出國報告（出國類別：開會）

參加國際里山倡議夥伴關係網絡（IPSI）「里山倡議主題彙編第 10 卷（SITR-10）編審工作坊」

服務機關：農業部林業及自然保育署
姓名職稱：石芝菁簡任技正、王元均技正、
陳美音技正
派赴國家：日本
出國期間：**113** 年 **6** 月 **21** 日至 **6** 月 **26** 日
報告日期：**113** 年 **9** 月 **25** 日

摘要

本次係農業部林業及自然保育署受國際里山倡議夥伴關係網絡（IPSI）邀請，赴日本東京參加 IPSI「里山倡議主題彙編第 10 卷（SITR-10）編審工作坊」，此次彙編主題為「確保社會-生態-生產地景與海景的生態系連結度」，與我國推動國土生態綠網政策極為切合。林業保育署以「Connecting the dots: Enhancing connectivity within and across SEPLS through implementation of Taiwan Ecological Network in Hualien County」為題投稿獲選，受邀與會分享投稿內容及與各國代表交流。

林業保育署發表內容係本次主題彙編惟一以國家尺度進行整體國土空間規劃，並結合社會－生態－生產地景海景（SPELS）與韌性評估（RAWs）實地操作的案例。派赴人員介紹我國如何透過分析歷年生物多樣性資料、規劃整體國土保育藍圖（國土生態綠網藍圖），並以花蓮區域綠網為案例（海岸山脈北段淺山森林暨海岸濕地保育軸帶、秀姑巒溪溪流保育軸帶），建立以綠網為空間藍圖、透過社會-生態-生產地景與海景（SPELS）取徑、並以韌性評估（RAWs）為工具來增加生態系連結度的實踐。透過參與工作坊以及主題討論分享，除充分與各國交流外，各國與會人員亦紛紛希望借鏡臺灣執行經驗，有效提升我國保育政策成效之國際能見度。

關鍵字：國土生態綠網(Taiwan Ecological Network)、保育軸帶、海岸山脈、秀姑巒溪、韌性評估、里山倡議、國際里山倡議夥伴關係網絡（IPSI）

目錄

壹、出國目的

國際里山倡議夥伴關係網絡（IPSI）係聯合國大學高等研究所與日本環境省共同啟動國際倡議組織，以生產地景保全與活用為取徑，維護生態系統與生物多性樣，謀求人類與自然和諧共生，目前已有逾百個國際會員，其中並有超過 20 個包含本署在內的臺灣公部門與民間組織，是我國里山倡議發展最重要的國際夥伴組織。IPSI 定期出版「里山倡議主題彙編（Satoyama Initiative Thematic Review），彙集年度各國重要相關案例，是國際生物多樣性政策規劃及科學研究之重要參考文獻。

IPSI 里山倡議主題彙編第 10 卷（SITR-10）的主題為「確保社會-生態-生產地景與海景的生態系連結度」，正符合本署在行政院支持下，透過既有里山倡議及社區保育的基礎，自 107 年起推動的「國土生態保育綠色網絡建置計畫」。國土生態綠網目前已指認出 45 條區域保育軸帶，透過政府機關、學術單位及在地社區協力，共同推動生態系復育與連結。國土生態綠網計畫推動迄今成效卓著，是我國生物多樣性政策的重要成果，其全國尺度與在地落實程度在國際上十分罕見，亟需透過各種管道向國際發表，SITR-10 可作為國土生態綠網向國際露出之重要機會，援由本署（農業部林業及自然保育署）、本署花蓮分署及國立東華大學積極進行投稿，並經主辦單位 IPSI 通知入選，並邀請作者群參與里山倡議主題彙編第 10 卷（SITR-10）編審工作坊，進行投稿案例簡報說明、相互審視其他投稿稿件及議題交流討論等，為該刊物出版前之重要會議。

「里山倡議主題彙編」係國際重要組織之正式出版刊物，其發表內容將作為各國政策擬訂及研究之重要引用資訊，本次一共有 12 件投稿案例獲選，本署發表之國土生態綠網案例將極有助於我國將政策執行成果向國際揭露及促進國際合作交流，因此此次擇派本署負責國土生態綠網之石芝菁簡任技正、實際負責在地案例推動之花蓮分署王元均技正、陳美音技正與合作單位國立東華大學孫夏天（Paulina G. Karim）博士一同前往日本出席，除透過實地參與工作坊以及主題討論，充分與各國交流外，亦透過分享臺灣執行經驗，提升我國保育政策成效之國際能見度。

貳、出國人員名單及行程表

一、出國人員名單

1. 農業部林業及自然保育署石芝菁簡任技正
2. 農業部林業及自然保育署花蓮分署王元均技正
3. 農業部林業及自然保育署花蓮分署陳美音技正

二、行程表

日期	行程
6 月 21 日	臺北—日本東京
6 月 22 日	➢ 工作坊簡報討論與內容準備 ➢ 日本東京都心 OECM 參訪
6 月 23 日	➢ 會議開幕 ✓ 日本聯合國大學國際里山倡議夥伴關係網絡秘書處主任 Tsunao Watanabe（Director of IPSI Secretariat, Program Manager of UNU-IAS）與日本環境省生物多樣性策略辦公室主任 Wataru Suzuki（Director of Biodiversity Strategy Office, Ministry of the Environment, Japan）開場致詞 ✓ 與會單位介紹及交流 ✓ 工作坊議程說明 ➢ IPSI SITR-10 研究案例簡報 ✓ SITR10-01-Ghana：Giving Communities the right to the governance of their natural resources- A case of the Asunafo-Asutifi Landscape in the Ahafo Region of Ghana, West Africa ✓ SITR10-02-Taiwan-Wufeng：Towards the harmony with nature: The sustainable transformation of rice industry to protect the

		ecosystems services ✓ SITR10-03-Malaysia-MtKinabalu：Connecting Mt. Kinabalu and Crocker Range Parks for nature and culture ✓ SITR10-04-Thailand：Community forest: Potential link to maintain ecological connectivity at landscape level ✓ SITR10-05-Malaysia-Kinabatangan：Integrated Management of Natural Resources of Kinabatangan Landscapes, Sabah, Malaysia by Using the Platform of UNESCO's Man and Biosphere Reserve ➢ 分組討論：主題 1「概念」
6 月 24 日	➢	IPSI SITR-10 研究案例簡報 ✓ SITR10-06-Kenya：Enhancing ecological connectivity in Kaya forests landscape through Biocultural Heritage Territory （BCHT） management model ✓ SITR10-07-Taiwan-Hualien：Connecting the dots: Enhancing connectivity within and across SEPLS through implementation of Taiwan Ecological Network in Hualien County （SITR10-07 即為林業保育署發表案例） ✓ SITR10-08-Taiwan-Nanan：How home gardens maintain the ecological connectivity of SEPLS：A Case Study From Nan'an Community, Taiwan ✓ SITR10-09-Spain：Management in SEPLs to ensure high-quality connectivity for brown bear in the western Cantabrian Mountains （Northwestern Spain） ✓ SITR10-10-India：Green space and habitat connectivity in Peri-urban Delhi, India: spatio-temporal dynamics, drivers and implications ✓ SITR10-11-Colombia：The Significance of SEPL in Ecological Connectivity and Conservation of the Tropical Dry Forest: An Experience in the Dry Enclave of the Dagua River in Colombia ✓ SITR10-12-Taiwan-Penghu：Empowering Youth for ensuring

	ecological connectivity: Socio-ecological production seascapes（SEPLS） restoration through active participation in Penghu ➢ 分組討論：主題 2「方法」 ➢ 分組討論：主題 3「未來方向」 ➢ 交流分享：分享林業保育署四個 SEPLS 案例友善生產產品
6 月 25 日	➢ 分組討論：主題 3「未來方向」（續） ➢ 綜合討論及總結 ➢ 會議閉幕：說明後續工作及期程
6 月 26 日	日本東京—臺北

備註：6 月 23~25 日工作坊詳細議程，詳附件一。

參、工作坊會議內容

一、 會議開幕及工作坊說明

(一) 本次工作坊正式議程於 6 月 23 日開始，開幕首先由 IPSI 秘書處主任 Tsunao Watanabe 渡邊綱直（Director of IPSI Secretariat, Programme Manager of UNU-IAS）進行開場；並由日本政府支持 IPSI 的主要單位環境省生物多樣性策略辦公室主任 Wataru Suzuki 鈴木涉（Director of Biodiversity Strategy Office, Ministry of the Environment, Japan）代表日本環境省出席致詞。

(二) 日本環境省生物多樣性策略辦公室負責日本政府的國家生物多樣性策略與行動方案（NBSAP）、亦負責籌劃該國出席聯合國生物多樣性公約締約方大會，此項任務與我國由林業保育署負責之工作對等。因此開幕式後本署石芝菁簡任技正特別與 Wataru Suzuki 先生交流，初步了解日本正配合聯合國 2030 生物多樣性目標進行該國 NBSAP 之調整、並積極籌備參加即將於 10 月 21 日到 11 月 1 日於哥倫比亞卡利（Cali）舉辦的聯合國生物多樣性公約第 16 次締約方大會（CBD COP16）。Wataru Suzuki 先生為率團前往 CBD COP16 的主要日本政府談判代表之一，其知悉我國雖非締約方但亦將出席該會議，雙方並約定可於哥倫比亞 CBD COP16 進行更多交流討論。

圖1. 國際里山倡議夥伴關係網絡秘書處主任 Tsunao Watanabe 開幕致詞

圖2. 日本環境省生物多樣性辦公室主任 Wataru Suzuki 開幕致詞

圖3. 石芝菁簡任技正致贈日本環境省生物多樣性辦公室主任 Wataru Suzukiru 紀念品

圖4. 於會議期間和日本環境省生物多樣性辦公室主任 Wataru Suzuki 進行交流

(三) 工作坊說明：

1. 由於本次會議為密集討論之工作坊性質，因此會議安排逐一介紹各與會成員，其中來自臺灣一共有 4 案例，除本署與東華大學共同投稿之案例之外，另有本署花蓮分署支持慈心有機農業基金會推動的南安案例（SITR10-08）、由農村發展及水土保持署支持國立中興大學執行的臺中霧峰案例（SITR10-02）、澎湖案例（SITR10-12）等。其餘投稿案例分別來自非洲（迦納、肯亞）、亞洲（印度、泰國、馬來西亞）、南美洲（哥倫比亞）、歐洲（西班牙）等。
2. 本次工作坊由主辦單位事先依據各投稿案例主題內容，安排專家審查與投稿案例互審（每一組投稿者審視其他 2 件投稿案例），以確保彙編案例之品質。主辦方基於本次 SITR 主題為『Ensuring ecological connectivity in socio-ecological production landscapes and seascapes（SEPLS）』，事先提出 5 個問題供審閱者及投稿者參考：

(1) 透過經營管理 SEPLS 會有那些效益產生？以及這些效益如回饋及增進生態連結度？（What are the multiple benefits derived through

SEPLS management? And how have these benefits helped ensure and enhance aspects of ecological connectivity?）

(2) 透過經營管理 SEPLS 獲得的生態連結度效益時，會產生需要權衡取捨的面向是甚麼？在這之中誰會獲益？誰會受損？（Are there any trade-offs and synergies among efforts to attain quality ecological connectivity in managing SEPLS? If so, what are they, and who has been losing or winning? ）

(3) 案例中的生態連結度如何測量？以及如何評估所產生的生態功能增益？並透過經營管理 SEPLS 來說明案例相關的權衡取捨及共同協作。（How can you measure ecological connectivity, assess its ecological functions and benefits, and examine related trade-offs and synergies through managing SEPLS?）

(4) 案例所在的區域中，如何透過經營管理 SEPLS 協助空間藍圖規劃的生態連結度，以及促使該區域的經營管理可以更有效益，更永續，更公平？（How has the SEPLS management in your area helped in operationalizing ecological connectivity in spatial planning and management and making the processes more effective, sustainable, and equitable?）

(5) 在地以及傳統知識、文化多樣性等是否能增進生態連結度對於社會以及經濟上的產出？如果可以，如何增進？（Has local and traditional knowledge and cultural diversity helped to ensure and enhance the quality of ecological connectivity for socially and ecologically sound outcomes? If so, how?）

3. 工作坊由各分享案例先進行 18 分鐘簡報，之後 12 分鐘進行提問與回答，除事先安排的審稿者外並開放現場其他投稿作者針對簡報內容提問以及交流。

4. 本次工作坊另安排安插於案例簡報之間的 3 個主題討論，透過分組討論讓各投稿者交流討論，逐漸將發散於各投稿案例內之經驗與回饋聚焦在本次工作坊主題上，使本次主題彙編得以順利付梓。相關內容詳如後第三點「工作坊主題討論」。

圖5. 石芝菁簡任技正介紹林業保育署團隊

圖6. 本次出席工作坊的 4 個臺灣案例成員

圖7. 各國與會人員合影

二、 林業保育署案例簡報說明（**Connecting the dots: Enhancing connectivity within and across SEPLS through implementation of Taiwan Ecological Network in Hualien County**）

(一) 林業保育署之案例簡報由本署石芝菁簡任技正、花蓮分署王元均技正與國立東華大學孫夏天 （Paulina G. Karim）博士共同負責。（本篇文章共同發表人包括：農業部林業及自然資源保育署林華慶署長、羅尤娟組長、石芝菁簡任技正、陳佳慈專員；花蓮分署黃群策分署長、王元均技正、陳美音技正；國立東華大學李光中教授、孫夏天博士）

(二) 簡報內容摘要說明：（完整簡報內容詳附件二）

1. 由本署石芝菁簡任技正介紹臺灣生態環境概況與林業及自然保育署自107 年起推動「國土生態保育綠色網絡建置計畫」之背景。以國家整體政策尺度，運用生物多樣性基礎資料進行空間規劃，並透過跨部門整合與合作，有系統進行國土復育與重要棲地串聯，其中藍圖建置以

