Technical Report: Impact Analysis of Proposed Airport and Free Trade Zone in Tainan County, Taiwan

台南縣七股國際機場與自由貿易港區計劃影響分析專案報告

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Spring Semester 2003

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2003 春季 環境規劃實習

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EXECUTIVE SUMMARY

This technical report examines the potential impacts of the latest economic development project proposed for Tainan County, Taiwan. This project, the Chiku International Airport, would rise on 17 km^2 square kilometers of state-owned salt ponds near the coast and Chiku Lagoon. About 5 km^2 square kilometers of industrial assembly facilities would be constructed adjacent to the airport in an industrial free trade zone as part of the project. The air cargo complex would be designed to facilitate quick assembly and export of high-tech manufactured goods. It would be built to ultimately handle as many as 15 million passengers and 1.68 million tons of cargo each year.1

The airport and the free trade zone project is the third major economic development plan recently proposed for coastal Tainan County. In the early 1990s, the Binnan Industrial Complex, containing a petrochemical refinery, steel mill and port, was proposed for the northern edge of Chiku Lagoon. Binnan generated significant local opposition from those concerned about pollution of oyster beds and fishponds, and international opposition from those concerned about protecting the endangered Black-faced Spoonbill. In addition, it would have produced a 25% increase in Taiwan's CO_2 emissions and required the construction of two new dams or a desalination plant to provide sufficient water.

The other economic development proposal is the Nanyin National Scenic Area. This coastal scenic zone is projected to greatly expand tourism and markets for local value-added products, without significantly interfering with the existing fisheries sector. The National Scenic Area has been championed both locally and abroad as a sustainable economic strategy that minimizes social disruption.

The international airport would be built on the same site as Binnan and in the heart of the National Scenic Area. The airport project is expected to produce as many as 52,000 jobs, most in construction during the first five years of development. Development arising from the airport could bring an additional 250,000 jobs, if the area is significantly urbanized. The airport is expected to generate annual revenue of approximately NT$18 billion.

The size of the airport and its ancillary assembly and manufacturing zones has grown since first proposed to more than twice the original estimate, raising questions about the thoroughness of project planning.

The airport plan is viewed as a way to generate prosperity for a rural region that has been bypassed by much of the island's economic activity. Yet a careful analysis needs to be made of the real benefits accruing from the assembly hub, and the lost opportunity cost brought about by airport construction, both nationally and locally. Our research indicates that alternative strategies could bring equal or greater economic benefits, with less risk and fewer potential costs.

NATIONAL QUESTIONS

While supporters have portrayed the airport as a linchpin in Taiwan's efforts to compete as an international transport hub, there is compelling evidence that building in Chiku could be a national mistake. The international cargo component could be accommodated by expansions of CKS or Kaoshiung airports. Competitive dynamics in the international air cargo sector favor primary national airports, in this case, CKS. Building a new $143 billion airport and assembly center in a relatively undeveloped rural area could undermine both CKS and Kaoshiung and be financially risky, particularly given Taiwan's weakness relative to China in this manufacturing sector.

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1 South International Cargo Airport and Free Trade Zone Feasibility Assessment Report, 2003, Tainan County

Industrial and residential development arising from the airport's presence would use scarce water and intrude into fish ponds and farmlands, undermining Tainan County's aquaculture and agriculture sectors, which play central roles in production of the nation's food. Tainan County fishponds and Chiku lagoon make up the largest aquaculture zone in Taiwan, supporting 16,000 jobs. Also of national significance is the tranquil scenic landscape of coastal Tainan County, at the heart of the region's proposed designation as a National Scenic Area. The scenic landscape, along with the area's history, cultural heritage, environmental and religious sites, has spawned a burgeoning tourism economy. The county had 15 million visitors in 2000; almost double the number from 10 years before. Coastal Tainan County has a minimum of 4.5 million annual visitors. This valuable scenic landscape could be disrupted by noise and sprawl. Major tourism sites that could be impacted by airport noise and development include Salt Mountain, Nan Kunshen Temple and Mashakou Beach Resort.

