RSG)

Frederic Launay & Pritpal Soorae

and

IUCN/SSC Wildlife Health Specialist Group (WHSG)

Richard Kock

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Justification

The environmental conservation and management philosophy of The International Union for the Conservation of Nature (IUCN), exposed in key documents such as *Caring for the Earth* and the *Global Biodiversity Strategy*, acknowledges the need for approaches that include community involvement and participation in sustainable natural resource conservation, promote the overall enhancement of the quality of human life, and that seek to conserve and, where necessary, restore ecosystems.

Clearly, the most sensible means - ecologically and economically - to protect a species and maintain its genetic stock is to manage populations and stocks in the wild (Conway 1989). However, a variety of factors have caused the severe decline or disappearance of entire populations or species in the wild (*e.g.* local or global extinctions). In such cases, restoration of wild populations from captive-managed stocks is the only option to re-establish the wild populations and, most importantly, their ecological roles (Kleiman *et al.* 1994; Stanley Price 1989). Restoration efforts focused on single species of plants and animals are becoming more frequent around the world (Wilson & Stanley Price 1994; Griffith *et al.* 1989). Some such efforts succeed; yet, many still fail (Beck *et al.* 1994; Stanley Price 1989; Griffith *et al.* 1989). Therefore, experimentally tested guidelines are needed to ensure re-introductions and translocations are both justifiable and likely to succeed. It is equally important that the conservation world learns from each initiative, successful or not, and scientists and experts around the world are able to comment and constructively criticize each attempt (Beck *et al.* 1994; Scott & Carpenter 1987).

The four tapir species are ideal candidates for re-introduction and translocation programs. Previous studies have shown that ungulate translocation programs have high success rates (Shepherdson 1994). Studies have further revealed that tapirs are highly adaptable to changes in diet, environmental conditions, and habitat use (see Brooks *et al.* 1997 and references therein), and hence have the potential to successfully overcome some of the greatest challenges presented to relocated animals.

Also, tapirs live in ecosystems where biological diversity is maintained, in part, by the tapirs' key ecological roles, including seed predation and dispersal (especially of large seeds), selective sapling browsing in tree fall gaps, and nutrient recycling (see Fragoso 2005; Fragoso & Huffman 2000; Brooks *et al.* 1997; Salas & Fuller 1996; Bodmer 1991). These important roles make tapirs fundamental components of the restoration of ecosystems and ecological processes.

The Tapir Specialists Group (TSG), a member of the Species Survival Commission (SSC) of the IUCN, has set the highest priority to the development of protocols that are of direct, practical assistance to persons or institutions planning, approving, supervising, and/or carrying out tapir re-introductions and/or translocations. This document comprises the first edition of these protocols, and is by no means complete or authoritative. To date, we are unaware of any scientifically designed and tested tapir re-introductions or translocations, so we lack the basic knowledge to provide authoritative guidelines. Because of this, we opted to take an experimental approach to developing the protocols. As such, this document is composed of some scientifically gathered information, well-informed suggestions and recommendations about how to proceed with tapir re-introductions and translocations as an experiment. Similarly, our target audiences at this juncture are the practitioners who would carry out the experiments (usually wildlife managers or scientists), rather than decision-makers in governmental agencies.

With the above in mind, the guidelines for tapir re-introduction and translocation presented herein are divided into steps that are designed to test different modes of re-introduction and translocation, taking into account individual animal variability and the diversity of environmental settings. We strongly emphasize that there must be intensive record-keeping. Detailed record-keeping allows for peer-reviewing and future replication of successful methods and techniques - an element largely missing in many restoration efforts (Beck *et al.* 1994; Scott & Carpenter 1987). Moreover, data can be used for comparison among programs with different tapir species in different areas. Only through comparisons can we begin to understand the role of the innumerable variables involved in re-introduction/translocation programs and improve the process based on the gained knowledge.

It is hoped that our approach will stimulate tapir researchers, conservationists and other interested parties to think critically about these protocols, helping to improve upon our suggestions towards a more comprehensive management tool for tapir conservation.

However experimental our guidelines may be, they still hold a few fundamental rules in common to any re-introduction and translocation program that must be emphasized. First, the TSG solidly upholds the philosophy that the most important rule is always to ensure the safety and well-being of the animals and their foster habitats. Mortality of animals is a natural biological process, but every care should be taken to ensure losses are due to natural causes, not to preventable conditions or situations, such as inadequate handling or transportation. Similarly, the health of the habitats where reintroductions will occur must always be maintained or improved by the restoration process.

Second, although the protocols below are designed to encourage a scientific experimental approach, the TSG has accumulated a wealth of experience and facts to address critical steps in the process, such as chemical restraint and handling. For those steps, detailed guidelines and recommendations are provided. The TSG strongly advocates for the use of these guidelines and will sponsor only those programs that adhere to them.

Third, the ultimate goal of any such program is to establish a viable population that can grow and evolve on its own. Animals confiscated from illegal owners or traders, or relocated because of habitat loss (*e.g.* filling of dams) may be considered experimental subjects to gather information that could be valuable for future restoration or translocation programs, and the protocols below may help design and implement experimental releases for such cases. But the fundamental goal of the protocols is to restore populations; this goal should always be kept in sight and all experimental releases should be done so as to gather information that ultimately assists in developing or improving guidelines for restoration.

Four, re-introductions and translocations are always very lengthy, complex and expensive processes (Wilson & Stanley Price 1994; Stanley Price 1989). Proper budgeting is fundamental. Before attempting to implement these protocols, financial and logistical considerations should be carefully thought-out to guarantee the resources are available to carry the program to term. Available funds should not ultimately dictate how the restorations or translocations will be conducted; rather, the well-being of the animals released should always take precedence. If limited funds preclude implementing a program that meets the abovementioned rules and may compromise the well-being of relocated animals, the TSG strongly urges that it not be done.

The protocols herein are designed only for those programs that adhere to the above four basic rules. We present options as basic protocols with significant latitude for designs that can adapt to a range of budgets and can be applicable to all four tapir species over a wide variety of local conditions. Funds will commonly shape the size and length of the process, as well as tailoring some aspects of the design, but every effort should be made to carry out all the steps outlined in the protocols.

Last, safety of the personnel should also be kept in mind. Some of the procedures in the protocols should be carried out by properly trained and experienced personnel, as tapirs can be harmful to humans, especially under stressful conditions. This may mean that budgeting for training courses and capacity-building activities may be needed.

Definitions

According to the IUCN Guidelines for Re-Introductions (1998):

"RE-INTRODUCTION" is an attempt to establish a species in an area which was once part of its historical range, but from which it has been extirpated or became extinct ("Re-establishment" is a synonym, but implies that the re-introduction has been successful).

"TRANSLOCATION" is a deliberate and mediated movement of wild individuals or populations from one part of their range to another.

We use the same definitions as the Guidelines for Re-introductions (IUCN 1998), but in this document "re-introductions" refer exclusively to the release of captive animals that were either born in captivity, or have been in captivity for a relatively long period of time, into former parts of the historical distribution of the species. These include, among others, animals rescued during illegal trade, in triage centers etc. We use the term "relocated animals" to refer to animals that have been either re-introduced or translocated.

By **"HARD RELEASE"** we mean the release of animals with no additional support given, particularly food, extended acclimatization or behavioral training at the release pen and elsewhere at the release site. We call **"SOFT RELEASE"** the alternative approach, meaning that animals are provided food at a holding pen at the release site while they acclimate, may be provided behavioral training (*e.g.* food/shelter seeking, avoidance of humans, predator avoidance), and may be provided continued (for a limited time) supplemental feeding at the release pen after its door has been opened, and/or at other sites throughout the release site. In either case, animals should be monitored for a long period after release to ensure their well-being.

Objectives and Aims

A. Overall Aims:

The principal aim of any re-introduction or translocation program is to establish a viable, free-ranging population of a species, subspecies or race, which may be globally or locally extinct. The program should require minimal long-term management.

B. General Objectives:

The objectives of a re-introduction or translocation program may include: to enhance the long-term survival of a species; to re-establish a population of keystone species (in the ecological or cultural sense); to maintain/restore natural biodiversity; to provide long-term economic benefits to the local economy; to encourage changes in cultural attitudes toward the environment; to promote conservation awareness; or any combination of these (Scott & Carpenter 1987). The release of one or several confiscated, rescued or triage animals can be dangerous to an ecosystem (Woodford & Rossiter 1994). The availability of surplus, confiscated or rescued animals should not be the justification for a re-introduction and/or translocation program, because these are unlikely to number enough to ensure the re-establishment of a population, or an enhancement of its viability.