及里山倡議為本次工作坊分享論述的重點。

2. 由本署花蓮分署王元均技正介紹花蓮區域綠網藍圖規劃，並聚焦海岸山脈北段淺山森林暨海岸濕地保育軸帶和秀姑巒溪溪流保育軸帶劃設目的，說明本次分享 4 個 SEPLS 案例位置、保育標的，以及國土生態綠網如何結合里山倡議等相關工作。
3. 由東華大學孫夏天博士說明臺灣推動里山倡議韌性社區評估 RAWs 如何運用國土生態綠網空間規劃藍圖與本身發展之韌性評估工具、適應性調整結合並串聯生態系連結，以具有邏輯性且清晰的方式將花蓮在地示範案例分享給各國與會人員。

(三) 審查與回饋意見概述：

本次除由其他兩組作者提供審查意見之外，另有兩位編審者提供建議。綜合審查意見肯定本署投稿文章符合本次主題，且文章內容條理清晰地論述如何透過 RAWs、SPELS 以及國土綠網的藍圖規劃，一步步建構生態系連結之方法學（Tools-Approach-Strategy framework）。而審查者也提出修改意見供本署團隊後續修正投稿文章參考，例如應留意外來入侵種與生態連接性的關係，如何避免因提升生態棲地連結後造成外來物種入侵的負面影響；以及強化在地意見領袖（local champion）對於計畫推動的重要性。同時也因為本署案例是國際上少見由政府主動提出的大型國家級計畫所產出，各審查者建議本署案例可以多加論述政府機關應扮演的角色以及重要性，例如如何由整體規劃到全國各地的在地實踐，作為各國相關發展參考。詳細提問及評論意見如附件三。另外，本署團隊並負責提出西班牙（SITR10-09）與馬來西亞（SITR10-03）案例的審查意見。

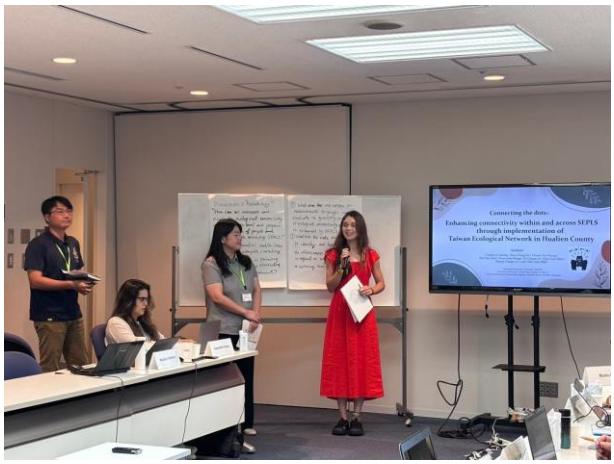


圖8. 本署案例由本署、花蓮分署與東華大學合作進行簡報

圖9. 石芝菁簡任技正報告國土生態綠網重點工作

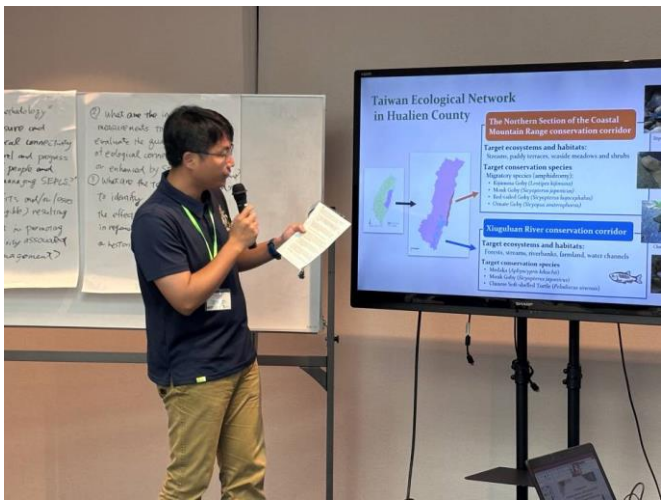


圖10.　　王元均技正介紹海岸山脈北段及秀姑巒溪保育軸帶

圖11.　義大利專家（Dr. Guado Gualandi）提供本署案例編審意見

圖12.　石芝菁簡任技正提供西班牙案例（SITR10-09）審查意見

圖13.　石芝菁簡任技正提供西班牙案例（SITR10-09）審查意見

三、 工作坊主題討論

(一) 主題一：概念（Concept）

1. 主題說明：為了增進生態系連接所需的 SEPLS 裡的元素型式及程度（What is connected in SEPLS informs the type and degree of the effort required to ensure connectivity）; 這些元素如何連結在一起？（How they are connected）; 在社會生態生產地景和海景（SEPLS）背景下的生態連結的元素獨特性，以及需加強處理的範疇。（Unique aspects of connectivity in the context of SEPLS and areas to strengthen and address）

2. 討論摘要紀錄：

(1) 元素可區分為可見/有形的（Tangible elements），包括非人類物種，例如動物、真菌、植物等，討論過程提出泰國案例的大象、豹等物種需要投入大量保育成本來促使這些關鍵物種得以長期存活。而有形元素還包含棲地環境、水域、濱水植物帶、海岸等，以及人類以及所帶來的活動。另一類為不可見/無形的（Intangible elements），諸如文化、知識和行為，比如整合現代科學與傳統文化知識（TEK）對於經營管理 SEPLS 是非常重要，而傳統知識長保存在不同在地語言裡，也因此語言多樣性是很重要的一環。本署也提出花蓮案例中日本禿頭鯊（Hala）具有的社會-文化-生態重要性，透過在地部落語言中對於 Hala 的描述所賦予的生態特性，透過傳統的土地耕作永續利用方式，呈現可同時達到生態、生活、生產上的裡山地景的願景。同時也提出國土綠網計畫中透過保存在地部落傳統生活方式，結合溪流、濱水植物帶等生態棲地串連，強化生態系服務以及提升生物多樣性。

(2) 討論這些關鍵元素之間的連結類型可能會產生正面影響（例如，從生態系統服務中衍生出的「供應服務」—食物、乾淨的水和藥

物；「調節服務」—氣候調節、授粉和溫度調節；「文化服務」—原住民儀式、靈性實踐、傳統藝術、生態旅遊、以土地為本的教育；「支持服務」—土壤肥力和生態系統的韌性），以及負面影響（例如，洪水、乾旱、疾病對自然和人類的危害、不平等），尤其在連結中斷的情況下。這些連結受到直接驅動因素（例如土地使用、入侵外來物種的引入、氣候變遷、污染）和間接驅動因素（例如市場需求、人口壓力、政治體制、衝突和戰爭）的影響。關鍵是檢視干擾發生的地點，並識別「斷點」（例如，物種消失等），並與之前的狀況進行比較。類似的方法已被用於克服臺灣的水資源短缺問題。我們也討論到垂直與水平的連結性（例如，考慮「水流」，它具有三個維度：上游與下游的連結，水域與土地區域之間的連結，地下水與地表水的垂直連結性。因此，檢視「水流」的不同維度至關重要。例如，如果水被污染，它會散布化學物質，可能導致土壤、淡水和沿海棲地生物多樣性的侵蝕。最後，在文化人類學層次上的連結度也不可被忽視。例如，人們如何意識到棲地在長期期間發生的動態變化，對於理解生態連結性至關重要。長期與資源密切接觸的當地社區（擁有不同文化、實踐、習慣和風俗）能夠更加理解 SEPLS 的時空變化，並可能提供具體場域的共同管理/保育策略。

(3) 討論中本署團隊也提出在臺灣花蓮的新社 SEPLS 中，當地居民觀察到本地洄游性魚類的數量減少，甚至消失。這是由於 1990 年代在大不岸/加塱溪流域設置了 171 座橫向構造物，阻礙了魚類的遷徙路徑所導致的結果。透過結合原住民與當地知識（ILK）以及傳統水資源管理，再加本署與關係權益者協商過程與跨部門的合作，最終拆除了 9 座下游攔河堰，其中包括位於河口的最大一座。至今，對洄游性魚類族群的短期生態監測顯示其數量有大幅增

長。獨特蝦類的回歸，讓當地居民感到自豪與認同。洄游性魚類作為地景-海景生態連結的指標，也被引入新社國小的在地課程中。

(4) 而針對生態連結元素的獨特性，以及如何強化的範疇討論中，本署團隊提出新社地景海景連結案例，說明 1990 年代至 2000 年代，傳統水稻種植使用化學肥料和農藥的耕作方式，導致生產地景海景中的珊瑚礁白化以及沿海區域海洋生物的消失。這一觀察是由當地原住民漁民和農民提出，促使了新社社區積極推動有機耕作和生態農業的發展。而這也成為建立新社倡議（Xinshe Initiative）整合地景與海景取徑（ILSA）的濫觴。

(二) 主題二：方法（Methodology）

1. 主題說明：從 SEPLS 觀點出發，指出在衡量生態連結性時有幾個關鍵點。首先，我們需要了解我們要衡量的是哪種類型的連結性，才能確定適當的指標和工具。一般來說，連結性是指物種、物質和資訊的流動。我們需要了解這些流動的過程、流動中斷的情況，及其價值，才能進一步理解阻隔性或破碎化所造成的影響。透過主題討論，來指認出可以用來衡量生態連結性和生態連結性倡議影響的益處和不利影響的方法，以及在 SEPLS 背景下，研擬用來確保、增強或恢復生態連結性的方針和策略。

2. 討論摘要：

(1) 透過分組討論指認出需要測量與評估的正面效益以及負面影響範疇，包括增進生態系服務的效益、社會經濟層面的效益、環境效益等，且討論過程中必須思考到生態連結是多維的，結合不同元素所帶來連鎖效應（例如，水污染影響魚類生存 + 人類健康 + 養分循環）等。而結合主題一提到的有形與無形的益處：最具體

的益處是棲地和生態連結性，而無形的益處包括人類與環境的連結、傳統知識、對於促進生態連結的自豪感、相互理解以及知識共創等。

(2) 指認出效益影響的範疇後，緊接著是如何找出監測的指標。指標不容易是單一性，而是必須運用綜合性的方式，採用可量化（族群數量、空間範圍、頻率、密度）或質性描述（人類認知、多方協力合作）等。比如生態系結構、物種族群量、密度、物種移動方式等。

(3) 在地居民、社區參與的部分，我們也討論到有成員提出人類對在地物種的認知與傳統知識有其重要性，比如人類的出現應被視為生態連結性的一個指標，因為人類行為往往是生態連結性的關鍵。例如，肯亞的案例顯示，猴子在有人活動的地方不會受到豹的攻擊，但當保護區建立後，因為沒有人的存在，猴子全部離開了保護區域。但本署團隊認為這個論述需要更加謹慎，以免造成觀念上混淆。另外，居民與社區參與公共決策上，也必須透過有效的對話方式進行溝通，本署團隊分享的花蓮平臺機制可以提供很好的案例。

(4) 針對可以運用哪些工具來實踐，從以科技為基礎出發的工具，比如紅外線攝影機、GPS 定位、GIS 工具等進行討論。而多元性工具比如本署與東華大學團隊提出的韌性評估工作坊（RAWs）具有 20 個評估指標，具有作為社區基礎工具監測 SEPLS 中生態連結性的高度潛力；也有成員提出公眾參與式地理資訊系統 Public Participation Geographic Information System （PPGIS）可以做為理想的工具。本署團隊也提出生態服務給付 PES 以及公眾參與及環境教育 Communication , education, and public awareness （CEPA）等推動政策經驗給與會成員參考。討論過程中，各成員一致認同

能力建構與知識轉移發展可以支持長期監測（例如，培訓當地社區進行以社區為基礎的生物多樣性監測和本地環境巡護），認為科學-政策-社區夥伴關係是可持續發展的未來，強烈建議各成員應加強能力建構、跨場域學習和知識交流等。

(三) 主題三：未來方向（Ways forward）

1. 主題說明：在 SPELS 經營管理下建立的生態系連結，其後的成效維持與延續是本主題討論的重點。維持、增強或恢復生態連結性的努力主要投入在土地/海洋使用的變化（例如，保留部分農田作為生態廊道）或實踐管理的改變（例如，推動有機農業）。考慮到 SEPLS 是複雜的社會生態系統，這些投入不可避免地會面臨產生意外後果的風險，例如植被增加可能導致入侵物種的擴散，或生態廊道的建立可能引發人類與野生動物之間的衝突等。此外，建立某些生態連結也可能在不同空間和時間尺度上引起不同利益相關者之間的矛盾結果。

2. 討論摘要：

(1) 在本主題討論時，本署團隊發現部分案例對於生態連結度的定義過於狹隘，認為建立動物通道即屬於生態連結，甚至主張 SEPLS 本身就是生態廊道，具有生態連結性。因而本署團隊主張生態廊道不等同 SEPLS，SEPLS 是一種社會生態生產地景海景取徑，建構出具有生物多樣性價值的里山里海，其中人為的活動是重要元素之一。

(2) 討論中亦提到以地區（place-based）為基礎十分重要，在選擇對保育重要的物種和棲息地/區域時，應與關係權益方，特別是在地參與者（例如，以此為生計的農民）進行協商。當尋求管理層面的解決方案時，地域上的問題（例如生態問題）可以轉化為機會（例如生態旅遊的發展）。 而土地權屬（例如，公共土地與私人