Lastly, the endangered Black-faced Spoonbill, one of the 50 rarest birds in the world and a cultural icon in Taiwan, calls coastal Tainan County home. From 40-70% of the world's spoonbills, about 300 to 700 birds, have historically roosted at and foraged around Chiku Lagoon, about 14 km from the airport site. This is the largest Black-faced Spoonbill wintering site in the world. The birds are believed to have insufficient feeding habitat at present, and construction of an airport and ancillary development could pave over feeding grounds, as well as saltlands that could be used to create new habitat to foster the growth of a sustainable spoonbill population. Inducing spoonbills to settle in other regions is a challenging endeavor that could take years, and likely would never be successful.

SPECIFIC AIRPORT IMPACTS

While the Chiku International Airport would not dramatically increase CO_2 emissions or divert the region's major water sources, as Binnan could have, this study has identified significant environmental impacts arising from aircraft noise, and airport-related land development.

NOISE

To assess noise impacts, we generated noise contours using the latest version of the U.S. Federal Aviation Administration's Integrated Noise Model software, inputting Tainan County physical characteristics and operations estimates drawn from Taiwan airports and aircraft fleets. We modeled both day-night averaged sound level (DNL), which averages overall noise experienced during a day, and flyover noise, which displays sound levels experienced during a single aircraft operation. A second DNL contour model was later developed from data provided in Spring 2003 by airport consultants.

Results show that about 13,000 people will live with 60 dB or more noise levels, considered by the Taiwan EPA as the threshold for reviewing possible land-use conflicts. More than 29,000 people would be exposed to 45 dB or higher noise levels, which can have significant impacts on people during nighttime. Two schools would need to be moved, and 14 would be impacted by aircraft noise. Conversation-interrupting noise levels would disturb one-third of coastal Tainan County tourist sites every 10 minutes. And noise levels could agitate roosting spoonbills.

INDUCED GROWTH

Projected airport-related industrial growth was mapped base on the precedent of the Memphis Airport in the United States, a major cargo airport that has produced 75 km^2 of development. One-third (25 km^2) and two-thirds (50 km^2) of the Memphis model development were mapped, assuming average Tainan City densities. The primary factors influencing the location of growth are assumed to be transportation access, congestion and siting of employment centers. A second map was prepared showing the pattern of expected growth if a new road is built connecting the Tainan Science-Based Industrial Park with the airport.

Under the higher end of the first scenario, growth is predicted to displace or impact about 40% of coastal Tainan County tourist sites, and remove about one-third of the county's fish ponds, which provide not only food for people, but also foraging habitat for spoonbills.

COMPARATIVE ANALYSIS OF BINNAN, AIRPORT AND NATIONAL SCENIC AREA

A matrix comparing the economic, environmental and equity effects of Binnan, Chiku Airport and the proposed Nanyin National Scenic Area shows that expanded tourism would provide twice as much annual revenue as the Chiku Airport, and the same number of jobs, at a dramatically lower cost in construction, operation and maintenance.

Development of the NSA-based tourism is predicted to provide multiple benefits: substantial employment and substantial government revenues, without the dislocation and costs to the existing Chiku-area way of life, and to the local environment.

While the airport's largely construction-related jobs would probably provide higher wages than NSA-area tourism jobs, the former would be short-term, and some would be filled by foreign labor. Airport-induced growth, however, could bring many more jobs, if extensive urbanization occurs.

Yet our analysis indicates that urbanization could be expected to take a great toll on the tourism industry. We predict that constant aircraft noise, industrial and suburban development and the accompanying traffic congestion would damage the qualities that make the Chiku area attractive to tourists: the tranquil scenery, the fisheries-based economy, and the rural atmosphere. Additionally, the black-faced spoonbill will likely never escape the extinction vortex if the airport, free trade zone and associated growth occur. Such a change in the essential coastal Tainan landscape would be expected to reduce tourism jobs by one-third. Fishery jobs would suffer as well, as ponds are displaced by urbanization.

The sum total of these negative impacts suggest the airport and free trade zone project is an ill-conceived strategy that undermines National policy, and precludes local economic development associated with the Nanyin National Scenic Area. Pursuing the National Scenic Area as a means of job creation and community development would be a wiser course for Coastal Tainan County.