C. Specific Objectives of the TSG Guidelines

- To be a foundation for the development of management guidelines (for re-introductions and translocations) for re-population, population rescue, re-establishment of food chains and other ecological processes;
- To establish criteria for proper re-introduction or translocation methods, and for measuring indicators of success based on the survival and reproductive success of re-introduced/translocated individuals;
- To provide an experimental methodology for initial research through comparisons among re-introduction (hard and soft release) and translocation programs;
- To create an initial forum for discussion on the methodology and techniques;
- To create an initial forum for discussion of the potential involvement of local communities on the implementation of re-introduction and translocation programs.

Chances of Success

One of the first cautionary notes in the IUCN Guidelines to Re-introduction is that "some will succeed, many will fail" (see also Beck *et al.* 1994; Griffith *et al.* 1989). Griffith *et al.* (1989) analyzed success and failure of translocations from many published accounts for birds and mammals. Their analysis resulted in a probabilistic model to help enhance the chances of success. We applied the model to a general tapir translocation program, focusing on one area. We asked what would be the probability of success of releasing 2 to 10 animals in an area considered excellent, *versus* one considered good, *versus* one considered poor/fair, in a core region of the species' distribution (*sensu* Griffith *et al.* 1989). For the analysis, we considered the tapir to be native game, and a late breeder with a small litter size (*sensu* Griffith *et al.* 1989). In the above scenarios, the model suggests little variability in success rates between numbers of released animals within categories of habitat quality (*e.g.* 2 *vs.* 4 *vs.* 6 *vs.* 8 *vs.* 10 animals, regardless of habitat quality) (Figure 1). However, with these low numbers of released animals there is a marked difference among the different habitat categories, suggesting that this variable is crucial to success of tapir translocations/re-introductions, especially if low numbers of animals are being released. As seen in Figure 1, the probability of success falls markedly for introducing the same number of individuals over a short period of time into habitats of lesser quality.

Notably, the model also suggests that similar results could potentially be obtained for releases into habitats of different quality if the program is kept over a long period of time (*e.g.* releasing into an area considered only of good quality, but essential for the species survival, *vs.* an area of excellent quality but of limited importance for the species' survival). These results highlight the relevance of choosing highly suitable habitats for translocation/re-introduction programs and the unavoidable considerations about the length of such programs, especially for budget planning. Among the options to consider for a successful program, prior work could be undertaken to improve the quality of the area before the program starts. In fact, availability of suitable areas is so important, that the model suggests high chances of success even with a small quantity of animals.

The above considerations momentarily aside, Conservation Biology tenets state that small populations have a much lower chance of survival over the long term than populations with larger numbers of animals. Our analyses with the Griffith *et al.* model considered

only between two (2) and 10 animals released and do not properly show the effect of large numbers of released animals on the probability of success.

The chances of success will improve considerably, regardless of habitat quality, if larger numbers of animals are released. Figure 2 shows how the chances of extinction - probabilities between 0 and 1 - drop substantially in simulated populations of Malayan tapirs (*Tapirus indicus*) of 10, 20, 50 and 100 individuals, from high chances of extinction (nearly 100%) to none at all.

Finally, during their analysis, Griffith *et al.* (1989) found that when considering donor populations, success was more likely when individuals came from medium to large populations that were either growing or stable. Therefore, when planning any translocation event with tapirs, this factor should also be considered.

Summarizing, the quality of habitats for release, the length of the program, the number of animals released and source population are important factors to consider for ensuring high chances of success. Habitat restoration or enhancement may also be considered as alternatives to maximize the chances of success. The proper design of a re-introduction/translocation program should weigh the contribution of these factors to maximize success given the number of animals to be released and available funds. The definition of indicators of success is a critical element in any re-introduction and/or translocation programs. It is necessary to clearly define success before initiating such a program. A few examples of appropriate indicators of success are number of individuals surviving for a specific period of time, re-establishment of a self-sustaining, unmanaged population, and breeding success of re-introduced/translocated animals in the wild.

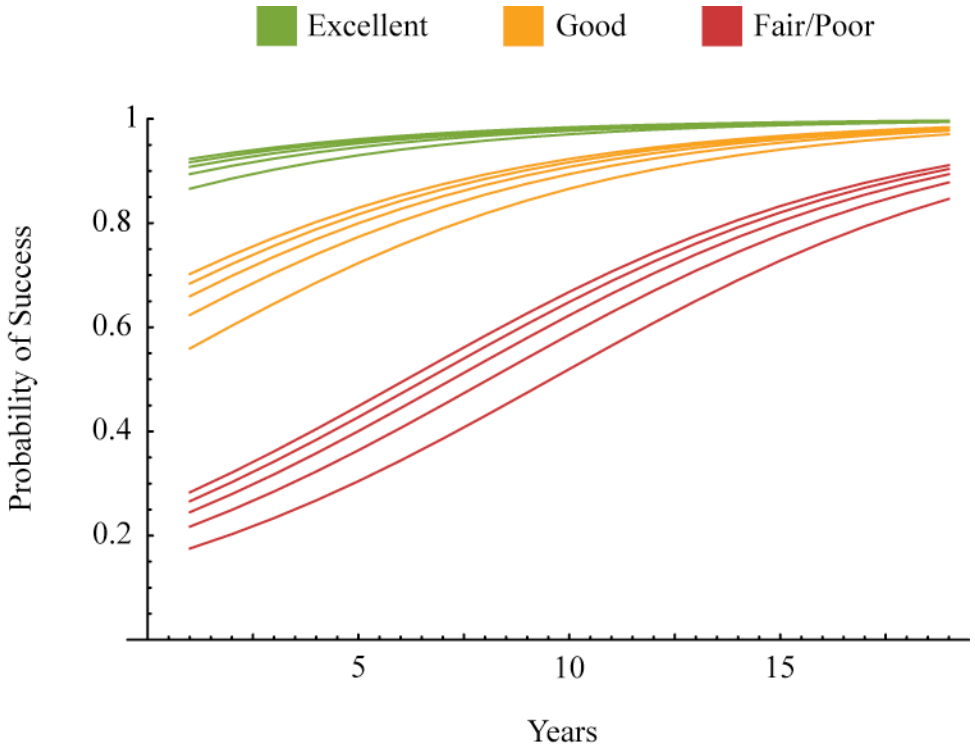

Figure 1. Probability of success of tapir translocation varying according to quality of habitat and number of animals introduced (from 2 to 10).

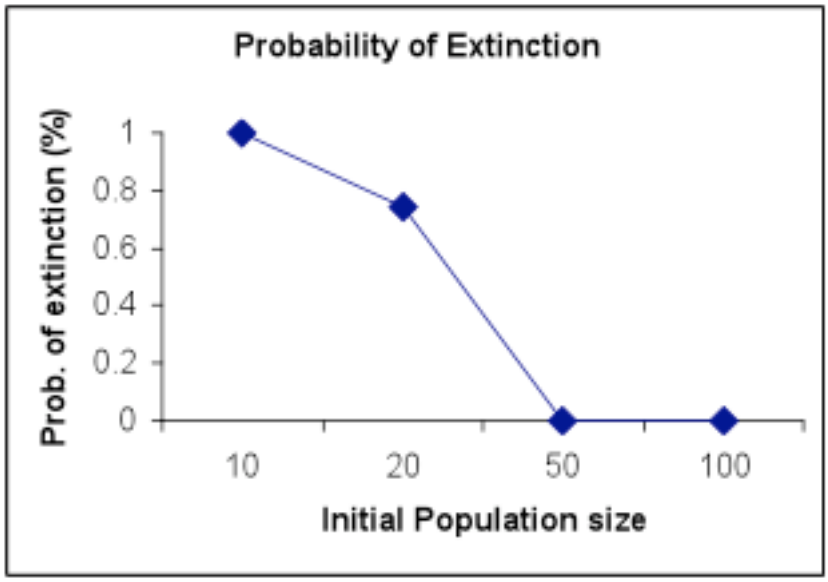

Figure 2. Probability of extinction in simulated populations of Malayan tapir (*Tapirus indicus*) of different sizes. These simulations were carried out as part of the Malayan Tapir PHVA Workshop conducted by the Tapir Specialist Group in Malaysia, 2003 (see Medici *et al.* 2004).

Many other studies have shown a variety of factors affecting re-introduction success, some of them in common with Griffith *et al.*'s study, including (sources are Brent *et al.* 1997; Curio 1996; Wilson *et al.* 1994; Shepherdson 1994; Beck *et al.* 1994; Stanley Price 1989; Campbell 1980):

- Use of wild-caught animals (preferably), or animals from first- or second-generation captive breeding parental stocks; captive-raised animals will show effects of domestication, random genetic change and inbreeding depression;
- Social organization (complex social structures correlate with low success rates);
- Body size or its life history correlates (larger animals have been found to be less likely to succeed);
- Length of project (longer-term projects significantly correlate with higher success rates);
- Habitat protection (presence of protected native environments increases chances of success – restorations caused by habitat loss have been largely unsuccessful);
- Training before release (animals with adequate behavioral skills are more likely to succeed);
- Imprinting avoidance (imprinted animals fail to re-introduce);
- Long-term monitoring (projects with long-term monitoring of released animals are more successful);
- Local employment/local involvement/community education (the more involvement, awareness and economic benefits to local communities, the higher the chances of success);
- Medical screening (contrary to expectation, fewer invasive medical screenings of animals was shown to correlate with an increase in project success);
- Post-release provisioning (less provisioning correlated with higher chances of success - remarkably, this result was seen in re-introduction of captive-born animals, not in wild-caught);
- Number of animals released (the more, the higher the chances of success).