土地）和土地管理（例如，人們對某些做法的承諾）需要受到關注，讓在地參與者能夠有效地參與推動並感受到歸屬感。而邊界是重要因素之一，應根據可管理性/可行性和該地區的代表性來設定適當的邊界—相對完整的生態循環在此處展現，而邊界外的因素可能會影響邊界內的保育成效現象。因此隨著時間的推移，邊界可能需要調整以反映生態連結的需求（例如，物種的遷移）。

(3) 在多元關係權益方的討論中，不論在分享與生態連結直接或間接相關的不同觀點、知識和實踐（例如管理活動），不同權益方之間的協作是必要的。本署團隊也提出臺灣經驗，指出政府各部門間對於實現無縫的溝通和有效的協作有其重要性，例如可以透過國土生態綠網（TEN）計畫，讓相關政府機構與其他關係權益方進行土地和海洋的跨部門合作，來達成地景-海景交界區海洋資源的有效保護管理。

(4) 本署團隊在討論中提出整合適應性經營管理的原則，我們指出 SPELS 經營管理以及空間規劃藍圖是雙向的，不論是將 SPELS 經營管理目標調整融入以生物多樣性保育為標的的空間規劃；或者是為生物多樣性保育做出的空間藍圖規劃結合 SPELS 的經營管理目標，都是具有高度價值的。

(5) 最後，討論中對於夥伴關係的建立與陪伴，都有高度認同。公私協力是未來不可避免的發展趨勢，而年輕世代能否被賦權，對於未來這些保育議題也具有一定程度的重要性。而且未來企業應該扮演的角色會越發重要，不論是推動 TNFD、ESG、SDGs 等國際趨勢的參與。

圖14.　派赴人員積極參與主題討論

圖15.　王元均技正於主題討論發表意見

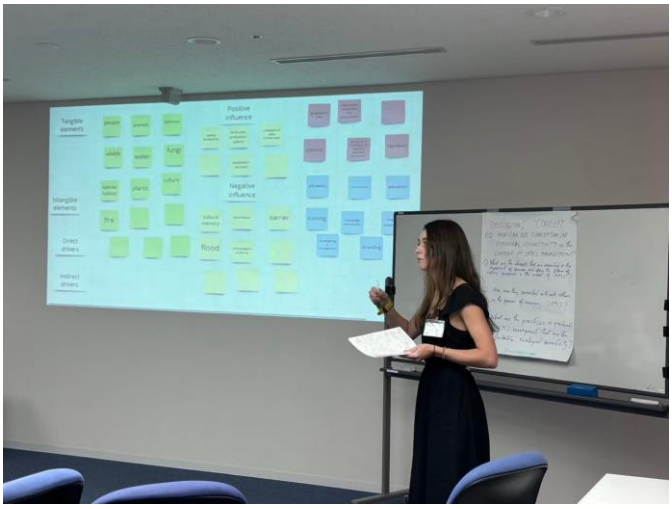


圖16.　國立東華大學孫夏天博士於主題討論中進行分享

四、 其他投稿案例

(一) 本次彙編工作坊中，除本署提出案例之外，臺灣另有慈心團隊提出的花蓮南安案例，本署也於交流討論中特別強調，該案例所在位置亦為國土生態綠網計畫中秀姑巒溪溪流保育軸帶範圍內之重要節點，而慈心團隊的輔導可以強化里山地區生產地景（農田）與渠道間的連結，並以菊池氏細鯽為重要指標物種；由國立中興大學執行的霧峰案例則是提出友善生產田區如何利用猛禽棲架來達成停用農藥，除維持稻米產量之外，亦維持該地區的生物多樣性；另一澎湖案例則探討傳統漁法對生物多樣性的維護，以及年輕世代賦權對於傳統文化保存的必要性。

(二) 其他國家案例皆為非政府單位所推動執行，例如由 NGO、民間基金會或企業推動等，也因此各國夥伴成員對於我國政府有整體計畫、有系統的投入社會生態生產地景的生物多樣性保育策略感到十分驚艷和肯定。

(三) 在其他各國案例中，較有大尺度生態連結規模的是來自西班牙、以棕熊為指標物種的棲地連結案例，此案例透過地理資訊系統分析累積長達 20 多年資料的棕熊族群分布以及移動資料，預測族群可能擴散的方向，進行棲地營造（包含種植棕熊的食物），透過此種方式來連結棲地，讓原本被隔離的 2 個主要棕熊族群得以有機會進行基因交流。討論中本署團隊提出棲地改造後可能對當地人熊衝突提升的問題，也分享臺灣推動臺灣黑熊人熊衝突的解決方案與經驗。

五、 展示林業保育署四個案例友善生產產品

本次工作坊現場由本署花蓮分署提供 4 個 SEPLS 案例產出之生態友善產品給與會夥伴，具體展示這些在地部落與社區在里山倡議推動下的生產產品，強化論述本署案例實質提升在地居民收益：另外也展示本署臺中分署與觀樹基金會及義美食品合作，輔導林農種植具經濟效益的原生種土肉桂，所開發的「土肉桂夾心酥」產品，供與會者了解我國多元森林經營並與企業合作的成果。透過現場分享友善生產

產品進行交流，加強國際夥伴對於本署成果之正面印象，提升相關政策國際知名度。

圖17.　展示本署四個案例友善生產產品（鱉溪米、復興部落清甜菊花茶、港口部落蔥餅乾、羅山有機咖啡豆）

圖18.　展示本署臺中分署與觀樹基金會及義美食品合作開發的「土肉桂夾心酥」

六、 會議簡報準備與東京都心 OECM 參訪

(一) 本次會議於正式工作坊議程開始前一日抵達東京，以充分依主辦單位最新提供之審查意見進行工作坊簡報準備，6 月 22 日當日所有派赴人員即密集就簡報分工、簡報逐頁內容文稿、編審意見回應與對其他案例的編審意見進行討論與修改，充分準備簡報內容以呈現本署案例成果。

圖19. 抵達東京首日密集進行工作坊準備與發表簡報討論（日間）

圖20. 抵達東京首日密集進行工作坊準備與發表簡報討論（夜間）

(二) 本次會議地點為位於東京原宿青山之聯合國大學總部，該地點位於東京都會中心，派赴人員利用會議空檔就近前往參訪位於表參道之都會綠帶規劃。東京都鼓勵建物大樓參與都市綠帶，如日本東急集團位於表參道的多棟大樓即設計有空中花園，且利用設置動物棲息設施與定期生態監測，強化這些綠美化設施的生物多樣性與生態系服務效益，東京都整合都會公園、建物綠地、空中花園等的綠帶規劃，亦為展現都市藍綠帶效益的 OECM 潛力點。其中東急集團位於表參道一處百貨大樓內的特展，更進一步展示該企業集團自然維護與生物多樣性的整體規劃與成果，包含建物綠化協助都市綠帶設置、生物多樣性定期監測與永續森林木材的使用等，其展示空間的所有家具亦均使用日本當地經營森林間伐所生產之木材。

圖21. 東京都心(表參道)許多大樓建物設有空中花園等綠地

圖22.　東京都心(表參道)建物空中花園設有供動物棲息裝置，增加生物多樣性價值

圖23.　東急集團在其旗下大樓展示集團投入自然維護與生物多樣性規劃與成果

圖24.　東急集團在其旗下大樓展示集團投入自然維護與生物多樣性規劃與成果

圖25.　東急集團自然維護與生物多樣性規劃包含建物綠化、生物多樣性監測與永續森林木材的使用

圖26.　東京都結合都會公園、建物空中花園等綠地的都市綠帶是 OECM 潛力點

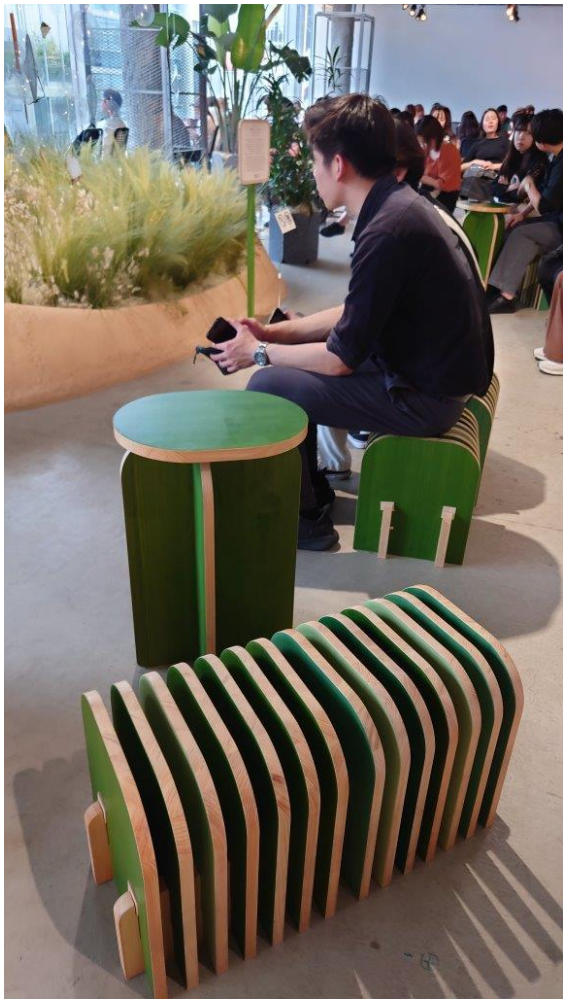


圖27.　東急集團生物多樣性展示區域的家具均使用日本當地經營森林間伐所生產之木材

圖28.　東急集團生物多樣性展示區域的家具均使用日本當地經營森林間伐所生產之木材(間伐材標示)

肆、心得與建議

一、 **強化與友好國際組織合作，擴大國際露出之連結綜效：**臺灣常因政治因素國際發展與國際交流受限，但可積極運用如國際里山倡議夥伴關係網絡（IPSI）這類與臺灣較為友好的國際組織，建立良好合作關係，藉由其連結更為重要的國際場合。我國積極參與 IPSI，以今年為例，即已促成 IPSI 與全球環境策略研究所(Institute for Global Environmental Strategies，IGES)邀請本署林華慶署長參

與 2024 亞太永續國際論壇里山倡議線上研討會(ISAP 2024 Satoyama webinar)，以本署全銜與署長正式職銜於該國際會議進行專題演講。另外 IPSI 亦已正式邀請臺灣於其 10 月在聯合國生物多樣性公約第十六次締約方大會(CBD COP16)所主辦的周邊會議中進行發表。

二、 **積極發展國土生態綠網、里山倡議等生物多樣性重要政策，作為國際交流基礎**：此次縱觀整場工作坊各國案例內容，多以個案研究或小規模推動經驗為主，本署發表由國土生態綠色網絡建置計畫建立空間藍圖，結合里山倡議及在地社區韌性評估等多元政策，呈現國家尺度、在地實踐的「以綠網為藍圖-SPELS 為取徑-RAWs 為工具」方法架構與實質推動成果。足見臺灣生物多樣性空間規畫與在地社區發展之整體政策在世界各國中已屬先進，應持續推動，相關成果即可做為國際交流與臺灣經驗分享的極佳基礎。

三、 **培養具在地社區實踐經驗之公務同仁進行國際交流，有效呈現實質推動成果**：近年國際上與聯合國生物多樣性約益發重視在地社區與原住民族角色，且越在地、越國際。各項國際交流與經驗分享，除了上位政策擬定的呈現外，在地實踐推動的成果更為重要。因此建議應積極培養在地執行政策同仁的國際交流經驗，除建立同仁國際觀外，更能呈現政策推動的在地實質成果。此次本署由總署政策規劃人員、搭配花蓮分署在地執行同仁合作進行發表，即發揮極佳效果，亦更能理解國內政策業務的國際價值。

附件一、6 月 23~25 日工作坊議程

Concept Note & Workshop Programme

IPSI Case Study Workshop 2024

Ensuring ecological connectivity in socio-ecological production landscapes and seascapes（SEPLS）

Dates:	23 - 25 June 2024
Venue:	United Nations University Headquarters Committee Rooms 2 and 3 （5th Floor） 5–53–70 Jingumae Shibuya-ku, Tokyo 150-8925, Japan
Organizer:	IPSI Secretariat / United Nations University Institute for the Advanced Study of Sustainability （UNU-IAS）
Supported by:	Ministry of the Environment, Japan

Background

The *Satoyama Initiative Thematic Review* is a publication series that compiles case studies providing knowledge and lessons related to socio-ecological production landscapes and seascapes（SEPLS）. It collects experiences and relevant insights, especially from practitioners working at the local level, to provide concrete, practical knowledge and policy recommendations. The series is produced by the Secretariat for the International Partnership for the Satoyama Initiative （IPSI）with contributions from IPSI member organisations.

The theme for volume 10 of the *Satoyama Initiative Thematic Review* is **"Ensuring ecological connectivity in socio-ecological production landscapes and seascapes （SEPLS） "**. Recognizing that landscape approaches practiced in the management of SEPLS enable a process to optimize the spatial patterns of natural and socio-economic elements on a landscape or seascape scale and enhance social social-ecological integrity, this volume will look at the strategies and approaches by which multiple stakeholders collaboratively minimize trade-offs, maximize synergies and enhance quality ecological connectivity to achieve more effective, sustainable, and equitable processes of spatial planning and management. In particular, the volume is expected to offer useful knowledge and information for the projected methodological assessment of integrated biodiversity-inclusive spatial planning and ecological connectivity （the so-called "ecological connectivity assessment"）for the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services （IPBES）. It is also intended to feed into the implementation of the new IPSI Strategy and Plan of Action for 2023-2030, particularly one of its five strategic objectives, namely "Area-Based Conservation Measures".