摘要

這份報告檢視台南縣最近提出經濟發展方案的可能影響・這方案爲七股國際機場和緊鄰興建的自由貿易港區、其中空港部份將佔用十七平方公里靠近海岸與七股潟湖的台鹽土地、而自由貿易港區佔五平方公里做工業組裝加工使用・空港興建目的在於加速高科技產品的組裝與出口、預計在 2031 年服務一千五百萬人次旅客、處理一百六十八萬噸貨運量・機場建設目標是最終達到每年一千五百萬的人次旅客運輸量以及一百六十八萬噸的貨物運載量・2

國際機場和自由貿易港區是近年來台南縣沿海第三個主要經濟發展計劃・在九零年初期、濱南工業區計劃包含石化廠、鋼鐵廠、以及港口、預定設在七股潟湖北邊・濱南計劃對蚵床及魚塭污染的影響、引起強大在地反彈; 而對於瀕臨絕種黑面琵鷺的威脅、更引起國際反對聲浪・此外、濱南計劃增加台灣百分之二十五二氧化碳排放量、需要新建兩個水庫或海水淡化廠提供所需水量・

另一個經濟發展計劃是設立南瀛國家風景特定區・這個濱海風景區計劃將帶來觀光業以及地方產品銷售市場的擴大、也不會嚴重干預既有漁業活動・國家風景區計劃、不管在地方或國際上、皆被視爲永續的經濟發展策略・

國際機場預定建在與濱南計劃相似的位置上、位於國家風景特定區的中心・這機場計劃預計增加五萬兩千個就業機會、其中工作機會的提供多在前五年機場的工程興建期・機場興建後伴隨而來的都市化發展、預計再提供兩萬五千個就業機會、這機場計劃預計創造一百八十億台幣的收益・

目前機場和其緊鄰的自由貿易港區的計劃面積、已經大於原始評估計劃兩倍、這使我們質疑整個機場規劃的完整性・

七股國際機場計劃被視爲可以創造鄉村經濟榮景的手段・然而、貨物加工港設立的真正獲利、與機場興建的損益成本、需要在國家與地方層次上、仔細地被分析・我們的研究顯示、替代策略方案可以帶來相等甚至更多的經濟利益、並且減少可能的風險與負面成本・

國家層面的問題

當七股國際機場被其支持者描繪成台灣全球競爭下不可或缺的國際轉運站、證據卻顯示興建七股機場可能是不利國家整體發展的錯誤政策・事實上、中正機場與高雄機場的擴充即可滿足國際運貨服務、而激烈的競爭關係使得國際貨運公司傾向停靠國家的主要機場、以台灣而言、爲中正國際機場・在一個相對未發展的偏遠地區建一個一千四百億的機場和加工自由貿易區可能會損害原有中正國際機場與高雄小港機場的經營、同時可能引發財務上危機、而台灣相對於中國在製造部門上的弱勢、使這情形尤其可能・

伴隨機場而來的工業與住宅的發展、將競爭使用原本已稀少的水資源、並侵佔原本魚塭與農田用地、損害在台灣全國糧食生產上扮演重要角色的台南縣農業部門與農業發展・台南縣魚塭與七股潟湖造就台灣最大水產養殖地帶、支持著一萬六千個工作機會・而位於規劃中南瀛國家風景區心臟地帶的台南沿海、其寧靜優美的地景特色、更是國家重要寶藏・優美的地景、伴隨著區域歷史和文化遺產、以及環境、宗教特色景點、使孕育中的觀光經濟迅速成長・台南縣在兩千年有一千五百萬遊客、人次增加幾乎爲十年前的兩倍、而其中台南縣沿海每年即有至少四百五十萬遊客・然而、這美麗地景的價值、可能會被噪音與發展蔓延效應所摧毀・主要旅遊景點包括鹽山、南鯤紳廟、以及馬沙溝海水浴場將會被機場噪音及其發展所影響・

