IUCN對引種、再引回及補殖等生物活體移置之立場聲明
IUCN Position Statement on Translocation of Living Organisms : Introductions, Reintroductions and Re-stocking

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序

　　全世界的野生動植物正面臨著嚴重的生存威脅。即使全世界對此問題甚爲關注，但迄今所付出之努力卻極爲有限。

　　1992 年聯合國環境與發展會議通過生物多樣性公約後，世界各國對物種的調查研究及復育工作日益重視，並陸續展開各項具體的保育行動，例如研擬國家生物多樣性保育策略及行動計畫、調查及保護全球高生物多樣性地區、整合域內及域外保育技術、調整農業及林業經營政策、強化各國保育人力物力及設備等執行能力。

　　本中心於八十五年度起，承行政院農業委員會經費補助，由彭研究員兼秘書國棟規劃主持，進行「野生植物保育策略之研究」計畫，並指派相關研究人員共十三人成立工作小組，廣泛蒐集世界各保育先進國家之植物保育立法、策略及行動計畫等文獻資料，詳加研讀並翻譯，目標是吸收先進國家之經驗，經過整理後擬訂出切合台灣自然、社會、經濟及人文背景之植物保育策略，以供政府決策單位及國內保育界參考。其中由國際自然及自然資源保育聯盟(IUCN)物種生存委員會、生態委員會及環境政策、法令與管理委員會合作研擬，經 IUCN 第 22 次理事會於 1987 年 9 月審查通過的「IUCN Position Statement on Translocation of Living Organisms: Introductions, Reintrcductions and Re-stocking」(IUCN 對引種、再引回及補殖等生物活體移置之立場聲明)，旨在陳述如何正確利用引種(introduction)、再引回(reintroduction)及補殖(re-stocking)等三種生物性經營手段，以及爲避免因規劃不當而產生不良後果，所應採取之措施及注意事項。爲一兼顧物種生存及生態系平衡，有效推動復育工作之寶貴參考資料，對國內目前正在推動的多項物種復育及研究工作將有甚大的幫助。爲能突破語言隔閡，引介本項重要立場聲明於國內保育界，感謝 IUCN 物種生存委員會之慨然同意，由本中心彭研究員兼秘書國棟完成翻譯，植物組楊助理嘉棟負責編印作業，並請 IUCN 物種生存委員會指導委員暨台大動物系李教授玲玲審閱校訂。冀望本譯文之付梓，能獲得國內保育界之回響，有利形成共識，並共同推動自然保育工作。

主任　顏仁德　謹誌

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IUCN 對引種、再引回及補殖等生物活體移置之立場聲明*

前言：

　　本聲明主在陳述 IUCN 對引種(introduction)、再引回(reintroduction)及補殖(re-stocking)等生物活體移置(translocation)之基本看法。上述三種移置方法之差別頗大，所以本文分為四部分，分別討論引種、再引回、補殖及其在經營管理上之應用。

定義：

　　移置(translocation)是指經由人為之活動，致使生物活體由一個地方移動到另一地方。本文中所提到的三種移置方法分述如下：

- **引種(introduction)**：以人為的力量，進行計畫的或偶然的移置，將某一物種散布到其原分布範圍之外。
- **再引回(reintroduction)**：以計畫性移置，將在其原生地內已絕滅之物種，引回到原分布範圍內。
- **補殖(re-stocking)**：經由對某種動植物之移置，以增加原生棲地內該物種之個體數。

　　移置在自然及人造環境之經營上都是很有力的方法，如果運用得宜，可對人類及生態系帶來很大貢獻；但如使用不當，它可能引起很大的損害。本聲明旨在說明如何善用移置，以及為避免因規劃不當而產生不良後果，所應採取之措施及注意事項。

*本立場聲明係由 IUCN 物種生存委員會、生態委員會及環境政策、法令與管理委員會合作研擬，經 IUCN 第 22 次理事會於 1987 年 9 月 4 日在瑞士格朗德審查通過。

第一章　引種(Introduction)

一、背景

　　外來種常因為經濟、狩獵、裝飾或維持移民之社區文化等原因而被引進到它們原來並不分布的地方。傷害性的引種對自然生態系所產生的為害遠大於利益。這種因人類活動而意外或計畫性的將一物種引進到它們原來不出現的地區之做法，對世界各地原生動植物及人類福祉常產生直接為害。

　　由於引進外來物種，常破壞當地共同演化的動植物群落之基因隔離機制(genetic isolation)。這種隔離機制對於地球上動植物之演化及多樣性的維持均非常重要。外來種對隔離機制之干擾，影響了當地自然生態系之動態平衡,致引起物種提前絕滅(premature extinction of species)。特別是一些生活力強、侵略性的動植物,不斷地擴大其生存空間而居優勢地位，取代了原生性群落的多樣化相貌。包括湖泊或隔離山頭等常泛稱為島嶼(islands)的隔離生態系特別容易受引種之害，因為它們單純的生態體系常是競爭力較弱物種之避難所。由於在這些生態島嶼之特殊條件下長期隔離演化的結果，使這些島嶼具有很高的特有種比例，並因而變得特別有價值。這些特有種通常非常稀有，而且在生態需求上非常特別。它們也可能是歷史上曾經廣泛分布的大群落之殘存生物，例如非洲及亞馬遜的更新世時期孑遺物種保護區(pleistocene refugia)。

　　即使人類對於在單調而且容易遭受為害的農業環境下生產出來的作物及家禽家畜甚為依賴，但是由於人類對大自然產物之需求量及種類不斷增加，所以野生動植物之多樣性對我們仍然是愈來愈重要。

　　引種可能為人類帶來利益。但是以下各章節裡，我們將討論一些引進外來種可能會有的不利影響，並且介紹一些在引進外來種前應先考慮的事項。

　　為減少引種對自然生態系之衝擊及損害，各國政府應在法令及經營管理上大力支持與配合，以貫徹以下各事項之有效執行。

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二、計畫性的引種(Intentional introduction)

(一)通則

1. 除非可以預期引種對人類或自然群落將帶來很明確、很具體的利益,否則不宜貿然進行。

2. 除非確認沒有適合的原生物種可滿足引種的需求與目的,否則不宜引進外來種。

(二)自然棲地內之引種(Introduction in Natural Habitats)