Objective:

The IPSI Case Study Workshop 2024 will be an important part of the process to develop the publication *Satoyama Initiative Thematic Review Volume 10*. It will engage the authors with the

purpose of sharing their case studies and providing feedback to further improve each manuscript. Each author is reviewing two other papers and will share their comments in writing prior to the workshop. During presentation sessions, all of the participating authors will be requested to share their feedback with a group to interactively discuss comments and suggestions （the names of the reviewers for each paper are also indicated in the programme）. The workshop also aims to deepen discussion on the theme, with the results to be reflected in a synthesis paper that will be included in the publication.

Expected Output:

Satoyama Initiative Thematic Review Volume 10

Presentation Contents:

The earlier part of Days 1 and 2 at the workshop will be devoted to a series of presentations in which each author will share their manuscript contents with all participants. Each presentation section will include （i） a 12-minute presentation by the author, （ii） comments from the two authors assigned for peer-review（maximum 5 minutes for each）, and（iii）Q&A and discussion （8 minutes）. Due to time constraints, speakers are asked to focus on the following five topics in their presentations:

1. What are the multiple benefits derived through SEPLS management? And how have these benefits helped ensure and enhance aspects of ecological connectivity?
2. Are there any trade-offs and synergies among efforts to attain quality ecological connectivity in managing SEPLS? If so, what are they, and who has been losing or winning?
3. How can you measure ecological connectivity, assess its ecological functions and benefits, and examine related trade-offs and synergies through managing SEPLS?
4. How has the SEPLS management in your area helped in operationalizing ecological connectivity in spatial planning and management and making the processes more effective, sustainable, and equitable?
5. Has local and traditional knowledge and cultural diversity helped to ensure and enhance the quality of ecological connectivity for socially and ecologically sound outcomes? If so, how?

Key Questions:

The following questions will be discussed among the participants at each discussion session.

- **Question 1**: How can we conceptualize ecological connectivity in the context of SEPLS management?
- **Question 2**: How can we measure and evaluate ecological connectivity and monitor its level and progress for the benefits of people and nature through managing SEPLS?
- **Question 3**: How can we address the challenges and seize the opportunities for ensuring and enhancing ecological connectivity in managing SEPLS for biodiversity, ecosystems and human wellbeing?
- The outputs of the discussions may include:
  - Conceptualization of ecological connectivity in the context of SEPLS management;
  - Multiple benefits derived through SEPLS management, which have directly or indirectly contributed to ensuring and enhancing ecological connectivity;
  - Methodology of measuring, evaluating, and monitoring ecological connectivity to be ensured through managing SEPLS and assessing the SEPLS management in regard to ecological connectivity;
  - Challenges and opportunities for SEPLS management in ensuring and enhancing ecological connectivity for socially and ecologically sound outcomes;

- Applicability of local and traditional knowledge and cultural diversity in ensuring and enhancing ecological connectivity through the SEPLS management; and
- Political and practical implications for multiple levels （e.g., in consideration of equity, participation, empowerment, decision-making, and actions）.

Programme:
Day 1: Sunday, 23 June 2024

9:30-9:55	**Onsite registration (1st Floor Reception Area of UNU Headquarters Building)**
Opening Session (Committee Room 2 (CR2))	
10:00-10:03 (2-3 min.)	**Opening Remarks** Tsunao Watanabe (Director of IPSI Secretariat, Programme Manager of UNU-IAS)
10:03-10:06 (2-3 min.)	**Welcoming Remarks** Wataru Suzuki (Director, Biodiversity Strategy Office, Ministry of the Environment, Japan)
10:06-10:20 (13-15 min.)	**Self-Introduction**
10:20-10:40 (20 min.)	**Introductory Presentation** UNU-IAS (15 min.) Q&A (5 min.)
10:40-10:45 (5 min.)	**Group Photo**
10:45-11:00 (15 min.)	BREAK (Committee Room 3 (CR3))
Presentation Session 1 (CR2) (12 min. presentation + 18 min. comments and Q&A)	
11:00-11:30 (30 min.)	**PRESENTATION 1** (SITR10-01-Ghana) **"Giving Communities the right to the governance of their natural resources- A case of the Asunafo-Asutifi Landscape in the Ahafo Region of Ghana, West Africa"** Vincent Awotwe-Pratt (Advocates for Biodiversity Conservation) *Comment A: Ms. Gladys Chepkoech Rutto (SITR10-06-Kenya)* *Comment B: Prof. Chen-Fa Wu (SITR10-02-Taiwan-Wufeng)*
11:30-12:00 (30 min.)	**PRESENTATION 2** (SITR10-02-Taiwan-Wufeng) **"Towards the harmony with nature: The sustainable transformation of rice industry to protect the ecosystems services"** Chen-Fa Wu (Taiwan Landscape Environment Association) *Comment A: Dr. Jeeranuch Sakkhamduang (SITR10-04-Thailand)* *Comment B: Mr. Vincent Awotwe-Pratt (SITR10-01-Ghana)*
12:00-12:30 (30 min.)	**PRESENTATION 3** (SITR10-03-Malaysia-MtKinabalu) **"Connecting Mt. Kinabalu and Crocker Range Parks for nature and culture"** Hamilda Francisca Majit (Sabah Parks) Yoji Natori (Akita International University) *Comment A: Mr. Yuan-Jyun Wang, Dr. Paulina G. Karim, Ms. Mei-Yin Chen, Dr. Chih-Chin Shih (SITR10-07-Taiwan-Hualien)* *Comment B: Dr. Somajita Paul (SITR10-10-India)*
12:30-13:30 (60 min.)	LUNCH (CR3)

13:30-14:00 (30 min.)	**PRESENTATION 4** (SITR10-04-Thailand) **"Community forest: Potential link to maintain ecological connectivity at landscape level"** Jeeranuch Sakkhamduang (Thailand Environment Institute) *Comment A: Prof. Chen-Fa Wu (SITR10-02-Taiwan-Wufeng)* *Comment B: Ms. Gladys Chepkoech Rutto (SITR10-06-Kenya)*
14:00-14:30 (30 min.)	**PRESENTATION 5** (SITR10-05-Malaysia-Kinabatangan) **"Integrated Management of Natural Resources of Kinabatangan Landscapes, Sabah, Malaysia by Using the Platform of UNESCO's Man and Biosphere Reserve"** Gerald Jetony (Sabah Biodiversity Centre/Natural Resources Office) *Comment A: Ms. Alice Jing-Juan Hsu, Dr. Yu-Chun Chan (SITR10-08-Taiwan-Nanan)* *Comment B: Dr. Szu-Hung Chen (SITR10-12-Taiwan-Penghu)*
14:30-14:45 (15 min.)	BREAK (CR3)
Discussion Session 1 "Concept" (CR2 & CR3)	
14:45-14:55 (10 min.)	**Introduction to Theme 1 (CR2)**
14:55-17:05 (130 min.)	**Group Discussion on "Concept" (CR2 & CR3)**
17:05-17:30 (25 min.)	**Wrap-up and Announcement (CR2)**
	Walk to Group Dinner venue
18:15-20:15	Group Dinner

Day 2: Monday, 24 June

9:15-9:25	**Registration (please go up the escalator to the 2nd Floor)**
Opening of Day 2 (CR2)	
9:30-9:35 (5 min.)	**Introduction to Today's Schedule**
Presentation Session 2 (CR2) (12 min. presentation + 18 min. comments and Q&A)	
9:35-10:05	**PRESENTATION 6** (SITR10-06-Kenya) **"Enhancing ecological connectivity in Kaya forests landscape through Biocultural Heritage Territory (BCHT) management model"** Gladys Chepkoech Rutto (Kenya Forestry Research Institute) *Comment A: Mr. Vincent Awotwe-Pratt (SITR10-01-Ghana)* *Comment B: Dr. Jeeranuch Sakkhamduang (SITR10-04-Thailand)*

10:05-10:35 (30 min.)	**PRESENTATION 7** (SITR10-07-Taiwan-Hualien) **"Connecting the dots: Enhancing connectivity within and across SEPLS through implementation of Taiwan Ecological Network in Hualien County"** Yuan-Jyun Wang (Forestry and Nature Conservation Agency, Hualien Branch (FANCA-Hualien)) Paulina G. Karim (National Dong Hwa University) Mei-Yin Chen (FANCA-Hualien) Chih-Chin Shih (Forestry and Nature Conservation Agency (FANCA)) *Comment A: Ms. Hamilda Francisca Majit/Prof. Yoji Natori (SITR10-03-Malaysia-MtKinabalu)* *Comment B: Dr. Emilio Rafael Díaz-Varela (SITR10-09-Spain)*
10:35-11:05 (30 min.)	**PRESENTATION 8** (SITR10-08-Taiwan-Nanan) **"How home gardens maintain the ecological connectivity of SEPLS : A Case Study From Nan'an Community, Taiwan"** Alice Jing-Juan Hsu (Tse-Xin Organic Agriculture Foundation) Yu-Chun Chan (Tse-Xin Organic Agriculture Foundation) *Comment A: Dr. Gerald Jetony (SITR10-05-Malaysia-Kinabatangan)* *Comment B: Dr. Daniel Osorio Dominguez, Dr. Leonor Valenzuela (SITR10-11-Colombia)*
11:05-11:30 (25 min.)	BREAK (CR3)
11:30-12:00 (30 min.)	**PRESENTATION 9** (SITR10-09-Spain) **"Management in SEPLs to ensure high-quality connectivity for brown bear in the western Cantabrian Mountains (Northwestern Spain)"** Emilio Rafael Díaz-Varela (University of Santiago de Compostela, Higher Polytechnic School (EPS) of Engineering) *Comment A: Dr. Daniel Osorio Dominguez, Dr. Leonor Valenzuela (SITR10-11-Colombia)* *Comment B: Mr. Yuan-Jyun Wang, Dr. Paulina G. Karim, Ms. Mei-Yin Chen, Dr. Chih-Chin Shih (SITR10-07-Taiwan-Hualien)*
12:00-12:30 (30 min.)	**PRESENTATION 10** (SITR10-10-India) **"Green space and habitat connectivity in Peri-urban Delhi, India: spatio-temporal dynamics, drivers and implications"** Somajita Paul (Jawaharlal Nehru University) *Comment A: Dr. Szu-Hung Chen (SITR10-12-Taiwan-Penghu)* *Comment B: Ms. Hamilda Francisca Majit/Prof. Yoji Natori (SITR10-03-Malaysia-MtKinabalu)*
12:30-13:30 (60 min.)	LUNCH (CR3)
Presentation Session 3 (CR2) (12 min. presentation + 18 min. comments and Q&A)	
13:30-14:00 (30 min.)	**PRESENTATION 11** (SITR10-11-Colombia) **"The Significance of SEPL in Ecological Connectivity and Conservation of the Tropical Dry Forest: An Experience in the Dry Enclave of the Dagua River in Colombia"** Daniel Osorio Dominguez (Corporación Ambiental y Forestal del Pacífico (CORFOPAL)) Leonor Valenzuela (CORFOPAL) *Comment A: Dr. Emilio Rafael Díaz-Varela (SITR10-09-Spain)* *Comment B: Ms. Alice Jing-Juan Hsu, Dr. Yu-Chun Chan (SITR10-08-Taiwan-Nanan)*

14:00-14:30 (30 min.)	**PRESENTATION 12** (SITR10-12-Taiwan-Penghu) **"Empowering Youth for ensuring ecological connectivity: Socio-ecological production seascapes (SEPLS) restoration through active participation in Penghu"** Szu-Hung Chen (Agency of Rural Development and Soil and Water Conservation, MOA) *Comment A: Dr. Somajita Paul (SITR10-10-India)* *Comment B: Dr. Gerald Jetony (SITR10-05-Malaysia-Kinabatangan)*
Discussion Session 2 "Methodology" (CR2&CR3)	
14:30-14:40 (10 min.)	**Introduction to Discussion Theme 2 (CR2)**
14:40-15:10 (30 min.)	**Group Discussion on "Methodology" (CR2&CR3)**
15:10-15:30 (20 min.)	BREAK (CR3)
15:30-16:10 (40 min.)	**Group Discussion on "Methodology" cont'd (CR2&CR3)**
16:10-16:30 (20 min.)	**Wrap-up and Synthesis (CR2)**
Discussion Session 3 "Ways forward" (CR2&CR3)	
16:30-16:35 (5 min.)	**Introduction to Discussion Theme 3 (CR2)**
16:35-17:25 (50 min.)	**Group Discussion on "Ways forward" (CR2&CR3)**
17:25-17:30 (5 min.)	**Announcement**