2南部國際貨運機場與自由貿易區可行性評價報告，2003，台南縣

而以台南縣爲家的瀕臨絕種的黑面琵鷺、是世界上五十種稀有鳥類之一、也是台灣文化上的代表圖像・全球百分之四十到七十的黑面琵鷺、約有三百到七百隻、一直以來在七股潟湖週邊、離計劃中的機場地點大約十四公里的地方棲息、覓食、這裏是全世界最大的黑面琵鷺度冬棲息地・目前證據顯示、黑面琵鷺沒有足夠的覓食區域、而機場建設和伴隨的發展計劃、將破壞一些目前黑面琵鷺的覓食棲地、以及填掉鹽田土地、從而阻斷創造新棲地來維護黑面琵鷺永續生存的可能性・另外、設法將黑面琵鷺導引到其他區域棲息是相當具挑戰性的嘗試、至少要花很多年、也有可能永遠不會成功・

機場效應

雖然七股國際機場不會像濱南工業區計劃一樣大量增加二氧化碳排放量或移轉掉區域主要的水資源、我們研究結果指出、主要環境影響將來自飛機噪音以及與機場相關土地發展・

噪音

要評估噪音、我們使用最新美國聯邦航空總署的噪音綜合模型軟體、放入台南地理環境特質、以及台灣既有機場與航空機體的飛行運作等元素、得出機場噪音分布圖・我們模擬七股國際機場日夜平均噪音質、其爲將一天平常的噪音、以及飛機行經時的噪音平均後所得到的數值・第二個機場日夜平均噪音質的模擬圖是用中華顧問公司提供的資料所繪出・

結果顯示、超過一萬三千人居住在六十分貝以上噪音範圍內、六十分貝是台灣環保署所訂定土地限用的標準・而超過兩萬九千人將暴露在四十五分貝以上噪音範圍內、四十五分貝噪音在晚間對人體有嚴重干擾影響・噪音將使兩間學校被迫遷移、而影響範圍更波及十四間學校・此外、噪音可能會使棲息在附近的黑面琵鷺充滿警戒・

衍生發展效應

我們根據美國主要貨運機場—Memphis 機場、其衍生出七十五平方公里的發展範圍、來做機場相關衍生發展的預測・以台南市平均密度假設、我們以 1/3（25 平方公里）和 2/3（50 平方公里）Memphis 發展模擬製圖・我們假設交通出口、節點、以及就業中心點等爲影響成長地點的主要因素・第二個圖則顯示當連接機場與南科道路興建後的可能的成長模式・

第一個模擬結果預測、衍生發展將影響百分之四十台南縣沿海觀光景點、並將填掉縣內三分之一的魚塭、其結果不只影響人類的食物供給、也將破壞黑面琵鷺覓食棲地・

濱南、機場、國家風景區比較分析

矩陣模型比較分析了濱南工業區、七股國際機場、以及南瀛國家風景區計劃的經濟、環境、社會公平性等影響、結果顯示成長的觀光業不但在興建、營運、維護工程中花費較低成本、其年收益將是七股機場年收益的兩倍、而同時也提供與七股機場相同的就業機會・

國家風景區的發展、奠基在旅遊業基礎上、將提供多方面利益、包括永續就業機會和永續政府歲收、而且不會改變目前七股地區生活型態與破壞地方環境・

或　　旅遊業的工作較高的薪水收入、但前者是短期的、而且部份工作機會可能爲外勞所取代・不過、機場的衍生發展所帶來都市化的擴張效應、可能會帶來更多工作機會・

我們的分析卻也顯示、都市化的擴張將以犧牲旅遊業的發展爲代價・我們預測、持續的飛機噪音、工業與郊區發展、以及伴隨而來的交通擁擠問題、將嚴重損害七股地區寧靜優美的景色、以漁業爲主體的經濟、和鄉村風味等特色、而這些正是七股之所以吸引遊客的地方・

此外、機場、自由貿易區、以及相關建設的發展、可能將使黑面琵鷺難逃絕種命運・沿海地景的重大改變、將使旅遊業工作機會減少三分之一・當魚塭因都市化的發展而消失、沿海養殖漁業也將沒落・

這些總體負面影響使我們認爲機場和自由貿易港區計劃是一個設想不周的策略、其將弱化國家發展政策、並阻礙與南瀛國家風景區相關的地方經濟發展計劃・相反的、以國家風景區做爲創造就業機會和社區發展的手段、將是台南縣較明智的選擇・