3. 在任何自然棲地、島嶼、湖泊、海洋或特有種比例很高的地區,都應禁止引進外來種。自然棲地指未受人類活動影響而明顯改變之棲地。可能的話,這些地區應該有一個足夠面積的緩衝區包圍它,以防止外來物種自鄰近地區侵入。在緩衝區內如果外來物種可能擴散到鄰近的自然棲地的話,也應禁止其引種。

(三) 半自然棲地內之引種(Introduction into Semi-natural Habitat)

4. 除非有特別理由而且事先經過縝密之調查規劃,否則任何外來種皆不應引入半自然棲地。所謂半自然棲地指已因人類活動而有明顯改變或經人類經營管理,但仍具有自然棲地之物種多樣性,仍維持物種間複雜交互關係者。但不包括農耕地、人工草地及造林地。

(四)人工棲地內之引種(Introduction into Man-made Habitat)

5. 在人工棲地、農耕地、人工草地或其他單純林經營的森林生態系內引入任何物種、亞種或變種,均需詳細評估對周圍自然及半自然棲地之影響。同時應採取適當措施以減少不利影響。

(五)規劃有效益的引種(Planning a Beneficial Introduction)

6. 欲調查、規劃有效益的引種、至少應包括:

   (1)引種前的評估階段。

   (2)屬於實驗性而且可以有效控制的試驗性引種。

   (3)在監測追蹤下的大規模引種。

評估階段

調查規劃時應考量以下各因子：

(a)除非針對該物種在原生地內限制其分布及數量的因子均經生態學家充分調查、瞭解，而且其可能的播遷方式也經評估鑑定，否則任何物種皆不應被引種到新的棲地。

下列問題應特別注意：

(1)外來種大量增加後對當地環境產生為害的可能性有多高？尤其是對將引入地的生物群落之可能影響如何？

(2)外來種被引進後是否會擴散並侵入鄰近棲地？尤應注意外來種之播遷方式。

(3)將要引入之外來種在計畫引入地區內之不同氣候及生物循環更替的各個階段之中，將如何繼續生長與適應？有研究指出，火災、乾旱及水災都會大大地改變植物之繁殖及擴散。

(4)外來種經由雜交而使原生物種減少或絕滅的潛力如何？

(5)外來種會和原生種雜交而產生多倍體的入侵種嗎？多倍體植物經常會產生變異性的後代，其中有些將很快的適應並佔據原生植物及當地栽培植物的生育地並取而代之。

(6)引進之外來種會不會是傳染其他動植物、人類、作物及家禽家畜疾病或寄生蟲之寄主？

(7)欲引進之外來種會不會因掠食或是對食物、遮蔽及繁殖地點之競爭或以其他方式而威脅原生物種族群之持續穩定生存？如果欲引進之物種是肉食性、寄生性或專一食草性，而且它們的食物，包括會因被吃食而受嚴重影響的稀有原生物種時，應禁止引種。

(b)引進水生物種時，有些特別的問題應考慮。因為水生物種常具有很強的擴散及入侵力。

(1)許多魚類在引種後會改變其營養位階或對食物之偏好，所以很難預測其再引回之效應。在河流或海中某一地點引種魚類，常會由於被引種物種之擴散到整個水系或海域而對

原生動植物產生難以預料的結果。雨季時河流之氾濫則會將被引入種擴散傳播到另一水系。

(2)引入新的魚類和大型水生無脊椎動物已證實對自然生態體系產生很大的破壞，因為牠們的幼體、亞成體及成體，會利用生態系之不同部分，產生很廣泛的影響。

(c)如果對於引種後沒有一個安全可行的控制方法，則絕對不能輕易引種。引種前務必要先進行風險分析(risk-and-threat analysis)，詳細調查分析假如引進物種之擴散超出預測範圍或產生預想不到的不利影響時，是否有有效的控制方法？而且該控制方法必須是很有效率，能被社會大眾所接受，並且不會對植物、動物、人類、家禽家畜及栽培作物產生為害才行。

(d)若前述各項問題均經詳細考慮而且獲得解決。接下來就需確定，該等欲引進之物種能否順利的在新的棲地中存活？如果可存活的話，它們是否真的將對引進地區之動植物相有所增益？對當地之經濟或景緻是否有幫助？其利益是否大於可能存在的不利影響？

控制試驗階段(The Experimental Controlled Trial)

決定要引進一物種後，應依照下列三點先進行控制試驗：

(1)試驗之動植物和計畫要大規模引種者應來自同一來源。

(2)供試之動植物不能帶有會感染原生物種、人類、作物、家禽家畜等的疾病及寄生蟲。

(3)欲引種之物種，它們在評估階段之評估結果應與實際試驗結果詳加比較，並據以檢討分析是否真的適宜進行引種。

大規模的引種(The Extensive Introduction)

如果欲引種之物種在試驗階段與預測之表現一致，則可以在嚴密監測下開始引種。但要有一套因應措施，以備需要時可立即控制或消滅該引進物種。

在全程之引種過程中各項資訊應對所有有興趣的科學家及其他人員

開放，俾讓大眾了解。

　　實際執行引種工作之人員或團體(不是社會大眾)應負責控制、監測被引種物種的花費，而且相關法令也應對這一點有所規範。

三、**意外的引種**(Accidental Introduction)

　　1. 意外的引種很難預測及監測，但應儘可能防止其發生。尤其應特別注意以下幾點：

　　　　(1)在島嶼型的保留區，像是隔離湖泊、山頂、森林、荒野地區(wilderness areas)，應特別注意，避免外來種植物之種子經由鞋子及衣服而傳入，或引進外來種動物，尤其是和人類關係密切的貓、狗及鼠類等。

　　　　(2)應採取措施(包括法令措施)以防止飼養與圈養繁殖之外來種野生動物，或新近馴化物種之釋放或散逸，它們可能於散逸後和野生種雜交。

　　　　(3)為了保護野生物及農業效益，應採取措施以防止進口農用種子和雜草或入侵性植物種子之混合、污染。

　　　　(4)當有大型工程要進行，像開築運河連接二個不同的生物地理區時,要特別考慮該二地區之動植物因運河連接後而發生混合之影響。例如巴拿馬運河連接了太平洋和加勒比海，蘇伊士運河連接了紅海和地中海，其間之水生生物因而混合。類似情形下，則必須考慮可以採取什麼措施以限制或減少不同地區物種之混合及影響。