Planning - Pre-Project Activities

A. Finances and Logistics

- Before starting, it is absolutely essential that the program has secured financial resources, dependable logistics, and reliable sources of infra-structure and personnel to be used throughout the whole program.

- Additionally, a re-introduction/translocation program can only be established once the team has put together the necessary structure and raised the necessary funding to monitor the animals in the long-term once they are released.

B. Personnel Skills

- The program requires a multidisciplinary team prepared to deal with all aspects of the process, including at a minimum a biologist, a full-time veterinarian, a geneticist, and a team of field assistants for the monitoring of animals after release.

- A forest engineer or a botanist might be necessary for the process of habitat assessment of capture sites and release areas.

- A social scientist, most likely an anthropologist specializing in hunting and/or resource extraction in rural forested areas, should be part of the team as well, in order to assess (and when possible monitor) the cultural context of the re-introduction/translocation site and the impact of the re-introduction/translocation activities on the local communities (see for example West & Brockington 2006).

- It is highly advisable to incorporate environmental educators in the team, as well as marketing experts and professionals specialized in conflict resolution, to address concerns arising in communities around the release site.

- Capacity building should be sought well before starting the program to address weaknesses in personnel training. For instance, members of the team could participate in the transport of a tapir between zoos and/or visit a re-introduction/translocation program of another large mammal. This is particularly important to avoid any harm to the animals and for the safety of the personnel.

- Participation of volunteers and interns should be encouraged. Their assistance is one of the most effective means to reduce the costs of the program while providing capacity building.

A Word on Safety

Tapirs can be dangerous animals. They are known to kill or severely injure people, including experienced zoo keepers (*e.g.* Estrada 2006). The protocols below emphasize the health and well-being of the animals, but it is equally important that personnel handling wild tapirs be aware of the dangers of the job at hand and proceed with extreme caution. We trust that all activities will be carried out with minimal or no threat to personnel, and that those particularly dangerous activities, such as sedating and handling trapped animals, will be done by properly trained and experienced staff.

C. Feedback and Local Participation

- It is highly recommended that an advisory committee be established to provide outside expert evaluation on all aspects of the program - not just on its scientific merit.

- It is advisable to involve the local communities in any re-introduction and/or translocation program. People in local communities should be the first ones to be consulted and agree on a proposed re-introduction or translocation program. Further on, they should be involved in the process and assist in protecting the re-introduced/translocated animals from illegal hunting and in maintaining the quality of habitats. They also will be fundamental agents of dissemination of information and conservation values to other communities. Their participation may include volunteer or paid positions as field assistants, educators, education facilitators, habitat monitoring staff, conservation campaign staff, law enforcement personnel, skilled workers, or even biologists or other scientists.

D. Licensing and Government Approval

- Before work commences all licenses, endorsements and approvals for capturing, immobilizing, transporting, manipulating, and collecting biological materials must be obtained from the appropriate government agencies. Some providers of the materials or anesthetic chemicals may require these licenses and permits before allowing the sale. In some instances, particularly when moving animals, biological samples or drugs across country boundaries, permits may be required from the exporting, the importing, and any in-transit countries. In some cases, verifiable credentials may be required attesting the proper training of responsible personnel to use the drugs and equipment. The TSG will only endorse these projects that have obtained all the required permits and licenses.

- All relevant government departments must be informed about the planned re-introduction and/or translocation program and must be given the opportunity to participate in the review and decision-making processes.

E. Choice of Release Site (Re-Introduction & Translocation)

Several factors must be reviewed in the candidate areas for release. A feasibility analysis of areas for successful release must include, but not be limited to, the evaluation of the following factors:

- **Area Viability - Carrying Capacity.** Is there already a sizable, potentially saturated population of tapirs in the area? Are critical resources, such as large patches of fruiting trees, salt licks, mixed primary and secondary forests, large water bodies, dry grounds (*e.g.* never flooded) etc., sufficiently abundant in the area? ***Note: Tapir re-introduction and translocation programs may offer a unique opportunity for understanding tapir's habitat preferences because they are likely to colonize, if within reach, the most suitable habitats first.***

- **Threats.** Are the causes of local tapir extinction still in place? In order to obtain this information it might be necessary to partner with a social scientist and develop an appropriate protocol to assess the cultural context of the region where the release site is located. Without a very thorough understanding of what is the local reality in the countryside around the release site, re-introduction may represent a serious and preventable threat to the animals, especially since tapirs can be rapidly

extirpated by hunters (see example in Spalton *et al.* 1999). ***Note: For any re-introduction and translocation programs to succeed it is critically important to be absolutely sure that the causes of local tapir extinction are no longer in place. Additionally, the team must be absolutely certain that the context that made the causes of extinction possible in the first place will not re-appear again. This should be considered as a long-term, on-going monitoring process that lasts forever.***

- **Conservation Category of Selected Release Site.** Public conservation units *vs.* private, levels of protection and monitoring. Which area provides the best chances of successful re-introduction/translocation programs considering habitat quality and management?

- **Presence/Absence of Predators.** Are there natural tapir predators in the area? This is of particular concern if the re-introduced animals are naïve about these predators, and if the predators learn to selectively kill newly re-introduced animals.

- **Genetic & Health Assessments.** Would re-introductions and/or translocations affect significantly the diversity of the existing gene pool, positively or negatively? Would re-introduced/translocated tapirs be exposed to (and be able to cope with) diseases enzootic to resident animal populations?

- **Possible Ecological Effects of new Animals in the Area**, including selective browsing of several plant species. Are some of these plant species protected/threatened in the tentative release sites? Tapirs may also affect streams and pools of water. Would this affect protected/threatened aquatic fauna?

- **Logistic Concerns.** Is it possible to track the re-introduced/translocated tapirs effectively in the selected release site and know their fate with existing technology and resources? Could the animals be retrieved from the site in case of insurmountable challenges (*e.g.* diseases, trained predators, uncooperative hunters)?

- **Human Populations Participation.** Are surrounding towns and villages supportive of the re-introductions and/or translocations? Is it possible to engage local communities?

- **Other Conflicts.** Possible effects to adjacent areas (agriculture, farming etc.), to populations of other species etc.

- **Possible Political Consequences.** The re-introduced/translocated tapirs could be blamed for other human-wildlife conflicts (*e.g.* jaguars killing cattle and the tapirs blamed for a "comeback" of jaguars to an area). Media campaigns and political support should be sought.

Hereafter, we shall focus on an area where the tapir is locally extinct, thus some of the above concerns do not apply. We assume that pre-study feasibility of potential release sites will be carried out to establish complete absence of tapirs.

Translocation of Tapirs

Translocations are considered here as a tool to establish a new population where one went locally or globally extinct; or to bolster the chances of survival of an otherwise threatened population. The protocols below are not for cases such as forced translocations (*e.g.* dam fills). Translocation of wild-caught animals with acclimatization aiming at adaptation to their new habitat has been shown to be highly successful (Shepherdson 1994; Griffith *et al.* 1989).

Note: ** denotes procedures the IUCN/SSC Tapir Specialist Group (TSG) deems indispensable and that must be followed according to the guidelines provided herein for TSG Project & Proposal Endorsement. These procedures are required to ensure the health and well-being of the animals.

A. Choice of Capture Site

- Relative population density estimates (different methods - *e.g.* radio-telemetry, camera-trapping, diurnal/nocturnal census, Footprint Identification Technique (FIT), dung counts etc.); estimates to be compared to those of known healthy, high density populations;

- **The capture site must be able to sustain the removal of animals, as determined by a Population Viability Analysis (PVA);

- **There should be substantial habitat similarity between capture and release sites, to include significant similarities in the presence and abundance of diet species (fruits and forage), as determined by rapid vegetation surveys;

- **From the same genetic stock as the release site or area;

- **Sanitary and epidemiological similarity between the sites.

B. Choice of Candidate Animals for Translocation

General Criteria

- Taxonomic status, genetics, sex, age, reproductive stage.

Exclusion Criteria

- Physically debilitated or handicapped animals
- Animals with dental conditions
- Aged animals
- Lactating females
- Females with offspring
- Pregnant females (determine presence and stage of pregnancy using ultrasound). Consider possible risks of translocating pregnant females, mortality of fetus, abortion etc.
- Other factors to be empirically determined during the capture process.

Tapirs with none of the above considerations may be considered potential candidates for translocation.