*** Dinner on your own**

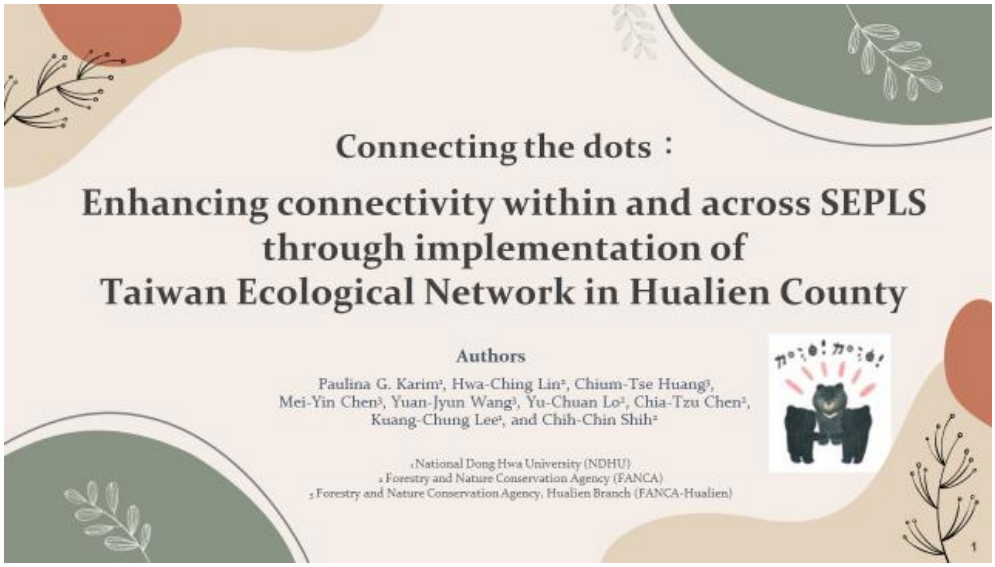
Day 3: Tuesday, 25 June 2024

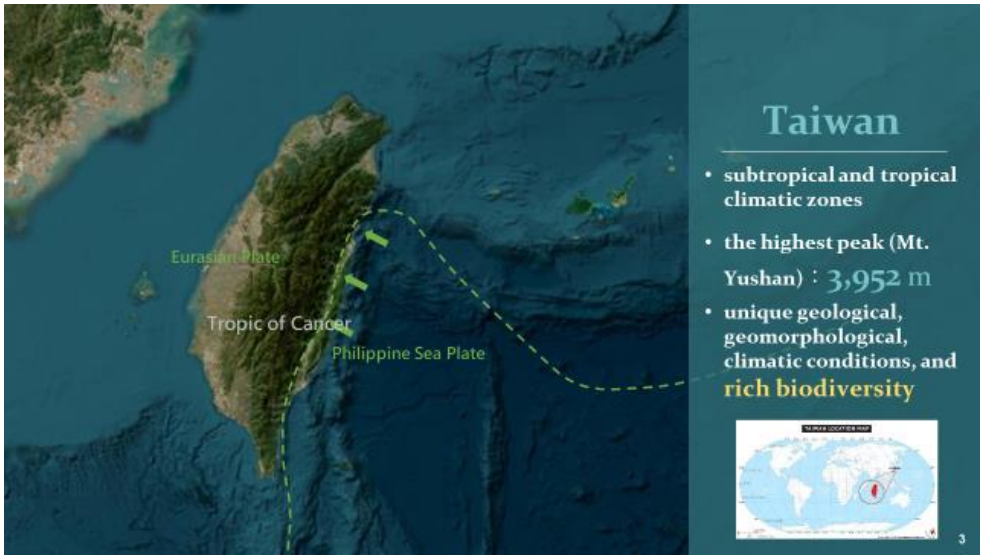
9:15-9:25	**Registration (please go up the escalator to the 2nd Floor)**
Opening of Day 3 (CR2)	
9:30-9:35 (5 min.)	**Introduction to Today's Schedule**
Discussion Session 3 "Ways forward" cont'd (CR2&CR3)	
9:35-9:45 (10 min.)	**Guest Speech** Jennifer Kelleher (Programme Lead, Governance, Equity and Rights, IUCN)
9:45-11:05 (90 min.)	**Group Discussion on "Ways forward" cont'd (CR2 & CR3)**
11:05-11:45 (40 min.)	BREAK (CR3) <Editor's discussion>
Closing Session	

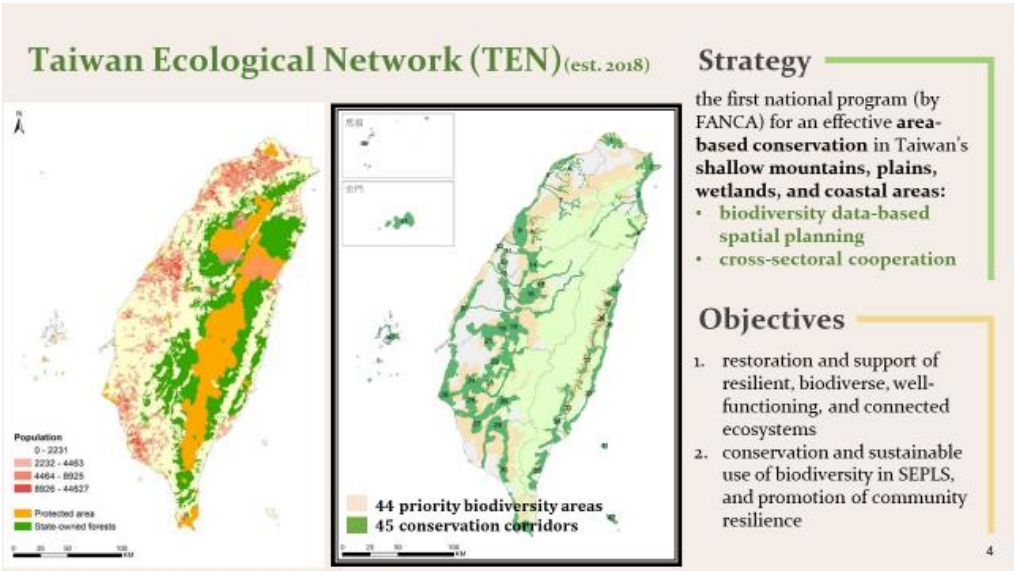
11:45-12:30 (45 min.)	**Key points and discussion**
12:30-13:30 (60 min.)	LUNCH (CR3)
13:30-13:50 (20 min.)	**Next Steps**
13:50-13:57 (7 min.)	**Wrap-up and Announcement**
13:57-14:00	**Closing remarks** Rina Miyake (Deputy Director of IPSI Secretariat, Programme Coordinator of UNU-IAS)

For enquiries, please contact the SITR Editorial Team (UNU-IAS) at sitr@unu.edu.

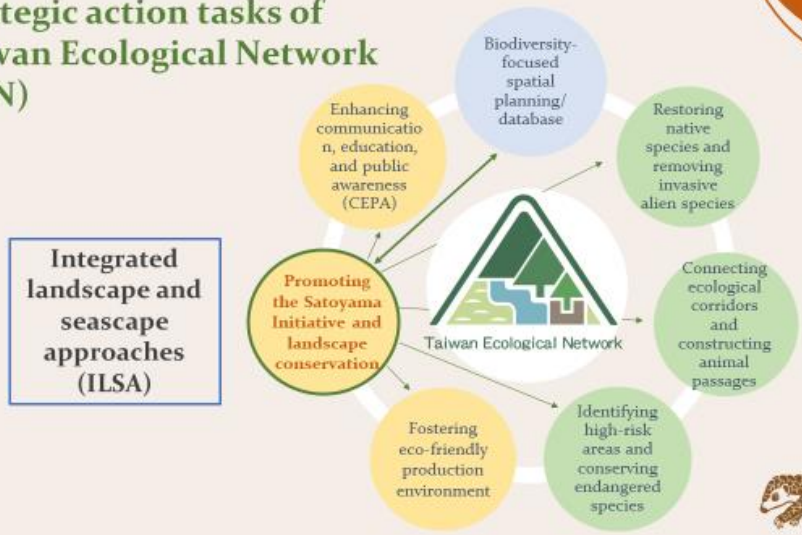
附件二、林業保育署案例簡報



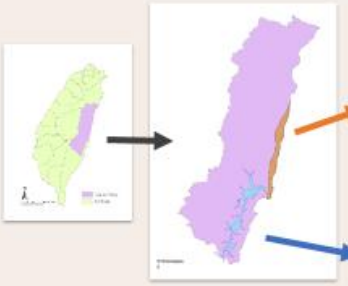




Strategic action tasks of Taiwan Ecological Network (TEN)



Taiwan Ecological Network in Hualien County



The Northern Section of the Coastal Mountain Range conservation corridor

Target ecosystems and habitats:
Streams, paddy terraces, seaside meadows and shrubs

Target conservation species
Migratory species (amphidromy):
- Kijimuna Goby *(Lentipes kijimuna)*
- Monk Goby *(Sicyopterus japonicus)*
- Red-tailed Goby *(Sicyopterus lagocephalus)*
- Ornate Goby *(Sicyopus zosterophorus)*


Stiphodon percnopterygionus


Monk Goby

Xiuguluan River conservation corridor

Target ecosystems and habitats:
Forests, streams, riverbanks, farmland, water channels

Target conservation species
- Medaka (*Aphyocypris kikuchii*)
- Monk Goby (*Sicyopterus japonicus*)
- Chinese Soft-shelled Turtle (*Pelodiscus sinensis*)


Chinese Soft-shelled Turtle

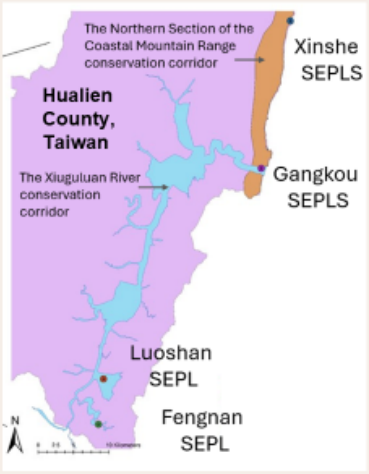

Medaka

7

Four case study SEPLS

Xinshe	Gangkou	Fengnan	Loushan
			
The Northern Section of the Coastal Mountain Range conservation corridor		**Xiuguluan River conservation corridor**	
Kavalan, Amis	Amis	Amis	Hakka, Hokkien
the Dabuan/ Jialang River watershed	River mouth of the Xiuguluan River	Upstream of the Xiuguluan River	Mid-stream of the Xiuguluan River
Terraced rice paddy farming, home gardens, foraging (wild plants/ intertidal zone), traditional weaving, fishing		Traditional hunting, farming, and gathering Geodiversity	Rice paddy farming, bamboo harvesting, tofu making, and fruit growing
Migratory species (21 shrimp varieties)	Chinese Mitten-handed Crab、Monk Goby, carnivorous plants	Monk Goby	Green pond frog, Mangrove fern

8



Objective

The objective of our study is to demonstrate how application of community-based RAWs (as an issue identification tool), operationalisation of ILSA in SEPLS (as a management approach) and their alignment with biodiversity-focused spatial planning – TEN (as a spatial strategy) has helped to ensure and enhance connectivity within and across SEPLS over time.

RAWs resilience assessment workshops

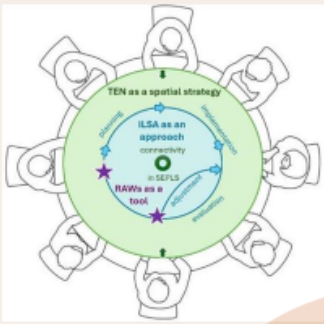
ILSA integrated landscape and seascape approach

TEN Taiwan Ecological Network

9

Conceptualisation and Methods

Tool-Approach-Strategy bundle



RAWs (as a tool)

- ✔ 5 socio-ecological perspectives, 20 indicators; international (Bergamini et al., 2014) and localised (Sun et al., 2020) versions; *in our analysis*: focus on Perspective A 'Ecosystem health and connectivity'
- ✔ ACM integration: an evaluation tool for planning and adjustment of the action tasks in SEPLS
- ✔ Community-based and participatory approach

ILSA (as an approach)

- ✔ ACM cycle: issue identification – planning – implementation – evaluation – adjustment
- ✔ Multi-stakeholder platform: IPLC, government agencies, academia, private companies, etc.
- ✔ Adaptive and iterative learning process

TEN (as a spatial strategy)

2018-2021 / 2022-2025 : 7 strategic action tasks with the focus on the Satoyama Initiative and landscape conservation in SEPLS

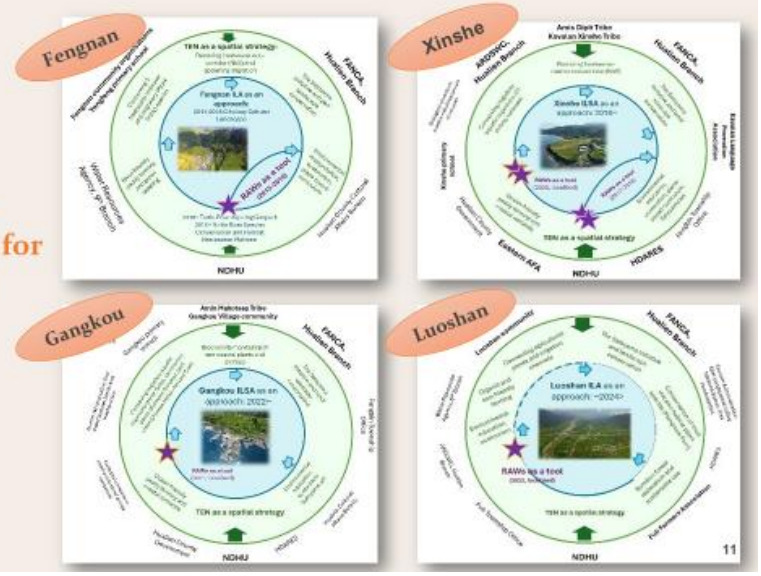
Multi-stakeholder collaboration and cross-sectoral partnership

10

Results

Tool-Approach-Strategy bundle for the four SEPLS:

Fengnan 豐南
Xinshe 新社
Gangkou 港口
Luoshan 羅山



11

Tool-Approach-Strategy bundle for the Gangkou SEPLS

RAWs (as a tool, 2021)

priority ecological connectivity issues:

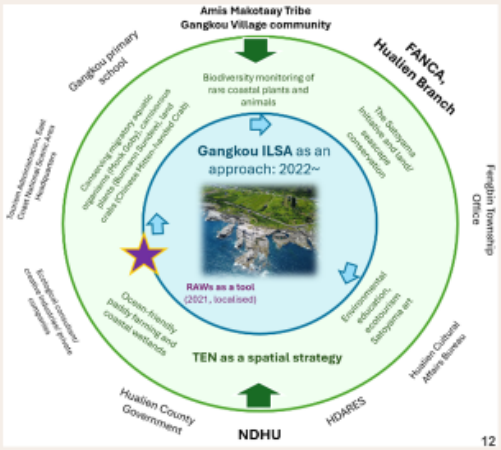
- disruption of natural waterways and irrigation canals
- water quality and availability for the household use
- reduced quantity/ size/ disappearance of freshwater and marine species.
- poaching of freshwater and coastal resources (clams and seaweed)
- invasive alien plant species (White Leadtree, Parthenium weed, and American Rope)
- need for SEPLS-to-SEPLS connectivity + communication alongside the Xiuguluan River conservation corridor