　　2. 當意外引進之外來種成功而且大量地繁殖時，必須詳細調查研究它們在經濟上及生態上的正面與負面效應。如果評估調查結果之整體效益是負面的,則應採取措施以限制其擴散。

四、**當外來種已存在時**(Where alien species are already present)

　　1. 一般而言，對人類沒有顯著效益而對當地原生動植物有負面影響的引種應予以移除或消滅。在目前到處都充滿外來物種之情況下，許多國家均無法有效地處理外來入侵物種；但是下列地區之

引進物種應設法予以根絕：

(1)具有高比例特有物種的島嶼。

(2)特有物種集中的地區(areas which are centers of endemism)。

(3)物種多樣性高的地區。

(4)生態多樣性高的地區。

(5)由於外來種之存在已威脅當地特有種生存之地區。

2. 對於人工飼育後散逸在外的野化動物尤其需要特別予以注意。牠們雖然在經濟及遺傳資源上可能有其價值或具有學術研究意義，但可能會變成對自然環境最具破壞的外來種。因為其族群對原生植群及動物之平衡影響密切，所以即使牠們本身有其價值，但仍應以保護原生動植物為第一優先考量。把牠們移除後圈養或馴化是一種有效的方法，不僅可保護這些有價值的人工飼育動物也符合牠們朝向馴化動物演化之趨勢。

當某地有繁殖中的鳥類族群或其他野生動物的重要族群時，要特別注意應將哺乳類的掠食性野化動物(mammalian feral predators)予以清除。事實上，掠食性野化哺乳類往往難以甚至不可能清除,就像野狗、野貓、野貂(minks and ferrets)等等。

3. 因為前述各項問題很大也非常複雜，特別是涉及被飼養後之野化的哺乳類動物或很多外來入侵植物時，若要採取清除的方式，則需請教專家。

五、生物控制(Biological Control)

1. 利用引種以進行生物控制的方法已被證明對於控制及根除很多被引進之植物或少數動物甚為有效。但是因為生物控制本身就涉及外來種的引進，所以實際進行時，應和計畫性的引種一樣，採取必要的程序和注意。

六、微生物(Micro-organisms)

1. 最近人類基於很多理由及目的而不斷增加對微生物的利用，其中有還包括經過人為改變遺傳基因的微生物。這些利用中，如果將微生物由一個地方移動到它原未分布之地區時，則要採取

前述與引進其他物種相同之注意事項及處理程序。

第二章　　物種的再引回(The Re-introduction of Species)

● 再引回是將動物或植物釋放或散布到它們曾經分布，但因人類活動或天然災害而消失之原生地的行為。再引回也是對於因人類的為害、過度採集、棲地劣化等原因而致某一物種在其原生棲地消失，但是目前已能有效控制這些為害因子之情況下，復育該物種的一個相當有效的方法。

● 除非造成原來絕種的原因已消除，否則不宜進行再引回。

● 除非欲引回地區符合該物種之棲地需求，否則也不宜進行再引回。如果某物種之絕滅是因為棲地的改變，在該棲地恢復前或物種絕滅後該棲地有很明顯之劣化現象而未改善前，都不宜進行再引回。

● 再引回之基本工作包括：
　1.可行性研究
　2.預備階段
　3.釋放或引種階段
　4.監測階段

一、 可行性研究

應進行生態研究，以評估了解該物種和欲引回之棲地間以往之關係，以及該物種於當地消失後棲地之變化情形。如果要再引回的個體是經過圈養繁殖或栽培，應考慮該物種已產生的改變以及是否有可能影響它們對原棲地再適應能力之新特性。

當地居民的態度也應列入考慮，尤其再引回原來被當地人為害、過度採集或獵捕之物種時。如果當地人之態度對再引回不利時，在進行再引回計畫以前一定要先採取有效的教育宣導，說明再引回工作對他們之利益，以改善他們的態度。

擬供再引回之動植物應選用和原來之種源最相近的品系(race)或型(type)。

開始再引回工作前，亦應確定是否有充足的經費以確保再引

回及後續之監測工作均能有效貫徹執行。

二、預備及釋放階段

　　成功地再引回動植物之先決條件是欲引回之物種要能在預定引回之棲地內滿足其生態需求。這就需要對動植物之需求及再引回地區之生態變遷情形都有詳細的了解。因此，在再引回之全部過程中，要隨時採納最好的科學資訊。

　　以再引回如高地山羊(ibex)、羚羊及鹿等偶蹄目野生動物為例，再引回工作需詳細地分析很多相關因子，包括了解並應用一系列的重要因子，例如再引回個體之理想年齡、性別比率、季節、特殊的捕捉技巧、運送方法、物種及引回棲地如何預防疾病與寄生蟲感染、如何使物種適應新環境、如何幫助動物在野外自行覓食、對新草料之調適、對活動範圍之印痕(imprinting)作用、預防個體逸出再引回地、釋放前在就地小圈養場繁殖以擴大其族群量並幫助牠們適應當地環境等。要再引回其他動植物時，問題也一樣複雜，必須仔細考量。

三、追蹤及監測階段

　　對釋放之動物進行監測是整體再引回計畫中不可欠缺之一環。可能的話，應進行長期研究，俾了解再引回物種之適應及擴散情形？是否需釋放更多個體？以及確認再引回工作之成敗原因？

　　另外，再引回之物種對棲地的衝擊影響也應進行監測，並據以提出並進行改善行動。也應透過出版品、演講等各種溝通管道以便大眾能獲得有關成功或失敗的再引回計畫的資訊。

第三章　　補殖(Restocking)

1. 補殖是在原來已有該物種之地區放入該動物或植物個體，以增加其數量。在下列情況下，補殖可能是一種很有用的方法：

(1)一個小而衰退的族群有嚴重的近親交配之虞時。

(2)族群數量已降到臨界點以下，欲藉自然成長以復原之速度太

慢。

(3)生物地理島嶼上各自隔離的小族群(small isolated populations on biogeographical islands)間為維持遠系交配(outbreeding)，需要人為交流及較瀕繁之移入(artifical exchange and artificially-high rates of immigration)時。

2. 在前述情形下應確定該族群之低活力是因遺傳組成，而不是經營管理不善導致棲地劣化或對該族群過度利用所引起的。如果只要對該族群好好經營就無上述問題，則不需要進行補殖工作。但是，一旦考慮要進行補殖計畫時，應注意以下二點：