C. Capture and Immobilization

Detailed information about the most appropriate capture methods and immobilization protocols for tapirs, as well as the most adequate methods for the collection, handling, storage, and analysis of biological samples for epidemiological and genetic studies can be found in the **IUCN/SSC Tapir Specialist Group Veterinary Manual and **IUCN/SSC Tapir Specialist Group Genetics Manual**. These documents have been published in English, Spanish and Portuguese and are available online in PDF format on the TSG Website (www.tapirs.org). However, some aspects of the proposed methods and protocols should be adapted to local conditions and tapir species whenever considered necessary, so long the health and well-being of the animals is not compromised. For the purpose of translocations of tapirs the use of box traps is highly advisable, to facilitate the transfer into a transport crate and loading onto a vehicle.

Box Trapping

- It is highly advisable that the capture site be easily accessible by motorized vehicle and on flat ground;

- The distance between capture site and transport vehicle must be short (*e.g.* capture site close to a road);

- Chemical restraint for evaluation of the animal, collection of biological samples for epidemiological and genetic evaluations (see detailed information below), and collar fitting must be done inside the box trap;

- Chemical restraint recovery must be allowed inside the box trap, followed by tranquilization/sedation for transportation;

- Options to carry the animal to the transport vehicle:
    - Using a transport crate as a trap, which can be lifted like a stretcher onto the bed of a transport truck;
    - Lead animal into transport crate from the box trap, then onto truck.

Darting

- Darting must be done to cause rapid chemical restraint of the animal. Because of the risks involved with potent darting drugs, this procedure must be done by properly trained experts and under close veterinary supervision, or by veterinary doctors themselves;

- A very serious threat of darting is that the animal may run into a body of water, succumb to the drug while in the water, and drown. This risk should be minimized by ensuring no water bodies are found in the immediate vicinity of the darting site (*e.g.* platforms at fruit patches visited by animals);

- Similarly, darting must be done from an elevated structure or some other safe location to avoid a possible charge by the animal that could result in harm to members of the team;

- Collection of biological samples for epidemiological and genetic evaluations (see detailed information below), and collar fitting must be done immediately after chemical restraint;

- With darting, there are two fundamental time steps to consider: (1) the time period between drug onset and placement of the animal in the transport crate, and (2) the time period the animal spends in the transport crate. Chemical restraint should be maintained until the animal is safely placed in the transport crate (*e.g.* the full length of the first time period).

Transport to the Release Site (See also Appendix A)

- **The animal must be trained during isolation to enter into the transport crate;

- **For transport, it is highly advisable that the animal be under sedation/tranquilization, but awake and standing (or better, in prone position - never lying down), followed by recovery in the holding pen at the release site. Yet, because different species and different animals vary in their response to transport and other local conditions, the level of chemical restraint and anesthetic agents to be used are at the discretion of the veterinarian in charge of the program. Detailed information about the most appropriate immobilization protocols for tapirs are available in the **IUCN/SSC Tapir Specialist Group Veterinary Manual**, published in English, Spanish and Portuguese and available online in PDF format on the TSG Website (www.tapirs.org);

- If possible, monitor the status of the animal constantly, or periodically, until reaching the holding pen (ideally at the release site);

- Animals should be preferably transported during the night.

  Caution about animals with fitted collars: Observe the animal's response to the radio-collar during the transport phase. Previous field studies have observed animals displaying initial discomfort reactions to the collars. In case this becomes a problem, it will be necessary to make a decision to either induce a deeper sedation/tranquilization, or transport the animal under full chemical restraint.

  Note: For all cases, there is a need to re-think current chemical restraint protocols for tapirs. Mainly, we need protocols that are amenable to time extensions, and allow for the safe restraint of the animal for a prolonged period of time. The protocol to be used also depends on transport times and must consider contingency plans (e.g. a plan B in case of vehicle failure or other accidents). For longer periods of transport we recommend tranquilization/sedation rather than chemical restraint.

Essential Contingency Plans

- **Emergency drugs should be always available in case of cardio-respiratory arrests, stressing the need for a properly trained veterinary doctor throughout the capture and transportation process. Check the **IUCN/SSC Tapir Specialist Group Veterinary Manual** for a list of emergency and safety drugs available;

- **Personnel, basic equipment and anesthetic drugs should be kept at hand for recapturing animals that escape during any phase of the capture/transport/release processes.

D. Clinical, Epidemiological and Genetic Evaluation

Detailed information about the most appropriate methods for the collection, handling, storage, and analysis of tapir biological samples for epidemiological and genetic studies can be found in the **IUCN/SSC Tapir Specialist Group Veterinary Manual and **IUCN/SSC Tapir Specialist Group Genetics Manual**. These documents were published in English, Spanish and Portuguese and are available online in PDF format on the TSG Website (www.tapirs.org). However, some aspects of proposed methods and protocols should be adapted to local conditions and tapir species whenever considered necessary, so long the health and well-being of the animals is not compromised.

Recommended Exams:

- Complete physical, including ophthalmologic, feet and oral cavity;
- Hematological analysis;
- Plasma biochemistry, including fibrinogen, an acute-phase reactant protein that increases on inflammatory or neoplastic disease;
- Stool exams, especially for protozoans and nematodes;
- Stool bacterial cultures, especially for *Salmonella, Campylobacter, Streptococcus*;
- Swabs (oral, nasal, oral, rectal, vaginal/preputial, lesions);
- Collection and identification of ectoparasites;
- Test serum immunoglobulin for infectious diseases, relevant diseases for tapirs (check **IUCN/SSC Tapir Specialist Group Veterinary Manual**) and disease of other taxonomic groups found in the animal's capture site;

- ♦ Evaluate the animal's capture site for previous or current disease outbreaks;
- ♦ Also, test for relevant ungulate diseases at the release site.

It is suggested that exams be always carried out at the same laboratory, to ensure standardization, repeatability and comparison of results for an individual, and among individuals.

E. Acclimatization

- **At least 3 days in the holding pen (built in a pre-selected location at the release site, size to be determined, must include natural sources of water);
- **Throughout acclimatization there should be constant monitoring of mobility, equilibrium, external lesions, general physical condition, stool conditions etc;
- 24 hour behavioral monitoring - Ethogram, diet, sleep patterns;
- Monitoring through elevated platforms around the holding pen, hidden from the animal(s) view;
- **Avoid feeding the tapir any fruits and seeds that are not native to the release site environment in order to prevent the introduction of non-native plants.

F. Release

- Open door, and wait for the animal to leave on its own. Put food outside the door; without food in the pen, the animal most likely will go out without strong stimuli;
- Start monitoring program of released animals (Protocol below).

Re-Introduction of Tapirs

A. Choice of Candidate Animals for Re-Introduction

Several factors must be reviewed in those individual candidate animals for re-introduction (*e.g.* see Brent *et al.* 1997; Beck *et al.* 1994; Shepherdson 1994; Campbell 1980). A feasibility analysis of animals for successful release must include, but not be limited to, the evaluation of the following factors:

- **Taxonomic Status.** Do the individuals to be re-introduced belong to the same taxonomic unit that previously resided in the area?

- **Genetic Considerations**. Explained below.

- **Sex.** Is the ratio of males to females adequate? Would it alter substantially the existing ratio? What are the potential consequences of a skewed ratio for the survival of the population?

- **Reproductive Potential.** Are the animals to be re-introduced of breeding age and able to breed for several to many years in the wild?

- **Origin of the Animals.** Do the animals come from captive breeding programs, from other existing habitats, from confiscations, or from lost habitats (*e.g.* areas filled by dams)? Are the source habitats similar to the planned areas for re-introduction?

- **Health History and Behavior.** Use the criteria below for the choice of zoological institutions and/or breeding facilities to supply animals for re-introductions.

Behavioral Considerations of Candidate Animals

- Animals displaying very high levels of stereotypical behavior or demonstrating signs of imprinting, such as feeding routines or attached to humans should not be considered. Rapid behavioral evaluation of candidate animals should be conducted.

- Animals with more stimulating enclosures (*e.g.* enclosures that include a pond) might fare better.

Genetic Considerations of Candidate Animals

When carrying out re-introductions it is desirable to minimize issues of introgression and hybridization (Rhymer & Simberloff 1996, and references therein), and loss of independent lineages (Moritz 1999). To avoid such issues we recommend a 2-step genetic evaluation of potential individuals for re-introduction:

- First, an evaluation of the genetic distance between the group of potential individuals for re-introduction and neighboring populations to the chosen release site. Animals that are genetically similar, implying a common evolutionary history, are the best candidates for re-introduction (*e.g.* Hedrick 1995). This procedure would ensure that the re-introduced individuals are from the same genetic stock found in the region. HOWEVER, if for some reason, animals of similar genetic history are not available, one should strive to re-introduce animals from as close a related lineage as possible.