ILSA (as an approach, est. March 2022)

- **Gangkou Forest-River-Village-Ocean Eco-Agriculture and Aquaculture Initiative (the Gangkou Initiative)**
- Action plan is structured around landscape-seascape elements: forest, river, ocean (and intertidal zone), and village – connectivity in mind

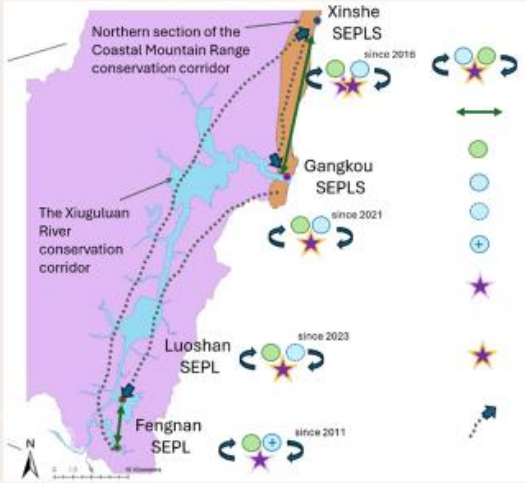
TEN (as a spatial strategy)

conservation objectives integrated into the action plan of the Gangkou ILSA



12

Discussion



A 'tool-approach-strategy' as a dynamic approach to connectivity in SEPLS (example)

Close relational, cultural, socio-economic connectivity between SEPLS

Taiwan Ecological Network

ILSA (well-established)

ILSA (to be established)

ILSA (with additional approaches)

RAWs based on the international Toolkit for Indicators of Resilience in SEPLS (Bergamini et al., 2014)

RAWs based on the localised version of Indicators of Resilience in SEPLS (Sun et al., 2020)

SEPLS-to-SEPLS iterative learning and knowledge sharing

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Q1: Multiple benefits/ enhancing ecological connectivity (EC) through Tool-Approach-Strategy bundle

[via RAWs]	[via ILSA]	[via TEN]
Understanding the precise meaning of EC in each SEPLS context (e.g., as the integrity of all landscape elements, as the presence of indicator migratory species) + **eliciting EC issues/ challenges** that need to be addressed	**Multi-stakeholder/cross-sectoral efforts** towards addressing the EC issues/ challenges through **implementation of the action plan** (e.g., removal of river weirs, connecting natural streams and irrigation canals, improvement of native habitats for carnivorous plans and land crabs)	**Setting/ adjusting strategic objectives for EC** + priority actions for **restoring/ enhancing EC within a conservation corridor** + **aligning** them with ongoing efforts in SEPLS (e.g., at a watershed scale, linking terrestrial and aquatic, freshwater and marine habitats)

Works in various directions

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Q2: **Trade-offs and synergies** in achieving ecological connectivity (EC)

Synergies

- ✔ Multi-stakeholder/ Cross-sectoral collaboration
- ✔ Local champions/ SEPLS leadership
- ✔ Government support (technological, financial, institutional)
- ✔ Effective facilitation and community-science-policy partnerships
- ✔ Bundle of various tools-approaches-strategies: flexibility and sensitivity

Trade-offs

- ✔ EC vs. socio-economic development objectives/ long-term goals vs. short-term priorities
- ✔ SEPLS location: strategically more challenging if outside of the conservation corridor
- ✔ Public land vs. private land EC issues
- ✔ Ecological connectivity (EC) vs. spread of invasive alien species - ?

15

Q3: **Measuring** ecological connectivity (EC)

Resilience assessment workshops (RAWs) as a community-based participatory tool - perspective A (Ecosystem diversity and connectivity)

RAWs offer a **comprehensive baseline understanding of SEPLS EC** based on the local lived experiences – EC entry points:

- diversity of/ connectivity between SEPLS elements;
- presence/ disappearance of faunal and floral indicator species;
- cultural dimension >> socio-ecological connectivity;
- insights from the Indigenous and local knowledge (ILK) perspective;
- identification of priority connectivity issues

RAWs in Luoshan SEPL (2023)

Picking up RAWs efforts: biodiversity monitoring surveys by expert teams + citizen science/ **aligning with TEN's objectives** within the conservation corridor/ **cross-comparison between sites** (e.g., across one watershed)

Stream ecological survey

Challenges : need for **long-term ecological monitoring + regular RAWs** (every 3-4 years); **capacitating local communities** (e.g., technology and skills); **aggregation** and **shared use** of **collected data; adaptive adjustments** based on measurement results; embracing **socio-cultural aspects** of EC

16

Q4: Operationalizing **ecological connectivity (EC) in spatial planning**

44 priority biodiversity areas
45 conservation corridors

Taiwan Ecological Network (TEN)

Nationwide cross-sectoral biodiversity-focused spatial planning strategy

Effective — The application of the RAWs tool, ILSA approach, and TEN strategy bundle in each case combines strategic biodiversity conservation and ecological connectivity objectives with adaptive co-management in SEPLS

Sustainable — Long-term thinking, adaptive and iterative process of learning by doing, top-down and bottom-up directionality

Equitable — Based on participatory, inclusive, co-productive processes, multi-stakeholder participation, cross-sectoral partnerships

Cross-SEPLS connectivity is key >> connecting the dots!!

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Q5: Traditional and local knowledge and cultural diversity for ecological connectivity (EC)

Turtle River rice

Perceptions of EC in local narratives, beliefs, folklore, and art
(e.g., childhood memories of Chinese Mitten-handed crab in Gangkou SEPLS)

Chinese Mitten-handed crab

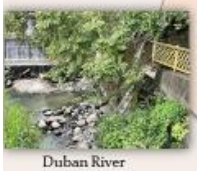
Reflection of EC species/ elements in Indigenous languages
(e.g., Hala in Fengnan SEPL)

Hala

Sustainable use and production activities in SEPLS
(e.g., Hala rice and Turtle River rice brands in Fengnan SEPL; organic mud volcano tofu in Luoshan SEPL)

organic mud volcano tofu

In daily livelihoods and sense of place
'Connectivity means using water from the stream, playing in the water, collecting shrimp'



Duban River

Indigenous curriculum in Xinshe Primary School

Place-based education and **community-based ecotourism**
(e.g., shrimp tourism in the Xinshe SEPLS, Indigenous curriculum in Xinshe Primary School)

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Conclusion

Lessons learned

- ✔ Importance of aligning SEPLS management with the spatial planning objectives
- ✔ Importance of adjusting spatial planning objectives with SEPLS priorities/ ILSA management outcomes
- ✔ Suitability of RAWs for identifying EC issues throughout ILSA process
- ✔ Multi-stakeholder and cross-sectoral partnerships are key for enhancing EC within and across SEPLS
- ✔ Being mindful of the multiple meanings of connectivity (ecological, socio-cultural, spatial, and temporal)

Ways forward

- ✔ Filling in connectivity gaps (adding the 'dots' on the map) to ensure the quality of connectivity within a conservation corridor;
- ✔ Continuing to promote EC during the third phase of TEN (2026-2029):
  - improvement of community-based and scientific monitoring and measuring tools,
  - closer partnership with stakeholder networks (TPSI and Community Forestry Network),enhanced cross-sectoral collaboration
- ✔ Alignment of efforts with the 2030 targets of Kunming-Montreal Global Biodiversity Framework

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Thank you!!

Many thanks to our SEPLS partners:

Fengnan SEPL

Xinshe SEPLS

Gangkou SEPLS

Luoshan SEPL

Very special thanks to our reviewers
(Dr. Yoji Natori et al. and Dr. Emilio R. Díaz-Varela et al.)
and SITR-10 Editorial Team!!

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附件三、林業保育署案例審查意見彙整

共 4 位審查者（A.Yoji Natori,B.Emilio R. Díaz-Varela、C.Reviewer 1、D.Reviewer 2）

1. **General Comments**

A. Yoji Natori

This is a very well-written manuscript on a comprehensive effort taking place for securing ecological connectivity in Taiwan. It describes a standardized method of tool-approach-strategy framework for ecological connectivity across the region, which will be a great reference for IPSI members in general and beyond. The planning is good only if it is followed by the implementation on the ground. The manuscript demonstrates four concrete examples from Hualien.

The discussion is comprehensive. My questions from the current paragraph are addressed in the next. That said, there is a limited presentation about the factors that makes this framework possible, but it could be a very important addition. In particular, the commitment of the government to implement the strategy developed and of making resources （technical, human and financial） available to the needed activities might be discussed more. Another point is the role of local champions. The absence of a local champion is mentioned about Qimei SEPL. Then, who are the local champions in the four SEPLS featured in the study? The accounts for these will shine light on the （additional） critical factors that enables the move from a plan to actions.

B.Emilio R. Díaz-Varela

Manuscript very well written, with an appropriate narrative, fitting adequately SITR10's publication theme. The body of text is lengthy, but it accomplishes the call's conditions （i.e. under a maximum of 6.000 words）. Specific issues and comments are integrated in the attached manuscript document, as well as in the "other comments" section below.

C.Reviewer 1

- This paper is an excellent contribution to SITR10. TEN's role in enhancing ecological/ social and cultural connectivity across and within SEPLS and operationalization of ILSA are the crux of the paper. All the above questions are addressed well.
- TENs role indicates a win-win situation for both biodiversity and society.
- The authors argue community based resilient assessment workshops have helped in enhancement of ecological connectivity and they reiterate on the lack of effective indicators and scientific methods to comprehensively measure connectivity.

D.Reviewer 2 This paper is very good and will be very useful for many IPSI members. It is well organized, contains a lot of detailed information, describes the methodology and provide several lessons learned.

2. **Other Comments:**

1	**Did the paper adequately address this year's publication theme? If not, how can the author improve the paper to better address the theme?** **A. Yoji Natori** Yes. **B.Emilio R. Díaz-Varela** Yes, this year's theme is addressed adequately and thoroughly in the paper. Some specific issues are pointed out in the comments below and in the attached commented manuscript. **C.Reviewer 1** Yes. **D.Reviewer 2** This paper addresses this year theme fully. All aspects are covered, some are more developed than others. Probably, as the authors were concerned with the length of the paper, they could not develop some areas.
2	**Did the paper address the above-mentioned five key questions? If not, how can the author improve the paper to address the questions? Are there any other key questions that should be addressed, and if so, what are they?** **1. What are the multiple benefits derived through SEPLS management? And how have these benefits helped ensure and enhance aspects of ecological connectivity?** **2. Are there any trade-offs and synergies among efforts to attain quality ecological connectivity in managing SEPLS? If so, what are they, and who has been losing or winning?** **3. How can you measure ecological connectivity, assess its ecological functions and benefits, and examine related trade-offs and synergies through managing SEPLS?** **4. How has the SEPLS management in your area helped in operationalizing ecological connectivity in spatial planning and management and making the processes more effective, sustainable, and equitable?** **5. Has local and traditional knowledge and cultural diversity helped to**

ensure and enhance the quality of ecological connectivity for socially and ecologically sound outcomes? If so, how?

A. Yoji Natori

Yes. I understood as follows.

1. Benefits are not detailed on the specific sites, as the artcile focuses on the process and institution. I do not see this as a significant short coming.
2. The article is about seeing trade-offs and addressing them. A substantial discussion is made for considerations and approaches necessary in doing so.
3. Measuring ecological connectivity is identified as a challenge to be addressed in the future. Complexity of the task （involving many different perspectives） is the source of difficulty. I look forward to addressing this common challenge during the workshop!
4. The tool-approach-strategy framework that is extensibely and coherently discussed in the article demonstrates a concrete case for SEPL management and operatioanlizing ecological connectivity in spatial planning.
5. TK is mentioned as critical piece in the puzzle and addressed at the local level through RAWs. Ecological connectivity at the regional- and national-levels sits on top of that foundation. Because of that premise, the manusctipt leaves the explicit consideration of TK to that level.

B.Emilio R. Díaz-Varela

Yes, the five key questions are addressed. Specifically, question [1] it is implicitly addressed in the descriptions of the four study cases （sections 3.1, 3.2, 3.3, 3.4）; question [2] is explicitly described in the section 4.2 of the discussion （from L392）; question [3] is implicitly addressed in a conceptual way in the description of TEN, and methodologically in the “mixed-methods approach” described in section 2.3., where RAWs are described as a methodology for identification of connectivity needs and priorities, with explicit results shown throughout the results section; question [4] is addressed through the “tool-approach-strategy” bundle, starting in section 1.3 but developed throughout the text （also with variants described e.g. in section 4.1, from L334）; finally question [5] is implicit in the descriptions of the four SEPLS, in general with the elicitation results associated to the RAWs , or specifically with some local knowledge / cultural examples （e.g. the relationship between Monk Goby species, the toponym Cihalaay, and the Hala Rice brand described in L155-161）.