(a)只有當造成族群衰退之原因已大部份被消除，而且欲以自然方法增加族群數已不可能時，才可考慮採用補殖計畫以保存正嚴重衰退之族群。

(b)決定是否需要進行補殖計畫前，應先對擬執行補殖計畫地區之承載量(capacity)調查，評估我們期望達到的族群數量可不可能永續？如果是的話，應進一步探討目前族群數量稀少的原因，然後採取行動幫助現存族群擴展到期望的數量。只有在這些行動失敗後，才可以進行補殖計畫。

3. 當確定要進行補殖計畫時,應注意下列事項：

(a)應注意擬供為補殖之個體的遺傳組成。

(1)原則上對於野生個體應儘量避免做遺傳上的人為改變，因為人為的遺傳改變可能會改變天擇效應、物種的本質及生存能力，進而可能嚴重影響該物種或其族群的存活。

(2)遺傳上衰弱的或無性繁殖的個體不宜做為補殖族群，因其基因之同質性高，將相對限制其生存能力。

(b)用為補殖之動植物應和它們將釋放入之族群同一品系。

(c)如果某一物種之天然分布範圍很廣，而且補殖計畫之目的係在保育其氣候上或生態上邊緣地區的嚴重衰退族群時,補殖應使用來自相似的氣候或生態區之個體。否則，來自氣候或生態較和緩地帶的個體和邊緣地帶個體雜交後會影響其對惡

劣環境具抵抗力及健壯的基因型。

(d)有時可以從動物園獲得個體，但應充分了解該動物之來源及飼養歷史，並依照前述有關引種評估階段(Assessment phase)之 a.b.c.d 各項指導原則詳為評估。另外應避免將新疾病引入野生族群內，尤其有些靈長類動物會傳染人畜共同疾病。

(e)有些資源永續利用型的補殖計畫(例如將飼養場中由卵孵化的部分鱷魚釋放)，要遵照上述 a 及 b 之規定原則。

(f)如果係基於人道原因需釋放圈養之動物，則最好把們放到原來有該動物分布，但目前已消失的地區，以再引回(re-introduction)的方式去釋放，才不致於對野外同種族群傳染新疾病，或擔心特們會不會被野外同種個體接受之問題。

第四章　　移置在國家、國際及科學上之意義與應用

一、在國內經營管理上之應用

1. 政府現有的各種保護農業、基本工業、荒野及國家公園等之組織架構，均應用來管理計畫性及非計畫性的引進生物。特別是可透過動植物之檢疫法令而進行管制。

2. 各國政府應利用現有生物學、生態學及自然資源經營方面的專業機構或專家，就生物移置策略及各項引種、再引回、補殖或野生物種之飼育等個案提供意見。

3. 各國政府應研訂下列事項之國家策略：
   (1)野生物之移置。
   (2)野生動物之捕捉及運送。
   (3)瀕絕物種之人工繁殖。
   (4)野生物之馴化養殖有關之選擇及繁殖。
   (5)入侵性外來種之預防及控制。

4. 國家應有法令限制不必要的引種。

　　計畫性的引種，應訂定許可制度。此許可制度不僅適用於自國外引進物種，也適用在國內將原生種引到另一個新地點。這套制度也應該適用於補殖計畫。

意外的引種

- 對於所有可能引起潛在為害之生物，除非經嚴格審核及許可，否則應禁止其輸入及貿易。特別在寵物之交易上應貫徹執行。
- 當可能引起潛在為害之生物被圈養飼育以供商業用途時(例如貂)，應藉由法令規定，建立嚴格的飼育設施之設計及作業標準。尤其應建立當停止飼養該等動物時之處理作業程序。
- 對於活體魚餌的使用應予以嚴格管制，以免因疏忽而將外來的物種引入水中。

罰則

5. 未經核准而任意引種，以及因過失而造成對環境有傷害性物種之逸出或引入，均應以犯罪論處。未經核准而進行引種之禍首及對引種過失應負責的人均應對其所引發之損害負法律責任，而且必要時應負責採取消滅行動或棲地復原措施。

二、國際上之管理

(一)引進物種之跨國移動

1. 應採取特別措施，以防止引進種跨越進入鄰國邊界。當可能發生這種情形時，應儘速通告鄰國並商議採取適當措施。

(二)斯德哥爾摩宣言(The Stockholm Declaration)

2. 依照斯德哥爾摩人類環境宣言第 21 條之規定，各國應確保其管轄境內之活動不能對其他國家之環境產生為害。

(三)國際協定及公約

3. 各國應了解下列各項與物種移置有關的國際協定及文件：

(1)減少海洋物種引種危險作業協定(ICES, Revised Code of Practice to Reduce the Risks from Introduction of Marine Species, 1982)。

(2)聯合國農糧組織魚類遺傳資源專家諮詢報告(FAO, Report of the Expert Consultation on the Genetic Resources

of Fish, Recommendations to Governments No L 1980)。

(3)歐洲內陸魚類諮詢委員會補殖工作小組報告(European Inland Fisheries Advisory Commission, Report of the Working Party on Stock Enhancement, Hamburg, FRG 1983)。

(4)波昂公約(The Bonn Convention)。

(5)伯恩公約(The Berne Convention)。

(6)東南亞國協自然及自然資源保育公約(The ASEAN Agreement on the Conservation of Nature and Natural Resources)。

(7)海洋公約第 196 條(Law of the Sea Convention, article 196)。

(8)東非地區保護區及野生動植物協議(Protocol on Protected Areas and Wild Fauna and Flora in Eastern African Region)。

除了前述之國際協定及文件外，各國亦應了解華盛頓公約(CITES)。國際間運送該公約所公布之附錄瀕絕物種均應依照其規定及許可。詳細規定可向位在瑞士的 CITES 秘書處洽詢。

(四)區域性發展計畫

4.國際性、區域性或各國之開發及保育組織，於考慮其各別層次之保育策略或計畫時，應針對引進外來物種之衝擊及影響進行深入研究，並推荐適當行動以減少或消除其負面效應。

(五)科學研究

5. 亟需針對目前有關引種、再引回及補殖之知識予以綜合彙整。

6. 對於入侵性外來種之控制及消滅，亟需研究有效、目標明確，合乎人道，並為社會大眾可接受的處理方法。

7. 為了有效地實行引種、再引回及補殖計畫，經常需要對

不同來源之動植物鑑定其遺傳相似性。所以對於基因型之分類鑑定方法之研究需不斷加強。

8. 有關動植物如何經由人類活動之影響而擴散之研究也需進行。(即擴散媒介分析 dispersal vector analysis)