- Second, of animals considered suitable, a group should be chosen that:

    - **Minimizes mean kinship** – minimizing kinship ensures a broad representation of founder genomes in the population to be introduced, and reduces overrepresentation of genes favored in captive environments or source populations (Frankham *et al.* 2002); however, in an initial phase, overrepresented genomes from source populations (including captive animal pool) might be a better option, so as not to loose valuable genetic diversity from the source populations;

    - **Minimizes number of generations in captivity** – helps minimize overrepresentation of genes that are favored in the source populations (including the captive animal pool);

    - **Maximizes allelic diversity** – while, in general, there is a low correlation between quantitative genetic variation and molecular genetic variation (as measured by molecular markers, such as microsatellites), maximizing allelic diversity allows for us to hedge our bets that favorable genetic variation will be included in the introduced population (Reed & Frankham 2003). In addition, the rate of loss of alleles is much greater during a bottleneck event (such as happens with a founding population) that the rate of loss of heterozygotes (Hartl & Clark 2007). Therefore, maximizing allelic diversity helps guarantee sufficient genetic variation will survive the initial bottleneck event. Allelic diversity may be increased with subsequent re-introductions, or from neighboring populations;

- **Maximizes variability at MHC loci** – there are still questions concerning the usefulness of using variability at MHC loci in captive breeding programs, or as criteria for choosing individuals (Miller & Hedrick 1991). We include it here in an experimental basis, to assess whether MHC variability is in any way associated with better survivorship in the wild;
- **Minimizes inbreeding** – minimizing inbreeding seems to have positive effects in re-introduction programs (Frankham 1995). It is better to use measures of inbreeding based on pedigrees. When using molecular markers, because we only sample a small portion of the genome, there can be high sampling error. In the cases where there is high inbreeding in the captive or source population, steps can be taken to minimize inbreeding in the population before re-introduction begins, either by exchanging individuals with other populations, or by carefully planning captive breeding.

- Similarity criteria must be defined. In other words, how distant can individuals be before we say that they are not from the same genetic stock anymore?

Reproductive Potential and History Categories of Candidate Animals

- Rank potential re-introduction candidates based on their age and history (Shepherdson 1994; Campbell 1980):

    - Wild-born and captured at an early age, and of sub-adult or young adult ages (most desirable);
    - Wild-born and captured as an adult (*e.g.* translocated animals);
    - Captive-born animals of sub-adult or young adult ages;
    - Captive-born adult animals (least desirable);
    - Triage/re-habilitation animals are **not recommended** and may be hazardous to the environment if improperly screened for diseases and exhibiting habituation to humans.

- Take into consideration biological information such as:

    - **Dispersal age –** sub-adults and young adults may possibly have better chances of success;

    - **Reproductive potential** – select animals that are at or below peak reproductive potential (*e.g.* animals 10 years old or younger). Evaluation of reproductive health, evidence of cyclicity in either behavior or hormonal profile;
    - **Time in captivity** – compare current age of each animal *vs.* time of entry into captivity *vs.* time in captivity. How much of the animal's life was spent in captivity? Although captive breeding and re-introduction is a high-profile management tool for many threatened species, it is unclear how long-term captive breeding can influence fitness attributes such as natural defenses to predators (Snyder *et al.* 1996, Kraaijeveld-Smit *et al.* 2006).

Clinical and Epidemiological Evaluation of Candidate Animals

- **Epidemiological similarity:** conduct a first health screening and compare the health status of each candidate animal against the epidemiological status of the habitat chosen for the program (including wild and domestic species). The criteria of epidemiological similarity between candidate animals and wildlife/habitat in the release site must be followed. Epidemiological similarity means that infectious disease profiles of candidate animals are similar or compatible with wildlife in the re-introduction site. This reduces the risk of introduction of new diseases to the habitat and the risk to expose a re-introduced animal to new diseases.

- Some diseases shall eliminate candidates, including but not limited to:
    - Brucellosis
    - Chlamydia
    - Tuberculosis
    - Foot and mouth disease
    - Others, still to be determined. Some might be regionally more important than others.

Create SCORES to Classify Individual Candidate Animals

- **Pre-Determining Fixed Scores:** Based on fixed characteristics and factors that will not change immediately after release – genetics, sex, reproductive potential etc.

- **Status/Variable Scores:** Based on factors that indicate the status of the animals through the process of selecting candidates and immediately after release – variable factors such as behavior, health, home range etc. Status scores will be constantly monitored throughout the process.

- **Weighed Variables:** Some variables may be more important in determining the suitability of individuals (*e.g.* epidemiological variables, age, sex) than others (kinship, number of generations in captivity). Heavier "weights" may be assigned to more important variables through a scoring methodology that includes multipliers to bolster their contributions or multipliers that downsize the contribution of less important variables.

- **Exclusion Criteria:**

    - Physically debilitated or handicapped animals
    - Animals with dental conditions
    - Aged animals
    - Lactating females
    - Females with offspring
    - Pregnant females (determine presence and stage of pregnancy using ultrasound). Consider possible risks of translocating pregnant females, mortality of fetus, abortion etc.
    - Animals habituated to humans
    - Other factors to be empirically determined during the capture process.

Tapirs with none of the above considerations may be considered potential candidates for re-introduction.

FINAL NOTE: We would like to stress that all this screening process should be conducted within the context of each re-introduction program. There is some level of flexibility, but the entire process and its parameters must be documented so that we have the ability to analyze the results and success of the program a posteriori. Additionally, we must have the necessary information to compare results among different re-introduction programs.

Hard Release Re-Introduction of Tapirs

Hard release is intended for those animals that can immediately fend for themselves in the wild and do not need assistance to adapt (behaviorally, physiologically and/or clinically) to wild conditions. Typically, this method is used for translocated animals - animals that have spent minimal or no time in captivity. It may be used for animals that have had minimal contact with humans and that behave instinctively (*e.g.* are shy, are able to identify and flee from predators, and do not show habitual patterns such as expecting food at certain times or places). Hard release may also be an alternative when large numbers of animals are being released and soft-release methods become impractical.

Note: ** denotes procedures the IUCN/SSC Tapir Specialist Group (TSG) deems indispensable and that must be followed according to the guidelines provided herein for TSG Project & Proposal Endorsement. These procedures are required to ensure the health and well-being of the animals.

A. Planning for Release

Plans should be made for release at the appropriate season - preferably at the end of the season with limited resources, or the beginning of the season with abundant resources (*e.g.* dry/wet season interface). Access to release sites (*e.g.* dry roads) or abundance of important resources (*e.g.* abundant *Mauritia flexuousa* fruits in some lowland tapir habitats as mentioned in Fragoso 1997 and Bodmer 1990) may be relevant for timing.

Isolation / Veterinary Monitoring - Basic Criteria

- **Must have an isolated area, and an extension area for training; the animal(s) must be kept away from domestic animals and other species, especially other ungulates, to minimize contact with unwanted diseases;

- The location of the isolating facility is left to the project's team to decide. In the zoological institution, breeding center, in an area close to the release site (preferential for environmental issues, altitude, climate, makes acclimatization and transport to the release site easier), or somewhere in-between enclosure and release site. Another alternative could be a mobile isolation facility. Isolation in or near the release site offers the opportunity to promote and monitor the exposure of animals to its diseases and parasites, and possibly provide medical care to

maximize chances of survival;

- **There must be at least one veterinary doctor knowledgeable about tapirs exclusively designated to treat the animals. Keeper protocols should be strictly followed to maintain the isolation status of the facility;

- **More than one individual in isolation is acceptable. But, there must be adherence to the principle of all-in/all-out;

- **There should be a safety period between cohorts of animals to be released, to minimize or eliminate cross-contamination among groups.

Diet Training during Isolation

- Ensure habitat enrichment within the confinement, resembling as best as possible conditions at the release site (*e.g.* native species of fruits and browse when they are typically available, natural obstacles);

- Offer food at different times during dusk/dawn to adjust animals to natural foraging patterns. Include days with smaller food rations;

- **Food must be provided avoiding (best) or minimizing human contact. This is not just a training issue, but a health concern as well. The isolation facility should be designed with this in mind;

- Offer several food items and vary their presence and/or abundance. Response to new diets can be used as an animal selection criterion.

Clinical and Epidemiological Evaluation

- **Carry out exams 15 to 20 days after the animal comes into isolation, which allows for any transport problems to manifest themselves after transport stress (such as pre-existing diseases etc.);

- **Detailed information about the most appropriate immobilization protocols for tapirs, as well as the most adequate methods for the collection, handling, storage, and analysis of biological samples for epidemiological and genetic studies can be found in the **IUCN/SSC Tapir Specialist Group Veterinary Manual** and **IUCN/SSC Tapir Specialist Group Genetics Manual**. These documents have been published in English, Spanish and Portuguese and are available online in PDF format on the TSG Website (www.tapirs.org). However, some aspects of proposed methods and protocols should be adapted to local conditions and tapir species whenever considered necessary, so long the health and well-being of the animals is not compromised.