C.Reviewer 1

Yes. + Other points:

	Q.1 – Multiple benefits are mentioned however, a bit of systematic writing is required Q.3 - Some methodological implications （e.g., participatory, indicators） - though further clear and specific connections with the focus on EC would be appreciated. Q. 4 - This is discussed - （a bit repetitive text could be streamlined） **D.Reviewer 2** （1） The benefits of ecological connectivity in the context of TEN aims at ensuring the size and quality of habitats that can support healthy population sizes as well as averting and opening ecological bottlenecks for species migration. This addresses the first key question noting the winners and losers, the link between benefits and ecological connectivity is also addressed but not expanded, probably due to lack of space in the work. （2） This paper specifically shows how synergies among efforts have been the base for the success of the work. It also indicates the main problems, even if does not offer a solution as work is in progress.（4）The question of effective, sustainable, and equitable processes is also addressed but not developed. I believe that it has been addressed in the RAWs but detail work of how the RAWs work is not available, I believe again for lack of space. If possible this could be expanded a bit. （5） The traditional knowledge and cultural diversity has been mentioned and probably could be expanded especially in the cases where it ensures and enhances the quality of ecological connectivity for socially and ecologically sound outcomes. I remember there are projects in the Taiwan SEPLS using traditional knowledge but they haven't been developed in this paper which concentrates on the method.
3	**Was the paper easy to understand? Please identify which parts of the paper were not easy to understand and how they could be improved, if any**. **A. Yoji Natori** Yes. Small request is to improve the use of dashes （or write sentences without them） for better readability. Abbreviations are in Appendix A, but it is easier to read if all of them are spelled out in their first appearances （many of them are, but some are not; particularly useful while reading electronically）. Then the appendix will not be necessary. **B.Emilio R. Díaz-Varela** Yes, it is well-written and easy to understand. Some specific details, corrections and suggestions are included in the attached file. **C.Reviewer 1** Yes. With a lot of information from 4 SEPL/S and some bit of repetitions. **D.Reviewer 2** The paper is well written and easy to understand. Figure 8 and the explanation can be difficult to understand if you do not know the background. The appendix A with abbreviations is useful and Appendix B is also very useful and it could be expanded.

4	**Did the paper offer enough information to show logical connections between actions taken and results? Did the paper provide sufficient lessons learned? If not, what information do you think should be added?** **A. Yoji Natori** Yes. **B.Emilio R. Díaz-Varela** Yes. The paper shows an effort finding connections between tools-approaches-strategies, defining connections between actions and results at different levels in the four study cases, with distinctive lessons learned. **C.Reviewer 1** Yes. But the criticality of ecological connection can be established better and re-writing of conclusion. At present, it is bundled in the activities of TEN, and the audience is left to interpret/ assume papers connection to the volume's central theme. **D.Reviewer 2** The logical connections between actions taken and results are shown. There are several lessons learned that can be useful for other IPSI members. A detailed example of how RAWs （resilience assessment workshops） were implemented and were run, could be useful. A more detail example of how connectivity was achieved, would also be useful as this is the year's main theme.
5	**Please add comments and/or suggestions for the author if any**. **A. Yoji Natori** I have provided additional comments and suggestions in the manuscript file. **B.Emilio R. Díaz-Varela** See comments in text. **C.Reviewer 1** More comments in the draft. **D.Reviewer 2** This paper is complete and very well done. As this year's theme is ecological connectivity and social implications of it, I would add a bit more detail in the description of ecological corridors and the functioning of RAWs that seem a very good tool to be replicated in other SEPLS. These details can be added in the text and / or in the appendix. A table or a paragraph with winners and losers could also help to visualize this very delicate part of the project.

附件四、工作坊主題討論內容彙整

SITR Vol. 10: "Ensuring ecological connectivity in

socio-ecological production landscapes and seascapes （SEPLS）

Draft Key Messages for Synthesis

1. Concept

- **What is connected in SEPLS informs the type and degree of the effort required to ensure connectivity**

  - Tangible elements including:

    - Non-human species viz., fungi, plant and animal species （e.g. key species/umbrella species/ indicator species, etc.）. E.g., The cases of the long-tailed "goral", the elephant, the leopard and the Asian golden cat in Thailand, which require greater conservation efforts to ensure their long-term survival as key species.

    - Habitats/ecosystems.

    - Patches, roads, corridors, watersheds and waterways, coastlines.

    - People and their production activities.

  - Intangible elements including culture, knowledge and behaviour.

    For example, the integration of modern knowledge and TEK is very important in the management of SEPLS. Since knowledge is held in specific vernacular languages depending on the context, the dissemination of ideas can fail if the language used is not adapted to the local context – e.g., Training chestnut growers in Spain using communication methods entirely adapted to the local context. Other examples related to culture include those that relate to sense of place, identity and how these are linked to ecological connectivity （-e.g., Socio-cultural and ecological importance of Hala （Monk Goby, Sicyopterus japonicus） – an endemic migratory fish species of the Turtle River in the Fengnan SEPL, Hualien County, Taiwan. It explains the name Cihalaay given to the area by its early Indigenous Amis inhabitants. The locals see a close correlation between

promotion of eco-friendly paddy rice farming and nurturing of healthy freshwater habitats for the Hala fish.）

- Movement of other elements, namely nutrient, water and wind flows and/or energy transfer across habitat need to be considered for ensuring ecological connectivity （e.g., fertilizer inputs and nutrient run-off （N and P） at a landscape-seascape interface）.

- Connectors: tangible - water, soil, air/wind; intangible - memories, language, cultural practices.（e.g., Water generally serves as a good connector between key elements across habitats; Promotion of Taiwan Ecological Network （TEN） within the Xiuguluan River and the Northern Section of the Coastal Mountain Range conservation corridors （Hualien County） aims to ensure connectivity of the landscape-seascape elements at a watershed scale, by linking terrestrial and aquatic as well as freshwater and marine habitats and enhancing biodiversity and ecosystem services. In all four SEPLS （Fengnan, Xinshe, Gangkou, and Luoshan） presented in Taiwan-Hualien case study, watershed spatial thinking was central for ensuring ecological connectivity. [case study authors: please add further examples of the contribution of other listed connectors]）.

- **How they are connected**

  - The types of links between these key elements can have a positive influence（e.g. derived ecosystem services such as 'provisioning' – food, clean water, and medicines; 'regulating' - climate regulation, pollination, and temperature regulation; ‘cultural’ - Indigenous rituals, spiritual practices, traditional art, eco-tourism, place-based education; 'supporting' - soil fertility and ecosystem resilience） and a negative influence （e.g. flooding, droughts, disease for nature and people, inequity） essentially in the event of disruption.

  - These links are influenced by direct drivers （e.g. land use, introduction of invasive alien species, climate change, pollution） and indirect drivers （e.g. market demand, demographic pressure, political regimes, conflicts and wars）. It is essential to examine where the disturbance occurred and identify “disconnection” （e.g., loss of species, etc.） and what existed before. A similar approach has been used to overcome water shortages in Taiwan.

  - Vertical and horizontal connectivity （e.g., considering "water flow", which has three dimensions: upstream and downstream, connectivity between water and land area, and vertical connectivity between groundwater and surface water. It is

therefore essential to examine the different dimensions of 'water flow'. For example, if water is polluted, it spreads chemicals that can lead to the erosion of biodiversity in soil, freshwater and coastal habitats.

- Anthropological dimension of connectivity. For example, the way in which people perceive the dynamic changes that occur in habitats over long-term periods is essential for a better understanding of ecological connectivity. After living for a long time in close proximity to resources, local communities （with different cultures, practices, habits and customs） become capable to appreciate the spatio-temporal changes in SEPLS and can potentially provide site-specific co-management/conservation strategies. （-e.g., case study authors: please add examples..... In the Xinshe SEPLS （Hualien County, Taiwan）, the local people observed decrease in numbers and disappearance of local varieties of freshwater shrimp. This was a result of obstructed migratory pathways in Dabuan/ Jialang River caused by construction of 171 lateral structures（river weirs）in the 1990s. Indigenous and local knowledge （ILK） and traditional freshwater stewardship practices combined with robust multi-stakeholder consultation processes and cross-sectoral partnership resulted in demolition of nine downstream river weirs, including the largest one at the river mouth. To date, short-term ecological monitoring of shrimp populations has been showing a substantial increase in numbers. Return of unique shrimp varieties has fostered a sense of pride and ownership among the locals. Shrimp as an indicator of the landscape-seascape ecological connectivity was also introduced into the place-based curriculum at Xinshe primary school.）

- Traditional rules and practices, for example regulations on which resources can be used and how, or which cannot be used （e.g., ban on bycatch of fish larvae and other juvenile individuals in the Xinshe and Gangkou SEPLS （Hualien County, Taiwan） - protecting sustainable spawning populations）.

- Raising awareness and communicating with communities: When working with local communities, it's difficult to explain connectivity as a stand-alone concept. Local communities see connectivity as an intrinsic part of their lived environment, perceiving it as one integral whole and also noting disconnections （-e.g., case study authors: please add examples.....Please see the Xinshe SEPLS example above.）. In SEPLS, people live in this landscape, they depend on local resources, so it's important to get them to understand how they manage their resources, what creates disconnections or what the connections are in their context.

- Landscape is a mosaic, but local people sometimes do not realize the connections between different sections or how their activities create disconnections. For communities, sometimes it is not negotiable to make some synergies because it affects their livelihoods or they are more vulnerable to some changes. For instance, the benefits of tourism in a region sometimes do not reach the local communities, who receive no money or whose local products are not sold.
- The correlation and connectivity between tangible （e.g., migratory species, habitats） and intangible （e.g., cultural practices, knowledge） elements of connectivity needs to be fully understood by all relevant stakeholders. Connectivity requires an open mind towards the multiple meanings of connectivity – ecological, socio-cultural, spatial, temporal, and others. This can support development and appropriate and lasting com-management arrangements and conservation strategies.

- **Unique aspects of connectivity in the context of SEPLS and areas to strengthen and address**
  - Multi-functionality

    -Production activity / Responsible production and consumption.

    For example, in Taiwan, a major tea production area is upstream, so planting trees have an impact on water quality, and organic practices have been implemented （In 1990s-2000s conventional （use of chemical fertilizers and pesticides） rice paddy farming in the production landscape resulted in coral reef bleaching and disappearance of marine biota in the coastal zone. This observation was made by Indigenous local fishermen and farmers and led to a strong push towards organic farming and eco-agriculture in the Xinshe SEPLS （Hualien County, Taiwan）. This became one of prerequisites for establishment of the Xinshe Initiative - an integrated landscape-seascape approach （ILSA） in the Xinshe SEPLS.

    Culture/Intergenerational transfer of knowledge. Traditional knowledge may not be applicable in the modern context due to changes in population size and other factors, but it can be combined with modern scientific research and tools. Knowledge co-production and weaving is very important.

  - Local contexts: Distance, geography

It is important to take into account not only ‘distances - short vs long’ but also ‘scale-micro/meso/macro’ when talking about ecological connectivity. For instance, scale will influence how we monitor connectivity and get the right results. Long term perspective is also very important. （-e.g.,case study authors: please add examples..... At a cross-SEPLS scale, immediate connectivity synergies are more likely to occur between SEPLS located in closer proximity or possessing similar geo-ecological, socio-cultural and economic backgrounds （Xinshe and Gangkou, Fengnan and Luoshan）.） Regulations relating to the use of local resources. For instance, limiting the quantity of resources consumed in the ecosystem to ensure sustainable harvesting.

2. Methodology

The SEPLS perspective identifies several key points in terms of measuring ecological connectivity. At the outset, it is important to understand what kind of connectivity we are aiming to measure before we determine the indicators and tools for it. Connectivity is in general understood as the flow of species, materials and information. It is important to know the flow, the disruptions of the flow, then the value of the flow to further understand the impact of disconnection or fragmentation. The following are some of the benefits and dis-benefits that can be used in measuring ecological connectivity and effects of initiatives for ecological connectivity; and the approaches and strategies that can be used for ensuring, enhancing or restoring ecological connectivity in the context of SEPLS.

- **Benefits & disbenefits to be measured and evaluated**

  - **Enhancement of ecosystem services （ESs）:** Different types of ESs （e.g., provisioning – food, clean water, and medicines; regulating – climate regulation, pollination, temperature regulation; cultural - Indigenous rituals, spiritual practices, traditional art, eco-tourism, place-based education; supporting – soil fertility）.

  - **Socio-economic** （e.g., income, tourism） **benefits** through social interactions: enhanced ecosystem services providing consistent income and resources.

  - **Environmental** （biodiversity） **benefits** such as reduction of surface temperature, protection of species & forests, creation of corridors and pollination leading up to environmental educational activities.

  - Understanding and mitigation of ecosystem disservices: what are they, why and how they occur and what impacts they have on ecosystem connectivity in SEPLS.

- The benefits and losses can also be seen in terms of human-wildlife conflicts including the increased cases of predator species attacking the livestock.
- **Cascading effects** （e.g., water contamination affecting fish life + human health + nutrient cycling）
- Corridors connectivity may result in unintended consequences and trade-offs, such as the one which was rebuilt between Cote d'Ivoire and Ghana and became a funnel for poachers and harbored lots of animals which were used as bushmeat. The spread of invasive alien species resulting in the growth of pathogens and allergens.
- **Multi-dimensional perspective:** Ecological connectivity is multi-dimensional and understanding the potential impact of connectivity, especially negative impacts is important.
- Conservation of specific species leading to reduction of ticks and other similar parasites. For example, conservation of bear and bat populations.
- The propensity of having unintended and unforeseen consequences - be it negative or positive.
- Establishing connectivity through protected forest at times makes the forest resources inaccessible for the local community. If the access is lost then the TEK is also lost with being able to not use it. E.g. Thailand case where law is strict on human interventions.
- **Tangible and intangible benefits:** The most tangible benefit is habitat and ecological connectivity, and intangible benefits include human connection to the environment, traditional knowledge, and pride of contributing to ecological connectivity, mutual understanding and knowledge co-production.