另外，現行有關引種法令之內涵及效力等亦均值得研究。

(六)IUCN 的責任

聯合國環境保護署(UNEP)、聯合國教科文組織(UNESCO)及聯合國農糧組織(FAO)等國際保育機構及預定要進行引種、再引回或補殖計畫之國家，均應提供充分之資金，以便身為國際獨立組織的 IUCN 能順利執行下列各項工作，盡其義務。

9. IUCN 應鼓勵從事各種和引種、再引回及補殖有關的資訊收集；尤其是對於再引回計畫之個案歷史、特別易受入侵種為害之棲地以及明顯具有強烈侵略性之動植物。

此種資訊應包括：

(1)入侵物種之目錄。

(2)入侵物種之分類學。

(3)入侵物種之群落生態學。

(4)入侵物種之控制方法。

10. IUCN 瀕絕植物單位(Threatened Plants Unit of IUCN)正在進行的植物高特有種地區、高生物多樣性地區以及高生態多樣性地區之劃定工作應加速進行，俾利本聲明中所推荐的各項指導原則得以有效實行。

11. IUCN 應建立有關外來物種之控制及消除的專家顧問名冊。

附　錄

IUCN Position Statement on Translocation of Living Organisms:

INTRODUCTIONS, REINTRODUCTIONS AND RE-STOCKING

Prepared by the Species Survival Commission in collaboration with the Commission on Ecology, and the Commission on Environmental Policy, Law and Administration .

Approved by the 22nd Meeting of the IUCN Council, Gland, Switzerland, 4 September 1987

- INTRODUCTIONS
- THE RE-INTRODUCTION OF SPECIES
- RESTOCKING
- NATIONAL, INTERNATIONAL AND SCIENTIFIC IMPLICATIONS OF TRANSLOCATIONS

FOREWORD

This statement sets out IUCN's position on translocation of living organisms, covering introductions, re-introductions and re-stocking. The implications of these three sorts of translocation are very different so the paper is divided into four parts dealing with Introductions, Re-introductions, Re-stocking and Administrative Implications, respectively.

DEFINITIONS:

Translocation is the movement of living organisms from one area with free release in another. The three main classes of translocation distinguished in this document are defined as follows:

- **Introduction** of an organism is the intentional or accidental dispersal by human agency of a living organism outside its historically known native range.
- **Re-introduction** of an organism is the intentional movement of an organism into a part of its native range from which it has disappeared or become extirpated in historic times as a result of human activities or natural

become extirpated in historic times as a result of human activities or natural catastrophe.

- **Re-stocking** is the movement of numbers of plants or animals of a species with the intention of building up the number of individuals of that species in an original habitat.

Translocations are powerful tools for the management of the natural and man made environment which, properly used, can bring great benefits to natural biological systems and to man, but like other powerful tools they have the potential to cause enormous damage if misused. This IUCN statement describes the advantageous uses of translocations and the work and precautions needed to avoid the disastrous consequences of poorly planned translocations.

PART I

INTRODUCTIONS

BACKGROUND

Non-native (exotic) species have been introduced into areas where they did not formerly exist for a variety of reasons, such as economic development, improvement of hunting and fishing, ornamentation, or maintenance of the cultures of migrated human communities. The damage done by harmful introductions to natural systems far outweighs the benefit derived from them. The introduction and establishment of alien species in areas where they did not formerly occur, as an accidental or intended result of human activities, has often been directly harmful to the native plants and animals of many parts of the world and to the welfare of mankind.

The establishment of introduced alien species has broken down the genetic isolation of communities of co-evolving species of plants and animals. Such isolation has been essential for the evolution and maintenance of the diversity of plants and animals composing the biological wealth of our planet. Disturbance of this isolation by alien species has interfered with the dynamics of natural systems causing the premature extinction of species. Especially successful and aggressive invasive species of plants and animals increasingly dominate large areas having replaced diverse autochthonous communities. Islands, in the broad sense, including isolated biological systems such as lakes or isolated mountains, are especially vulnerable to introductions because their often simple ecosystems offer refuge for species that are not aggressive competitors. As a result of their isolation they are of special value because of high endemism (relatively large numbers of unique local forms) evolved under the particular conditions of these islands over a

unique local forms) evolved under the particular conditions of these islands over a long period of time. These endemic species are often rare and highly specialised in their ecological requirements and may be remnants of extensive communities from bygone ages, as exemplified by the Pleistocene refugia of Africa and Amazonia.

The diversity of plants and animals in the natural world is becoming increasingly important to man as their demands on the natural world increase in both quantity and variety, notwithstanding their dependence on crops and domestic animals nurtured within an increasingly uniform artificial and consequently vulnerable agricultural environment.

Introductions, can be beneficial to man. Nevertheless the following sections define areas in which the introduction of alien organisms is not conducive to good management, and describe the sorts of decisions that should be made before introduction of an alien species is made.

To reduce the damaging impact of introductions on the balance of natural systems, governments should provide the legal authority and administrative support that will promote implementation of the following approach.

Intentional Introduction

General

1. Introduction of an alien species should only be considered if clear and well defined benefits to man or natural communities can be foreseen.
2. Introduction of an alien species should only be considered if no native species is considered suitable for the purpose for which the introduction is being made.

Introductions to Natural Habitats

3. No alien species should be deliberately introduced into any natural habitat, island, lake, sea, ocean or centre of endemism, whether within or beyond the limits of national jurisdiction. A natural habitat is defined as a habitat not perceptibly altered by man. Where it would be effective, such areas should be surrounded by a buffer zone sufficiently large to prevent unaided spread of alien species from nearby areas. No alien introduction should be made within the buffer zone if it is likely to spread into neighbouring natural areas.

Introduction into Semi-natural Habitat

4. No alien species should be introduced into a semi-natural habitat unless

4. No alien species should be introduced into a semi-natural habitat unless there are exceptional reasons for doing so , and only when the operation has been comprehensively investigated and carefully planned in advance. A semi-natural habitat is one which has been detectably changed by man's actions or one which is managed by man, but still resembles a natural habitat in the diversity of its species and the complexity of their interrelationships. This excludes arable farm land, planted ley pasture and timber plantations.