Recommended Exams:

- Complete physical, including ophthalmologic, feet and oral cavity;
- Hematological analysis;
- Plasma biochemistry, including fibrinogen, an acute-phase reactant protein that increases on inflammatory or neoplastic disease;
- Stool exams, especially for protozoans and nematodes;
- Stool bacterial cultures, especially for *Salmonella, Campylobacter, Streptococcus*;
- Swabs (oral, nasal, oral, rectal, vaginal/preputial, lesions);
- Collection and identification of ectoparasites;
- Test serum immunoglobulin for infectious diseases, relevant diseases for tapirs (check **IUCN/SSC Tapir Specialist Group Veterinary Manual**) and disease of other taxonomic groups found in the animal's institution of origin;
- Evaluate the animal's institution of origin for disease outbreaks;
- Test for relevant ungulate diseases at the release site.

It is suggested that exams be always carried out at the same laboratory, to ensure standardization, repeatability and comparison of results for an individual, and among individuals.

- **Epidemiological Challenge:**

    - Consider vaccinations and exposure to parasites. If vaccinations are to be used, it is necessary to establish a protocol of administration of vaccines, repetition of doses etc.

    - **Clinical and epidemiological profile of candidate animals should match or closely approximate the profile of other ungulates at the release site, and of tapirs in nearby populations.

- **Evaluation of Exam Results:**

    - **Positive:** Treatment if necessary, and re-evaluation; or elimination from the program.

    - **Negative:** Decision regarding aptitude for release.

Transport to the Release Site (See also Appendix A)

- **The animal must be trained during isolation to enter into the transport crate;

- **For transport, it is highly advisable that the animal be under sedation/ tranquilization, but awake and standing (or better, in prone position - never lying down), followed by recovery in the holding pen at the release site. Yet, because different species and different animals vary in their response to transport and other local conditions, the level of chemical restraint and anesthetic agents to be used are at the discretion of the veterinarian in charge of the program. Detailed information about the most appropriate immobilization protocols for tapirs are available in the **IUCN/SSC Tapir Specialist Group Veterinary Manual**, published in English, Spanish and Portuguese and available online in PDF format on the TSG Website (www.tapirs.org);

- If possible, monitor the status of the animal constantly, or periodically, until reaching the holding pen (ideally at the release site);

- Animals should be preferably transported during the night.

Essential Contingency Plans

- **Emergency drugs should be always available in case of cardio-respiratory arrests, stressing the need for a properly trained veterinary doctor throughout the capture and transportation process. Check the **IUCN/SSC Tapir Specialist Group Veterinary Manual** for a list of emergency and safety drugs available;

- **Personnel, basic equipment and anesthetic drugs should be kept at hand for recapturing animals that escape during any phase of the transport/release processes.

B. Acclimatization at the Release Site

- **At least 10 days in the holding pen (built in a pre-selected location of the release site, size to be determined, must include natural sources of water); this period may be extended to ensure adaptation to the release site;

- **Once in the holding pen at the release site, stop feeding the tapir with any fruits that are not native to the release site environment in order to prevent the introduction of non-native plants. Whenever possible, it is advisable to feed the tapir native fruits;

- **Throughout acclimatization there must be constant monitoring of mobility, equilibrium, external lesions, general physical condition, stool conditions etc.;

- **24-hour behavioral monitoring should be conducted - Ethogram, diet, sleep patterns;

- **Monitoring must be done through elevated platforms around the holding pen, hidden from the animal(s) view.

Evaluation of Animal(s) at Release Pen

- **Criteria for animal evaluation:**
    - ♦ Physically healthy;
    - ♦ Animal searches and finds safe locales for sleeping;
    - ♦ Animal is eating locally available food items;

- ♦ Animal is displaying foraging behavior? Is the animal exploring the surroundings?;
- ♦ Cortisol monitoring from stool samples. Cortisol should be measured as part of the protocol pre and post release, as it is a very good indicator of environmental adaptation and re-introduction success;
- ♦ How long until the animals are "ready" for release? Within days or weeks it is expected that the animals be fully acclimated to and familiar with the larger holding pen. Before release, however, evaluate the animals through scores:
    - Score keeping facilitates comparing successful/failed re-introductions, to identify possible causes, or to determine a minimum score needed above which animals have a high likelihood of succeeding.
    - Scores could be kept from the beginning, and changes could be monitored throughout, assisting in evaluation of animal readiness. Scores should include a few basic behaviors/variables that must be constantly monitored (*e.g.* frequency of feeding, health status, clinical status, stress behaviors, sexual/social interactions)

C. Release

- 12 hours before release, stop feeding the tapir in order to stimulate foraging behavior;
- Open door, and wait for the animal to leave on its own. Put food outside the door; without food in the pen, the animal most likely will go out without strong stimuli;
- Start monitoring program of released animals (Protocol below).

Soft Release Re-Introduction of Tapirs

Soft release is intended for animals that need assistance to adapt to wild conditions, particularly with obtaining food independently, or if adaptation to the release site is sought (Shepherdson 1994). Training, mainly through environmental enrichment, is key to soft-release. Ideally, training and survival-skills learning for release should happen at the critical life stages in the development of the animals. Thus, commonly soft release is intended for young animals of sub-adult age. It may also be used to re-introduce wild-caught animals after a prolonged time in captivity. Because the method relies on the animal developing/re-acquiring instinctive behaviors, human contact should be avoided - especially the association of humans with food.

Note: ** denotes procedures the IUCN/SSC Tapir Specialist Group (TSG) deems indispensable and that must be followed according to the guidelines provided herein for TSG Project & Proposal Endorsement. These procedures are required to ensure the health and well-being of the animals.

A. Planning for Release

Plans should be made for release at the appropriate season - preferably at the end of the season with limited resources, or the beginning of the season with abundant resources (*e.g.* dry/wet season interface). Access to release sites (*e.g.* dry roads) or abundance of important resources (*e.g.* abundant *Mauritia flexuousa* fruits in some lowland tapir habitats as mentioned in Fragoso 1997 and Bodmer 1990) may be relevant for timing.

Isolation / Veterinary Monitoring - Basic Criteria

- **Must have an isolated area, and an extension area for training; the animal(s) must be kept away from domestic animals and other species, especially other ungulates, to minimize contact with unwanted diseases;

- The location of the isolating facility is left to the project's team to decide. In the zoological institution, breeding center, in an area close to the release site (preferential for environmental issues, altitude, climate, makes acclimatization and transport to the release site easier), or somewhere in-between enclosure and release site. Another alternative could be a mobile isolation facility. Isolation in or near the release site offers the opportunity to promote and monitor the exposure of

animals to its diseases and parasites, and possibly provide medical care to maximize chances of survival;

- **Release into larger holding pen for extended acclimatization and monitoring. After initial acclimatization in a small pen, the animal should be released into a large holding pen (located within the release site, adjacent to the small holding pen, size to be determined, must include natural sources of water, and must include patches of fruiting trees). The pen should be a locale that the animal will familiarize with and may return to (at its will) for supplemental feeding or sleeping after release, until it can fully fend for itself;

- **There must be at least one veterinary doctor knowledgeable about tapirs exclusively designated to treat the animals. Keeper protocols should be strictly followed to maintain the isolation status of the facility;

- **More than one individual in isolation is acceptable. But, there must be adherence to the principle of all-in/all-out;

- **There should be a safety period between cohorts of animals to be released, to minimize or eliminate cross-contamination among groups.

- It is necessary to consider the case where there is more than one animal in the release enclosure. How to deal with conflicts? How to deal with "problem" animals?

Diet Training during Isolation

- **Ensure habitat enrichment within the confinement, resembling as best as possible conditions at the release site (*e.g.* native species of fruits and browse when they are typically available, natural obstacles);

- **Offer food at different times during dusk/dawn to adjust animals to natural foraging patterns. Include days with smaller food rations;

- **Food must be provided avoiding (best) or minimizing human contact. This is not just a training issue, but a health concern as well. The isolation facility should be designed with this in mind;

- **Offer several food items and vary their presence and/or abundance. Response to new diets can be used as an animal selection criterion.

Clinical and Epidemiological Evaluation

- **Carry out exams 15 to 20 days after the animal comes into isolation, which allows for any transport problems to manifest themselves after transport stress (such as pre-existing diseases etc.);

- **Detailed information about the most appropriate immobilization protocols for tapirs, as well as the most adequate methods for the collection, handling, storage, and analysis of biological samples for epidemiological and genetic studies can be found in the **IUCN/SSC Tapir Specialist Group Veterinary Manual** and **IUCN/SSC Tapir Specialist Group Genetics Manual**. These documents have been published in English, Spanish and Portuguese and are available online in PDF format on the TSG Website (www.tapirs.org). However, some aspects of proposed methods and protocols should be adapted to local conditions and tapir species whenever considered necessary, so long the health and well-being of the animals is not compromised.