- **Indicators**

  Mixed Approaches:

  - Quantitative （population size, spatial scale, frequency, density） & qualitative （human perception, collaboration）

- Visual, mapping （human commercial activities and diversity of human activities, vegetation）

- Temporal and spatial scale matters for perception
- Evidence-based approaches can produce most accurate monitoring outcomes: involving animal count - such as rodent population, salmon, eel and shrimp etc.
- Knowledge co-production approaches with engagement of Indigenous and local knowledge and modern science can lead to more comprehensive monitoring outcomes and reduce uncertainty.

Mapping & Assessing the Natural Capital:

- Ecosystem structure, health index and gene pool
- Population size, space, habitat distributions and species movement
- Flora and vegetation cover and diversity
- Return or increase of more native species
- Natural succession - wildfire opens up the land for pine cones. Similarly, it is also important to understand that several species have grown adapting to human activities rather, human beings are an integral part of their habitat （e.g., managed rice paddy landscapes, managed secondary forests）.

Community involvement and capacity development:

- Human perception and traditional knowledge of native species
- Human absence should be considered as an ecological connectivity indicator as human behaviour is often a key to ecological connectivity. [This part may be confusing unless carefully explained. Taiwan-Hualien.] E.g. Kenyan case where monkeys were safe around people from leopards but when a reserve was made, the monkeys all left because there were no people left.
- Awareness building about mosaic mix of agricultural land （not monocrop） and linking of multiple SEPLS functions - horizontal involving interactions among different components within the same landscape （such as home gardens, agroforestry systems and community managed forests）; and vertical linking referring to linking of different layers with the landscape （such as watershed management, terraced agriculture and rural-urban linkages）

- Local policy and development plans and the diversity that needs to be kept in mind while informing the public on key decisions made.
- Involvement of local communities, platform for discussion and quantitative communication which requires a common language. We also require the social, qualitative and policy elements to be reflected in the indicators.

- **Tools and Methods**

  Technology based:

  - Species: Camera traps, GPS tracking
  - Habitats: Mapping, satellite or drone images, feces analysis, camera traps, soil and water analysis.
  - Landscape matrix for measuring the diversity - use of software such as Fragstat and Global Forest Watch for tracking and getting metrics.

  Mixed approaches:

  - Resilience assessment tools. Resilience assessment workshops （RAWs） based on 20 indicators of resilience in SEPLS possess a high potential as a community-based tool for monitoring ecological connectivity in SEPLS. They can help to understand the precise meaning of ecological connectivity in each SEPLS context （e.g., as an integrity of all landscape elements or as a presence of indicator migratory species） and elicit priority issues and challenges at each stage of adaptive co-management process. For best results, the indicators need to be adjusted to local context - localized.
  - More use of the models suggested by IPBES such as the scenario model.
  - Use of traditional methods such as community tracking tools

  Multi-stakeholder approach:

  - Participatory approaches in terms of land use planning, Public Participation Geographic Information System （PPGIS）, participatory mapping, etc.

- Citizen science involving bird watching and coral reef checks（with trainings and licenses）
- Community based patrolling （forest, river, coastal and marine）
- Human-agent approach: stakeholder engagement, cross-sectoral collaboration

Economics and governance of ecosystem services:

- Payment for ecosystem services, payment for alternative services and products/ production. e.g. case of Komodo Islands
- Tourism dependency has to be explored
- Certification, public recognition, green labeling schemes

Elimination of harmful subsidies, investments and taxation schemes （e.g., where wetlands are converted to fruit lands）; promotion of nature-positive subsidies

Communication, education, and public awareness （CEPA）:

- Tailor communications for sharing information/ data for different stakeholders or awareness raising. E.g., illustrations of consequences of disconnection: e.g., images of dead fish, dead birds and habitat destruction.
- Challenges faced are of resource paucity in updating data and information – there is a need for a freely accessible platform for data sharing.
- Intergenerational knowledge exchange and mentorship programs （e.g., Indigenous Bunun practices in Nan'An Tribe （Hualien County, Taiwan））
- Capacity building and knowledge transfer for long term monitoring （e.g., capacitating local communities in conducting community-based biodiversity monitoring and patrol of local environment）
- Science-policy-community partnerships are the future of sustainability transformations. Facilitators, also known as bridging stakeholders or boundary brokers, play a key role in enabling lasting and effective connectivity processes. More capacity development, cross-site learning and knowledge exchange in this regard is highly recommended.

3. Ways forward

Nexus in the efforts for ecological connectivity in the context of SEPLS management

- The efforts to maintain, enhance, or restore ecological connectivity take the form largely of land/sea use change （e.g., setting aside some farmland for a conservation corridor） or changes in management practices （e.g., organic farming） – e.g., Kenya,
- Given that SEPLS are complex social-ecological systems inherently involving nonlinear dynamics, the efforts for ecological connectivity inevitably have risks of giving rise to unintended consequences （e.g., an increase in vegetation leading to a spread of invasive species, an establishment of ecological corridors resulting in an increase in human-wildlife conflicts）.
- Furthermore, even as anticipated effects, certain efforts for ecological connectivity may lead to conflicting results among different stakeholders across spatial and temporal scales.
- Effects of the interventions for ecological connectivity can be immediately brought about or observed on site, including not only those directly related to land/sea use （e.g., loss of income generation opportunities of locals through agricultural activities; positive effects on local community through ecotourism in combination with branding of local products）, but also those associated with land tenure, rights to access to land/sea resources, and capital for other activities （e.g., re-branding oil palm produce under new sustainable policy guidelines without substantial changes in landscape management in practice in Indonesia）– e.g., Kenya,
- Effects of the interventions can also extend to broader spatial and temporal scales （e.g., short-term loss but long-term pay off from the shift from conventional to eco-friendly farming; fertilizer use in the inland area impacting downstream and marine & coastal areas, plastic wastes running into the ocean damaging fisheries and human & ecosystem health; values of species not recognized immediately but noticed and appreciated once it is lost）.
- These effects of the interventions are often conflicting or contradictory in terms of cost and benefits among different stakeholders. Such incompatible results arise not only from dynamic and intricate human-nature interactions（e.g., less yields from high cost organic production）, but also, almost by design, based on the different responsibilities, mandates and jurisdictions for policy making and implementation, different levels of awareness of problems in question, diverse conceptualization and perspectives, varied capitals and capacities of stakeholders （e.g., small farmers disproportionately losing from the land disposition vs. big tourism industry）.

Key aspects of landscape approaches for ecological connectivity

Landscape approaches underpinned by the following key aspects can facilitate synergistic systemic change for sound ecological connectivity:

- **Place-based approach**:
    - Selection of species and habitats/areas important for conservation could be made in consultation with the stakeholders, particularly local actors （e.g., farmers who use them for their livelihoods） – the problem at the place （e.g., ecological issues） can turn into opportunities when looking for solution at the management level （e.g., in combination with social and economic issues）.
    - Land tenure （e.g., public vs. private land） and land stewardship （e.g., people's commitment to certain practices） need to be concerned so that local actors can better engage in the project with a sense of ownership.
    - Specific measures can be identified on a certain scale （e.g., only a few components to be connected within a relatively small landscape）, while a "place" should be considered not as static but as dynamic.
    - An appropriate boundary can be set in consideration of manageability/feasibility and representation of the area – a relatively full cycle of ecological processes manifest, whereas （social-）ecological processes outside of the boundary may affect the phenomena inside the boundary）. The boundary may need to be adjusted over time to reflect the needs for ecological connectivity （e.g., species movement）.
- **Multi-stakeholder approach**:
    - Coordination between different stakeholders （e.g., sectors, jurisdictions, actors） is crucial to share different views, knowledge and practices （e.g., management activities） directly or indirectly associated with ecological connectivity.
    - Sometimes, the governmental structure may not easily allow for seamless communications and effective collaboration for ecological connectivity （e.g., There is a need for land and sea cross-sectoral collaboration between relevant governmental agencies and other relevant stakeholders. Integrated national policies, such as Taiwan Ecological Network（TEN）, are a good mechanism for fostering nexus approaches at a landscape-seascape interface. ）.
    - Yet, facilitators （e.g., NGOs and academic institutions, see Taiwan-Hualien case study） can serve as an intermediary to ensure local participation and promote interactions among different stakeholders for cross-sectoral commitments, sectoral coherence, alignment of policies across various levels, and transdisciplinary

approaches to ecological connectivity. They also play a key role in facilitating ***adaptive*** processes where new issues and stakeholders can emerge from time to time.

- ey stakeholders could include: Indigenous and local communities, including women and youth, local champions （e.g., custodians of protected areas）,oundary （honest）brokers / facilitators, , government agencies, agricultural extension officers, private sector, academia, religios organisations, NGOs and others.

- **Adaptive co-management approach**:
  - Monitoring and evaluation （M&E）: When one cycle ends, it is important to ensure that the results could be reflected in the next cycle （being sensitive to the ideas that arise and open to new phenomena or unintended consequences – e.g., human-wildlife conflicts）.
  - To deal with ecological connectivity that can go beyond the boundary of a certain SEPLS as well as to achieve the regional, national and global goals, upscaling the initiative would be needed. This can be done through replicating good practices by making experiences and lessons from one site relevant to somewhere else, but requires caution – As there is no one size fits all solution, deliberative processes （e.g., communications） through adaptation （e.g., iterative, mixture of bottom-up and top down approaches） are needed to reflect the scale context and deliver tailored solutions in accordance with the scale.
  - A long-term vision and perspective are needed along with the consideration of immediate or short-term benefits from the intervention, risks and uncertainties.

Operationalizing landscape approaches for spatial planning and management practices

[Spatial planning is not very explicit in the points listed below - we might need to further strengthen this part. Taiwan-Hualien]

- **Awareness raising, trust building and empowerment**:
  - Boundary（honest, not self-interest）brokers（who may have long worked with local communities as a governance agency in SEPLS management） may help with overcome the tensions （e.g., contentious discussions between local communities in fear of landgrab and gov. authorities for establishing PAs and CCAs in Malaysia） and build trust among the stakeholders for collaboration particularly between local communities and policymakers.

- They can raise awareness of local stakeholders （e.g., an NGO intervention for awareness raising of farmers leading to famers' willingly giving up their land for corridor development in Colombia）, and align different views to build a ***common vision*** under a ***common platform*** （e.g., farmers' concessions for balancing plantation, tourism, local livelihoods and conservation needs）.
- Finding a ***common language*** across different stakeholders is a key to facilitate mutual understanding and knowledge sharing. In this process, it is important to empower stakeholders （particularly the local actors） and secure their rights.

- **Incentive mechanisms**:
  - Some subsidies can be provided for farmers who change farming practices from conventional to organic ones and encounter certain loss of livelihoods until their produce can be profitable （though it may be difficult to set the timeline）.
  - Appropriate financial mechanisms may allow for sustainability of conservation activities.
  - Different incentives for different stakeholders should be considered （e.g., political incentives for politicians, livelihood opportunities for local communities, economic incentives for businesses, etc.）
  - Biodiversity offset （c.f. carbon credits）: Economic incentives for business sectors, landowners, etc. Yet, accurate information should be given for proper implementation （e.g., people were misinformed on the tree planting for carbon credits in Thailand）.
  - Tax to private companies support corridor maintenance in Italy – requires caution about the top-down approaches.
  - Funding from the private sector, the state, or the donors （e.g., ADB, OECD countries）.

- **Integrated and adaptive management plans**:
  - SEPLS management and spatial planning are a two-way street. There is a high value in aligning SEPLS management objectives with biodiversity-focused spatial planning objectives, and vice versa – adjusting spatial planning objectives in response to SEPLS expectations and immediate priorities.
  - Such plans can be developed through multi-stakeholder meetings where different kinds of knowledge & technologies （e.g., traditional knowledge, AI for monitoring, etc.） could be shared and drawn on in a common language at a common platform. Here, different interests and objectives should be aligned for common commitments.

- Private sector would need to engage in the development process – e.g., developing strategies to add value to agricultural produce, livelihood activities, etc.
- Scale-specific concrete actions （e.g., Cocoa planting design along with the provision of certified sourcing materials, investment, and awareness raising of farmers in Ghana, etc.） should be identified and incorporated along with short-term and long-term strategies, and adaptive & anticipatory management actions. However, for upscaling for connectivity, collaboration between different areas/regions （e.g., through sufficient information sharing with local communities, involvement of regional actors） is needed – e.g., effects of water flow for truffles in Italy – collaborative action among a large number of actors is a challenge.
- Monitoring & evaluation should be incorporated where small steps should be taken and adjusted – e.g., IUCN's management effectiveness tracking tool, more research funds needed （from the private sector or the state）.
- Clear implementation plan is needed – e.g., In Kenya, absence of such a plan between national and local governments in Kenya, while technical expertise is insufficient at local governments.

- **Partnership building and compliance:**
  - Public-private partnership should be strengthened – e.g., by facilitating compliance through certification （e.g., certification leading to compliance which leads to participation and then multi-stakeholder engagement） – allowing for complementarity to address lack of technical expertise, etc.
  - Private sector engagement and long-term commitment is crucial for financial sustainability, but requires caution to avoid greenwashing （e.g., business as usual practices while following certain but limited guidelines – While taking advantage of cooperate social responsibility （CSR） – e.g., sea turtles conservation in Taiwan –, private sector should go beyond CSR and sustain long-term commitment – e.g., habitat conservation for endemic species （small fish – not a flagship species but important for wetlands） by Toyota in Thailand.
  - Youth involvement should be sustained for long-term commitments to conservation – challenging to keep them engaged in a long run（rather than as temporal volunteers）. In this regard, the private sector engagement is a key for the youth to secure their job opportunities and attractively engage in the initiatives （competitive to job market in cities）.

- Ensuring the international links and （e.g., TNFD, global biodiversity frameworks, OECMs, Natural Capital Protocol, carbon verification systems, etc.） should be important for concerted efforts.