Introductions into Man-made Habitat

5. An assessment should be made of the effects on surrounding natural and semi-natural habitats of the introduction of any species, sub-species, or variety of plant to artificial, arable, ley pasture or other predominantly monocultural forest systems. Appropriate action should be taken to minimise negative effects.

Planning a Beneficial introduction

6. Essential features of investigation and planning consist of:
   - an assessment phase culminating in a decision on the desirability of the introduction;
   - an experimental, controlled trial;
   - the extensive introduction phase with monitoring and follow-up.

THE ASSESSMENT PHASE

Investigation and planning should take the following factors into account:

a) No species should be considered for introduction to a new habitat until the factors which limit its distribution and abundance in its native range have been thoroughly studied and understood by competent ecologists and its probable dispersal pattern appraised.

Special attention should be paid to the following questions:

- What is the probability of the exotic species increasing in numbers so that it causes damage to the environment, especially to the biotic community into which it will be introduced?
- What is the probability that the exotic species will spread and invade habitats besides those into which the introduction is planned? Special attention should be paid to the exotic species' mode of dispersal.
- How will the introduction of the exotic proceed during all phases of the

- How will the introduction of the exotic proceed during all phases of the biological and climatic cycles of the area where the introduction is planned? It has been found that fire, drought and flood can greatly alter the rate of propagation and spread of plants.
- What is the capacity of the species to eradicate or reduce native species by interbreeding with them?
- Will an exotic plant interbreed with a native species to produce new species of aggressive polyploid invader? Polyploid plants often have the capacity to produce varied offspring some of which quickly adapt to and dominate, native floras and cultivars alike.
- Is the alien species the host to diseases or parasites communicable to other flora and fauna, man, their crops or domestic animals, in the area of introduction?
- What is the probability that the species to be introduced will threaten the continued existence or stability of populations of native species, whether as a predator, competitor for food, cover, breeding sites or in any other way? If the introduced species is a carnivore, parasite or specialised herbivore, it should not be introduced if its food includes rare native species that could be adversely affected.

b) There are special problems to be considered associated with the introduction of aquatic species. These species have a special potential for invasive spread.

- Many fish change trophic level or diet preference following introduction, making prediction of the results of the re-introduction difficult. Introduction of a fish or other species at one point on a river system or into the sea may lead to the spread of the species throughout the system or area with unpredictable consequences for native animals and plants. Flooding may transport introduced species from one river system to another.
- introduced fish and large aquatic invertebrates have shown a great capacity to disrupt natural systems as their larval, sub-adult and adult forms often use different parts of the same natural system.

c) No introduction should be made for which a control does not exist or is not possible. A risk-and-threat analysis should be undertaken including investigation of the availability of methods for the control of the introduction should it expand in a way not predicted or have unpredicted undesirable effects, and the methods of control should be socially acceptable, efficient, should not damage vegetation and fauna, man, his domestic animals or cultivars.

d)When the questions above have been answered and the problems carefully considered, it should be decided if the species can reasonably be expected to survive in its new habitat, and if so, if it can reasonably be expected to enhance the flora and fauna of the area, or the economic or aesthetic value of the area, and whether these benefits outweigh the possible disadvantages revealed by the

whether these benefits outweigh the possible disadvantages revealed by the investigations.

THE EXPERIMENTAL CONTROLLED TRIAL

Following a decision to introduce a species, a controlled experimental introduction should be made observing the following advice:

- Test plants and animals should be from the same stock as those intended to be extensively introduced.
- They should be free of diseases and parasites communicable to native species, man, his crops and domestic livestock.
- The introduced species' performance on parameters in 'the Assessment Phase' above should be compared with the pre-trial assessment, and the suitability of the species for introduction should be reviewed in light of the comparison.

THE EXTENSIVE INTRODUCTION

If the introduced species behaves as predicted under the experimental conditions, then extensive introductions may commence but should be closely monitored. Arrangements should be made to apply counter measures to restrict, control, or eradicate the species if necessary.

The results of all phases of the introduction operation should be made public and available to scientists and others interested in the problems of introductions.

The persons or organisation introducing the species, not the public, should bear the cost of control of introduced organisms and appropriate legislation should reflect this.

ACCIDENTAL INTRODUCTIONS

1. Accidental introductions of species are difficult to predict and monitor, nevertheless they "should be discouraged where possible. The following actions are particularly important:
   - On island reserves, including isolated habitats such as lakes, mountain tops and isolated forests, and in wilderness areas, special care should be taken to avoid accidental introductions of seeds of alien plants on shoes and clothing and the introduction of animals especially associated with man, such as cats, dogs, rats and mice. Measures, including legal measures, should be taken to discourage

- o Measures, including legal measures, should be taken to discourage the escape of farmed, including captive-bred, alien wild animals and newly-domesticated species which could breed with their wild ancestors if they escaped.
- o In the interest of both agriculture and wildlife, measures should be taken to control contamination of imported agricultural seed with seeds of weeds and invasive plants.
- o Where large civil engineering projects are envisaged, such as canals, which would link different biogeographical zones, the implications of the linkage for mixing the fauna and flora of the two regions should be carefully considered. An example of this is the mixing of species from the Pacific and Caribbean via the Panama Canal, and the mixing of Red Sea and Mediterranean aquatic organisms via the Suez Canal. Work needs to be done to consider what measures can be taken to restrict mixing of species from different zones through such large developments.

2. Where an accidentally introduced alien successfully and conspicuously propagates itself, the balance of its positive and negative economic and ecological effects should be investigated. If the overall effect is negative, measures should be taken to restrict its spread.

WHERE ALIEN SPECIES ARE ALREADY PRESENT

1. In general, introductions of no apparent benefit to man, but which are having a negative effect on the native flora and fauna into which they have been introduced, should be removed or eradicated. The present ubiquity of introduced species will put effective action against the majority of invasives beyond the means of many States but special efforts should be made to eradicate introductions on:
   - o islands with a high percentage of endemics in the flora and fauna;
   - o areas which are centres of endemism;
   - o areas with a high degree of species diversity;
   - o areas with a high degree of other ecological diversity;
   - o areas in which a threatened endemic is jeopardised by the presence of the alien.