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- Complete physical, including ophthalmologic, feet and oral cavity;
- Hematological analysis;
- Plasma biochemistry, including fibrinogen, an acute-phase reactant protein that increases on inflammatory or neoplastic disease;
- Stool exams, especially for protozoans and nematodes;
- Stool bacterial cultures, especially for *Salmonella, Campylobacter, Streptococcus*;
- Swabs (oral, nasal, oral, rectal, vaginal/preputial, lesions);
- Collection and identification of ectoparasites;
- Test serum immunoglobulin for infectious diseases, relevant diseases for tapirs (check **IUCN/SSC Tapir Specialist Group Veterinary Manual**) and disease of other taxonomic groups found in the animal's institution of origin;
- Evaluate the animal's institution of origin for disease outbreaks;
- Test for relevant ungulate diseases at the release site.

It is suggested that exams be always carried out at the same laboratory, to ensure standardization, repeatability and comparison of results for an individual, and among individuals.

- **Epidemiological Challenge:**

  - Consider vaccinations and exposure to parasites. If vaccinations are to be used, it is necessary to establish a protocol of administration of vaccines, repetition of doses etc.

  - **Clinical and epidemiological profile of candidate animals should match or closely approximate the profile of other ungulates at the release site, and of tapirs in nearby populations.

- **Evaluation of Exam Results:**

  - **Positive:** Treatment if necessary, and re-evaluation; or elimination from the program.

  - **Negative:** Decision regarding aptitude for release.

Transport to the Release Site (See also Appendix A)

- **The animal must be trained during isolation to enter into the transport crate;

- **For transport, it is highly advisable that the animal be under sedation/ tranquilization, but awake and standing (or better, in prone position - never lying down), followed by recovery in the holding pen at the release site. Yet, because different species and different animals vary in their response to transport and other local conditions, the level of chemical restraint and anesthetic agents to be used are at the discretion of the veterinarian in charge of the program. Detailed information about the most appropriate immobilization protocols for tapirs are available in the **IUCN/SSC Tapir Specialist Group Veterinary Manual**, published in English, Spanish and Portuguese and available online in PDF format on the TSG Website (www.tapirs.org);

- If possible, monitor the status of the animal constantly, or periodically, until reaching the holding pen (ideally at the release site);

- Animals should be preferably transported during the night.

Essential Contingency Plans

- **Emergency drugs should be always available in case of cardio-respiratory arrests, stressing the need for a properly trained veterinary doctor throughout the capture and transportation process. Check the **IUCN/SSC Tapir Specialist Group Veterinary Manual** for a list of emergency and safety drugs available;

- **Personnel, basic equipment and anesthetic drugs should be kept at hand for recapturing animals that escape during any phase of the transport/release processes.

B. Acclimatization at the Release Site

- **At least 10 days in the holding pen (built in a pre-selected location of the release site, size to be determined, must include natural sources of water); this period may be extended to ensure adaptation to the release site;

- **Once in the holding pen at the release site, stop feeding the tapir with any fruits that are not native to the release site environment in order to prevent the introduction of non-native plants. Whenever possible, it is advisable to feed the tapir native fruits;

- **Throughout acclimatization there must be constant monitoring of mobility, equilibrium, external lesions, general physical condition, stool conditions etc.;

- **24-hour behavioral monitoring should be conducted - Ethogram, diet, sleep patterns;

- **Monitoring must be done through elevated platforms around the holding pen, hidden from the animal(s) view.

Evaluation of Animal(s) at Release Pen

- **Criteria for animal evaluation:**

    - ♦ Physically healthy;
    - ♦ Animal searches and finds safe locales for sleeping;

- ♦ Animal is eating locally available food items;
- ♦ Animal is displaying foraging behavior? Is the animal exploring the surroundings?;
- ♦ Cortisol monitoring from stool samples. Cortisol should be measured as part of the protocol pre and post release, as it is a very good indicator of environmental adaptation and re-introduction success;
- ♦ How long until the animals are "ready" for release? Within days or weeks it is expected that the animals be fully acclimated to and familiar with the larger holding pen. Before release, however, evaluate the animals through scores:
    - Score keeping facilitates comparing successful/failed re-introductions, to identify possible causes, or to determine a minimum score needed above which animals have a high likelihood of succeeding.
    - Scores could be kept from the beginning, and changes could be monitored throughout, assisting in evaluation of animal readiness. Scores should include a few basic behaviors/variables that must be constantly monitored (*e.g.* frequency of feeding, health status, clinical status, stress behaviors, sexual/social interactions)

C. Release

- 12 hours before release, stop feeding the tapir in order to stimulate foraging behavior;
- Open door, and wait for the animal to leave on its own. Put food outside the door; without food in the pen, the animal most likely will go out without strong stimuli;
- Start monitoring program of released animals (Protocol below).
- Diet supplementation as needed, at random locations within the habitat and in the release pen (which should remain with door open):
    - Offer food at different times during dusk/dawn to adjust animals to natural foraging patterns. Include days with smaller food rations in order to stimulate foraging behavior;

- **Food must be supplied in random spots throughout the habitat area. Must be careful that the animal does not see/smell the supporting team and relate their presence to food;

- Monitoring diet supplementation sites with camera traps is advisable, especially if there is radio-tracking evidence to suspect that the animals are hanging around supplemental feeding stations;

- **Only local plants and fruits known to be diet species should be provided;

- **Amounts of supplemental food should be reduced with time. The schedule may vary - animals that become readily independent may require minimal support, while it is possible that some animals never succeed in adapting to wild conditions and rely on supplemental food until recaptured and brought back to captivity. The decision on when to terminate food supplementation must be assessed on an individual case basis. It is critical to observe if the animal is foraging, if it is curious about exploring the new surroundings and the habitat.

Monitoring of Released Animals

A. Re-Introduction with Hard/Soft Release & Translocation

- **Immediately after release there should be an intense monitoring period. During this period, we recommend the following activities:

    - **Radio-telemetry** monitoring 4-5 times per day for 15 days, to check for dispersal events, ability to find water and food, well-being etc. Radio-collars must be equipped with mortality sensors. Assessment shall be made by determining how much the animal has moved, not by direct sightings.

    - After the initial 15 days post-release, a 15-day period of partial monitoring should be established, with triangulations and signal checks at least twice daily when the tapir is active (dawn and dusk), and once during the night.

    - After 30 days, periodic **direct sightings** should be attempted once every seven (7) days. Attempts at sighting should be made using radio-collar signals or baiting stations. The goal is to visualize the animals, and evaluate their physical conditions, including ectoparasite load. If possible, avoid flushing the animal and avoid attracting the animal to humans.

    - **Camera-traps** should be set up throughout the release site. Radio-telemetry transmitter collars should have color tags for easy photo identification.

    - **Stool samples** should be collected to monitor cortisol levels (indicator of environmental adaptation and re-introduction and translocation success), endoparasite load and diet.

    - For re-introduced animals, we recommend daily monitoring (*e.g.* locating the animals once a day and periodic sightings) for at least 6 months after release.

    - For translocated animals, the monitoring period may be limited to triangulations 1-5 times per week after the 15-day intense monitoring period. Direct sightings may be attempted if there are reasons to believe the health of the animal is being compromised. Long-term monitoring may be shortened to six (6) months or fewer.

- Traps should be spread out in the area for captures at future times – especially if there are concerns about the well-being of the released animal(s). Funds permitting, regular periodic captures for health and epidemiological evaluations may also be conducted.

    - We recommend 3 recaptures: one at 6 months, one at 12 months, and a final at 24 months after release. More recaptures might be necessary, according to the responses of each individual to release;

    - Determine capture/recapture methods more appropriate for local conditions and the tapir species. Detailed information about the most appropriate capture methods for tapirs can be found in the **IUCN/SSC Tapir Specialist Group (TSG) Veterinary Manual**;

    - During each recapture, health and epidemiological parameters should be evaluated, and exams carried out as per the **IUCN/SSC Tapir Specialist Group (TSG) Veterinary Manual**.

- Other long-term monitoring activities may include:

    - Cortisol, parasite load and diet monitoring through stool samples;

    - Movement patterns through radio-telemetry (VHF and/or GPS) and camera-trapping;

    - Activity patterns (nocturnal, diurnal etc.);

    - Genetic studies: sample offspring and possibly new animals entering the release site;

    - Visual confirmation of reproductive success in the wild through direct sightings;

    - Monitor baiting stations in the case of soft release re-introduction;

    - Explore the possibility of monitoring hormonal levels through stool (*e.g.* progesterone, estrogen etc.).

- Other critical aspects/variables that MUST be monitored:
    - Continuous habitat monitoring (status and threats);
    - In case of mortality of re-introduced/translocated animals, it is necessary to conduct a thorough assessment of the site in order to determine the cause(s) of deaths. Whenever possible, it is important to do necropsies;
    - Socio-cultural aspects of the human populations living in the surroundings of the release site. It is of critical importance to have a continuous assessment of people's perceptions about the program. What do they think about it? Have they been in contact with released animals? Have there been any issues with released animals, any conflicts? Have there been any poaching events? Do they know of any effects on other wildlife species in the area?