2. Special attention should be paid to feral animals. These can be some of the most aggressive and damaging alien species to the natural environment, but may have value as an economic or genetic resource in their own right, or be of scientific interest. Where a feral population is believed to have a value in its own right, but is associated with changes in the balance of native vegetation and fauna, the conservation of the native flora and fauna should always take precedence. Removal to captivity or domestication is a valid alternative for the conservation of valuable feral animals consistent with the

alternative for the conservation of valuable feral animals consistent with the phase of their evolution as domestic animals.

Special attention should be paid to the eradication of mammalian feral predators from areas where there are populations of breeding birds or other important populations of wild fauna. Predatory mammals are especially difficult, and sometimes impossible to eradicate, for example, feral cats, dogs, mink, and ferrets.

3. In general, because of the complexity and size of the problem, but especially where feral mammals or several plant invaders are involved, expert advice should be sought on eradication.

BIOLOGICAL CONTROL

1. Biological control of introductions has shown itself to be an effective way of controlling and eradicating introduced species of plants and more rarely, of animals. As biological control involves introduction of alien species, the same care and procedures should be used as with other intentional introductions.

MICRO-ORGANISMS

1. There has recently been an increase of interest in the use of micro-organisms for a wide variety of purposes including those genetically altered by man.

Where such uses involve the movement of micro-organisms to areas where they did not formerly exist, the same care and procedures should be used as set out above for other species.

PART II

THE RE-INTRODUCTION OF SPECIES*

Re-introduction is the release of a species of animal or plant into an area in which it was indigenous before extermination by human activities or natural catastrophe. Re-introduction is a particularly useful tool for restoring a species to an original habitat where it has become extinct due to human persecution, over-collecting, over-harvesting or habitat deterioration, but where these factors can now be controlled.

can now be controlled.

Re-introductions should only take place where the original causes of extinction have been removed.

Re-introductions should only take place where the habitat requirements of the species are satisfied. There should be no re-introduction if a species became extinct because of habitat change which remains unremedied, or where significant habitat deterioration has occurred since the extinction.

The species should only be re-introduced if measures have been taken to reconstitute the habitat to a state suitable for the species.

The basic programme for re-introduction should consist of:

- a feasibility study;
- a preparation phase;
- release or introduction phase; and a
- follow-up phase.

THE FEASIBILITY STUDY

An ecological study should assess the previous relationship of the species to the habitat into which the re-introduction is to take place, and the extent that the habitat has changed since the local extinction of the species. If individuals to be re-introduced have been captive-bred or cultivated, changes in the species should also be taken into account and allowances made for new features liable to affect the ability of the animal or plant to re-adapt to its traditional habitat.

The attitudes of local people must be taken into account especially if the reintroduction of a species that was persecuted, over-hunted or over collected , is proposed. If the attitude of local people is unfavorable an education and interpretive programme emphasizing the benefits to them of the re-introduction, or other inducement, should be used to improve their attitude before re-introduction takes place.

The animals or plants involved in the re-introduction must be of the closest available race or type to the original stock and preferably be the same race as that previously occurring in the area.

Before commencing a re-introduction project, sufficient funds must be available to ensure that the project can be completed, including the follow-up phase.

THE PREPARATION AND RELEASE OR INTRODUCTORY PHASES

The successful re-introduction of an animal or plant requires that the biological needs of the species be fulfilled in the area where the release is planned. This requires a detailed knowledge of both the needs of the animal or plant and the ecological dynamics of the area of re-introduction. For this reason the best available scientific advice should be taken at all stages of a species re-introduction.

This need for clear analysis of a number of factors can be clearly seen with reference to introductions of ungulates such as ibex, antelope and deer where re-introduction involves understanding and applying the significance of factors such as the ideal age for re-introducing individuals, ideal sex ratio, season, specifying capture techniques and mode of transport to re-introduction site, freedom of both the species and the area of introduction from disease and parasites, acclimatisation, helping animals to learn to forage in the wild, adjustment of the gut flora to deal with new forage, 'imprinting' on the home range, prevention of wandering of individuals from the site of re-introduction, and on-site breeding in enclosures before release to expand the released population and acclimatise the animals to the site. The re-introduction of other taxa of plants and animals can be expected to be similarly complex.

FOLLOW-UP PHASE

Monitoring of released animals must be an integral part of any re-introduction programme. Where possible there should be long-term research to determine the rate of adaptation and dispersal, the need for further releases and identification of the reasons for success or failure of the programme.

The species impact on the habitat should be monitored and any action needed to improve conditions identified and taken.

Efforts should be made to make available information on both successful and unsuccessful re-introduction programmed through publications, seminars and other communications.

PART III

RESTOCKING

1. Restocking is the release of a plant or animal species into an area in which it is already present. Restocking may be a useful tool where:

it is already present. Restocking may be a useful tool where:

- o it is feared that a small reduced population is becoming dangerously inbred; or
- o where a population has dropped below critical levels and recovery by natural growth will be dangerously slow; or
- o where artificial exchange and artificially-high rates of immigration are required to maintain outbreeding between small isolated populations on biogeographical islands.

2. In such cases care should be taken to ensure that the apparent nonviability of the population, results from the genetic institution of the population and not from poor species management which has allowed deterioration in the habitat or over-utilisation of the population. With good management of a population the need for re-stocking should be avoidable but where re-stocking is contemplated the following points should be observed:

a) Restocking with the aim of conserving a dangerously reduced population should only be attempted when the causes of the reduction have been largely removed and natural increase can be excluded.

b) Before deciding if restocking is necessary, the capacity of the area it is proposed to restock should be investigated to assess if the level of the population desired is sustainable. If it is, then further work should be undertaken to discover the reasons for the existing low population levels. Action should then be taken to help the resident population expand to the desired level. Only if this fails should restocking be used.

3. Where there are compelling reasons for restocking the following points should be observed.

a) Attention should be paid to the genetic constitution of stocks used for restocking.

- o In general, genetic manipulation of wild stocks should be kept to a minimum as it may adversely affect the ability of a species or population to survive. Such manipulations modify the effects of natural selection and ultimately the nature of the species and its ability to survive.
- o Genetically impoverished or cloned stocks should not be used to re-stock populations as their ability to survive would be limited by their genetic homogeneity.

b) The animals or plants being used for re-stocking must be of the same race as those in the population into which they are released.

c) Where a species has an extensive natural range and restocking has the aim of conserving a dangerously reduced population at the climatic or ecological edge of its range, care should be taken that only individuals from a similar climatic or ecological zone are used since interbreeding with individuals from an area with a milder climate may interfere with resistant and hardy genotypes on the population's edge.

d) Introduction of stock from zoos may be appropriate, but the breeding history and origin of the animals should be known and follow as closely as possible Assessment Phase guidelines a, b, c and d (see pages 5-7). In addition the dangers of introducing new diseases into wild populations must be avoided: this is particularly important with primates that may carry human zoonoses.

e) Restocking as part of a sustainable use of a resource (e.g. release of a proportion of crocodiles hatched from eggs taken from farms) should follow guidelines a and b (above).

f) Where restocking is contemplated as a humanitarian effort to release or rehabilitate captive animals it is safer to make such releases as re-introductions where there is no danger of infecting wild populations of the same species with new diseases and where there are no problems of animals having to be socially accepted by wild individuals of the species.

PART IV

NATIONAL, INTERNATIONAL AND SCIENTIFIC IMPLICATIONS OF TRANSLOCATIONS

NATIONAL ADMINISTRATION

1. Pre-existing governmental administrative structures and frameworks already in use to protect agriculture, primary industries, wilderness and national parks should be used by governments to control both intentional and unintentional importation of organisms, especially through use of plant and animal quarantine regulations.
2. Governments should set up or utilise pre-existing scientific management authorities or experts in the fields of biology, ecology and natural resource management to advise them on policy matters concerning translocations and on individual cases where an introduction, re-introduction or restocking

or farming of wild species is proposed.

3. Governments should formulate national policies on:
   - translocation of wild species;
   - capture and transport of wild animals;
   - artificial propagation of threatened species;
   - selection and propagation of wild species for domestication; and
   - prevention and control of invasive alien species.

4. At the national level legislation is required to curtail introductions:

   Deliberate introductions should be subject to a permit system. The system should apply not only to species introduced from abroad but also to native species introduced to a new area in the same country. It should also apply to restocking.

   Accidental introductions

   - for all potentially harmful organisms there should be a prohibition to import them and to trade in them except under a permit and under very stringent conditions. This should apply in particular to the pet trade;
   - where a potentially harmful organism is captive bred for commercial purposes (e.g. mink) there should be established by legislation strict standards for the design and operation of the captive breeding facilities. In particular, procedures should be established for the disposal of the stock of animals in the event of a discontinuation of the captive breeding operation;
   - there should be strict controls on the use of live fish bait to avoid inadvertent introductions of species into water where they do not naturally occur.

   Penalties

5. Deliberate introductions without a permit as well as negligence resulting in the escape or introduction of species harmful to the environment should be considered criminal offences and punished accordingly. The author of a deliberate introduction without a permit or the person responsible for an introduction by negligence should be legally liable for the damage incurred and should in particular bear the costs of eradication measures and of habitat restoration where required.

INTERNATIONAL ADMINISTRATION

Movement of Introduced Species Across International Boundaries

1. Special care should be taken to prevent introduced species from crossing the borders of a neighboring state. When such an occurence is probable, the neighboring state should be promptly warned and consultations should be held in order to take adequate measures.

The Stockholm Declaration

2. According to Principle 21 of the Stockholm Declaration on the Human Environment, states have the responsibility 'to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states'.

International Codes of Practice, Treaties and Agreements

3. States should be aware of the following international agreements and documents relevant to translocation of species:
   o ICES, Revised Code of Practice to Reduce the Risks from introduction of Marine Species, 1982.
   o FAO, Report of the Expert Consultation on the Genetic Resources of Fish, Recommendations to Governments No L 1980.
   o EIFAC (European Inland Fisheries Advisory Commission), Report of the Working Party on Stock Enhancement, Hamburg, FRG 1983.
   o The Bonn Convention MSC: Guidelines for Agreements under the Convention.
   o The Berne Convention: the Convention on the Conservation of European wildlife and Natural Habitats.
   o The ASEAN Agreement on the Conservation of Nature and Natural Resources.
   o Law of the Sea Convention, article 196.
   o Protocol on Protected Areas and Wild Fauna and Flora in Eastern African Region.

In addition to the international agreements and documents cited, States also should be aware of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). International shipments of endangered or threatened species listed in the Appendices to the Convention are subject to CITES regulation and permit requirements. Enquiries should be addressed to: CITES Secretariat**, Case Postale 456, CH-1219 Chatelaine, Genève, Switzerland; telephone: 41/22/979 9149, fax: 41/22/797 3417.

Regional Development Plans

4. International, regional or country development and conservation organisations, when considering international, regional or country conservation strategies or plans, should include in-depth studies of the impact and influence of introduced alien species and recommend appropriate action to ameliorate or bring to an end their negative effects.

Scientific Work Needed

5. A synthesis of current knowledge on introductions, re-introductions and re-stocking is needed.
6. Research is needed on effective, target specific, humane and socially acceptable methods of eradication and control of invasive alien species.
7. The implementation of effective action on introductions, re-introductions and re-stocking frequently requires judgements on the genetic similarity of different stocks of a species of plant or animal. More research is needed on ways of defining and classifying genetic types.
8. Research is needed on the way in which plants and animals are dispersed through the agency of man (dispersal vector analysis).

   A review is needed of the scope, content and effectiveness of existing legislation relating to introductions.

IUCN Responsibilities

International organisations, such as UNEP, UNESCO and FAO, as well as states planning to introduce, re-introduce or restock taxa in their territories, should provide sufficient funds, so that IUCN as an international independent body, can do the work set out below and accept the accompanying responsibilities.

9. IUCN will encourage collection of information on all aspects of introductions, re-introductions and restocking, but especially on the case histories of re-introductions; on habitats especially vulnerable to invasion; and notable aggressive invasive species of plants and animals.

   Such information would include information in the following categories:

   - a bibliography of the invasive species;
   - the taxonomy of the species;
   - the synecology of the species; and
   - methods of control of the species.

10. The work of the Threatened Plants Unit of IUCN defining areas of high plant endemism, diversity and ecological diversity should be encouraged so that guidance on implementing recommendations in this document may be available.
11. A list of expert advisors on control and eradication of alien species should be available through IUCN.

Note:
* The section on re-introduction of species has been enhanced by the Guidelines For Re-Introductions

** The address of the CITES Secretariat has been updated.

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