B. Post-Release Problems

Some re-introduced or translocated animals may not adapt well to the new habitat. This might be evidenced by degeneration of physical conditions, development of a diseases, and/or behavioral patterns. Such animals should be re-captured and kept under observation in the holding pen, and treatment be given as needed. After improvement of their physical condition and health, a second release may be attempted. Animals that cannot be treated appropriately at the release site, or that after a second release attempt continue to show signs of mal-adaptation, should be returned to captivity.

Post-release monitoring may be shortened once previous monitoring experiences at the site provide indicators and cues that can be used to identify potentially successful releases from problematic animals (*e.g.* early *vs.* late feeding independence, early *vs.* late establishment of home ranges etc.) (Munkwitz *et al.* 2005; Brent *et al.* 1997).

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APPENDIX A: Tapir Transport Considerations

A. Crates

A crate to transport tapirs should be large enough for the animal to stand up and lay down but not wide enough to encourage the animal to turn around. It should meet all standards set forth in the **2003 IATA (International Air Traffic Association) Regulations (Crate #73)**:

- The transport crate must be designed for the specific number, sex and age of animals to be relocated taking into account the method of transportation;
- The crate should be constructed of one-inch solid wood or metal parts, bolted or screwed together with access to the animal for observation, darting and emergencies;
- Metal bracing must be present around the whole container;
- The crate for tapir transport should have removable guillotine doors at both ends;
- The interior must be completely smooth, and free of potential hazards to the animal;
- It should have numerous ventilation holes with a maximum diameter of 2" along the top and above eye level, which can be opened or shut as required;
- A slatted floor, or at least some openings for urine and feces to drain away, is required;
- Food and water containers must be provided with outside access;
- It is important that each crate is protected from dust and draughts.

B. Crate Training of Captive Individuals

All tapirs should be properly "crate trained" prior to transport. Crate training involves several weeks or months of giving the tapir access to the shipping crate. Crate training does not mean setting up the crate so staff can trap the animal inside the first time it enters the crate. Several tapirs have died in crates when not properly trained. Animals should not be transported until they are comfortable being inside the crate for several hours. It is important that the animal handlers be able to close the animal inside the crate for several hours with people and machines operating around it, and be able to move the crate with the tapir inside without stressful reactions. *Transport should be attempted only after proper training*. There is a large degree of variation in tapir temperaments and some animals may never be completely calm inside a crate. In extremely hyperactive animals it may be necessary to lightly sedate the animal prior to transport. This should only be done in the presence of an experienced veterinarian who is familiar with the drug and dosages for tapirs. It is also important to remember that the training should be done ensuring minimal or no direct contact with humans – especially if food or other rewards are being used for the training.

C. Logistic and Operational Considerations During Transport

- Transportation of the animals should commence as soon as all individuals have been loaded, assessed and watered;
- The transportation routes should be carefully selected well in advance, aiming for the shortest journey time possible. Rough road surfaces increase physical stress and should be avoided as much as possible;
- The vehicle should be appropriate for the load and the roads to be used;
- The vehicle should have a radio or telephone communication system on board to request assistance in case of eventualities (*e.g.* an animal escaping during transport, or a minor and easily fixable mechanical problem);
- Vehicle failures are potentially serious problems contributing to unsuccessful tapir transportation. Ideally, an extra transport vehicle should be at hand, in case the first one breaks down. Also, mechanics qualified to repair and maintain vehicles and specialized equipment such as cranes should accompany the transport vehicle to attend to any unexpected malfunctions;
- Animals should be transported at night, or in the cooler parts of the day to avoid heat exhaustion and stress due to discomfort;
- Police escort may be sought to guarantee minimal delays during transport.

D. Veterinary Considerations During Road Transport

- Once the animal is tranquilized/sedated in the secured crate, the animal's condition should be assessed and if the level of tranquillization is insufficient further doses may be administered by dart or pole syringe. Importantly, however, the longer the animal is recumbent under anesthesia, and the longer it is confined inside the crate on the truck, the greater the risks of transport;
- On long journeys the drainage should be opened at each stop to allow urine and fluids to flow keeping conditions in the crate as dry as possible and reducing the risk of slipping;
- The animal should be examined frequently during transport for any problems;
- The temperature inside the crate should be monitored and maintained at a comfortable level by increasing/decreasing ventilation, or when necessary, using a heating pad;
- Any stops should be in areas away from human noise, smell or activity to avoid unnecessary stimuli that will stress the animal;
- Water should always be made available to the animal during transportation, especially on hot journeys;
- During transport, equipment and drugs for veterinary intervention and, if necessary, euthanasia should be carried with the convoy to handle any emergencies.

E. Holding Pen at the Release Site

- The holding pen should have easy access for the transport vehicle;
- The release of the tapirs from the transport vehicles into the holding pen should be done with the least possible stress. The number of people present should be kept to a minimum, reducing contact with the animal as much as possible.

APPENDIX B: Other Considerations

A. Partnerships and Institutional Support

- Partnerships should be established between the program and:

    - Governments and governmental agencies at all levels - to keep them informed and engaged in the program;
    - Private and public education and research institutions - not only to raise awareness and support, but because the program could represent an education or research opportunity. It is important to remember that any other research or education spin-offs from the project should not interfere with the plans, logistics, animal well-being and chances of success;
    - Zoological institutions and breeding centers - these are the prime sources of veterinary expertise, in-kind support and animals for re-introduction;
    - Non-Governmental Organizations (NGOs) - these may include organizations managing areas at the release site, or with scientific expertise, for additional educational/awareness support, etc.;
    - Other research projects - especially for in-kind support or scientific expertise.

- In-kind support is commonly sought from:

    - Governments and governmental agencies at all levels - usually in the form of lands/access for release, or special legislation or policing;
    - Universities and research centers - equipment, technology, laboratory space or analyses;
    - Clinical and diagnosis laboratories;
    - Pharmaceutical companies;
    - Field equipment companies.

B. Local Communities, Education, Information

- Information and seminars to the local people directly or indirectly involved in the program.
    - Visits to properties adjacent to release sites to enlist support of local landowners and subsistence farmers, exchange ideas, and raise awareness;
    - Talks at local schools;
    - Distribution of posters and pamphlets about the program;
    - Talks at universities, national and international conferences, professional societies, zoological institutions etc.
- It is very important to note that re-introduction and/or translocation programs provide excellent opportunities for the development of environmental education campaigns on the local and regional levels focusing on tapirs as flagship species.

C. Contingency Plans for Failed Re-Introductions & Translocations

- Consider options to return to captivity those animals that for any reason were deemed unsuitable for the program, or that failed to adapt after release. If possible, secure zoo/breeding center space before an eventuality arises;

- Immediate necropsy should be carried out on dead animals;

- Have a plan on how to deal with any human/tapir conflicts especially in situations when released animals may be prone to raid crops. Alternatives may include compensation schemes, natural chemical deterrents (*e.g.* see Parker & Osborn 2006) or other harmless means to exclude tapirs from croplands;

- Be prepared to deal with animals that disperse out of release site. This is an inevitable fact. A contingency plan should include exploring and becoming familiar with surrounding areas, knowing all access roads and high points (for radio-tracking), dangers and risks (to animals and humans) before the animals disperse. Depending on funds, locations by plane, ultra light or helicopter may be pursued;

- Be prepared to deal with possible epidemics. Try to ensure holding pens are available, that other facilities are willing and able to hold animals in isolation until the epidemic is under control, and that animals can be quickly relocated to these pens and facilities. Ensure veterinary support (chemicals and personnel) from various sources in case of an epidemic event. Maintain a support network of collaborators and volunteers;

- Be prepared to deal with predator problems. Cats learn and become habituated to "easy kills" (Polisar *et al.* 2003). Alternatives may range from new release sites, to capture and translocation of nuisance predators, to training tapirs to fend off predators before release. We do not advocate for removal or euthanasia of problem cats.

D. Dissemination of Results

Results coming from the establishment and conduction of any tapir re-introduction and/or translocation programs should be shared with tapir researchers and conservationists worldwide through the IUCN/SSC Tapir Specialist Group (TSG), as well as the AZA (Association of Zoos & Aquariums) and EAZA (European Association of Zoos and Aquaria) Tapir Taxon Advisory Groups (TAGs) networks, as well as published in scientific papers and presented in national and international conferences.

Besides scientific information, it is fundamental to make available information on costs of designing, establishing and carrying out re-introduction and translocation programs for effective cost-benefit analysis of different protocol options. All this information will be critical for the improvement of this version of the TSG Guidelines for Tapir Re-Introductions and Translocations. We strongly emphasize this point and are willing to assist in the process in any way possible.