Impact Analysis of Proposed Airport and Free Trade Zone in Tainan County, Taiwan

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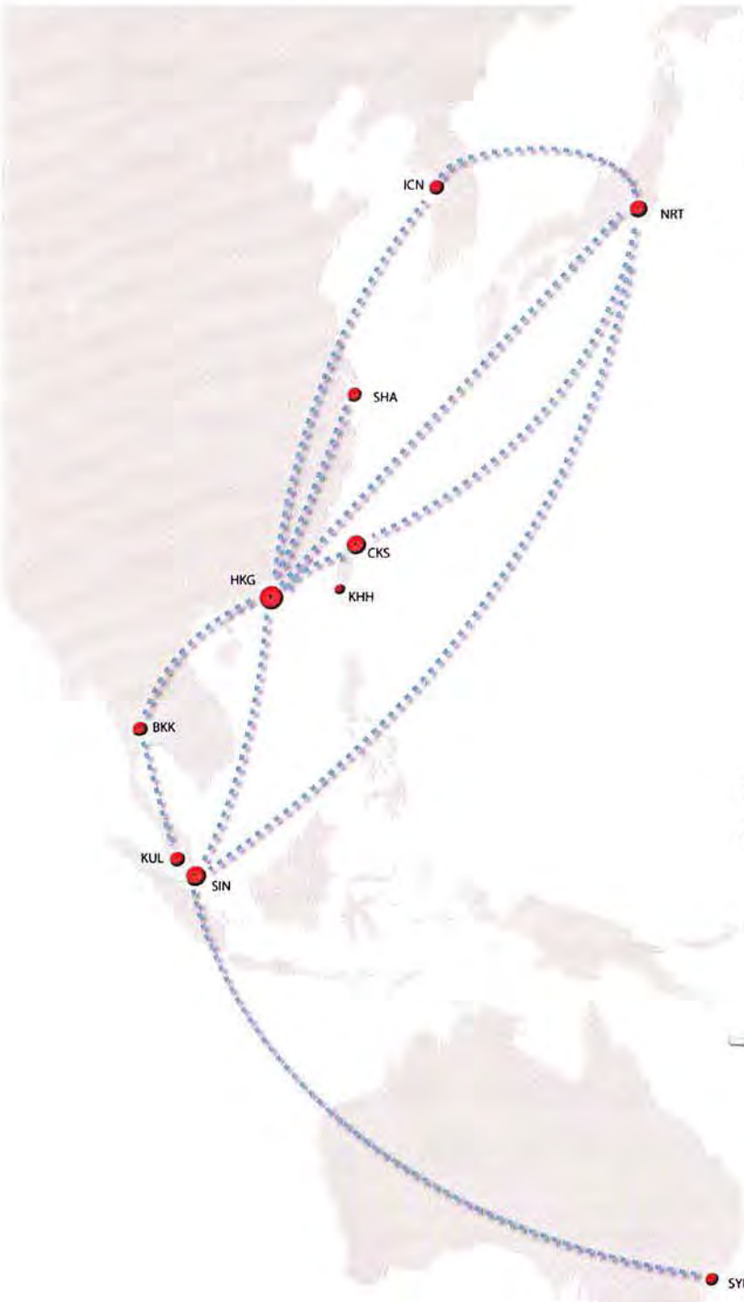
空運與臺灣經濟

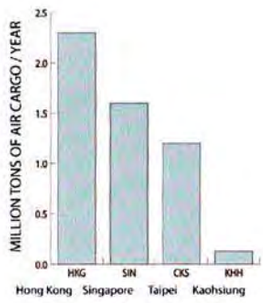


Does Taiwan Need Another International Airport?

Chiku Airport Will Weaken CKS

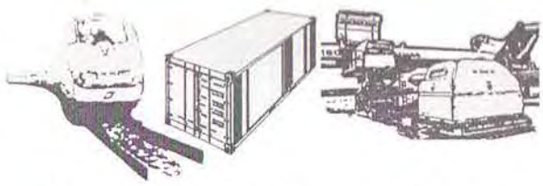
- Dynamics of competition in the air cargo industry lead to a concentration of traffic at primary airports and volatility at secondary airports.
- The Chiku airport will dilute CKS airport's competitiveness as a strategic transshipping hub in Asia.

LEADING AIR CARGO HUBS OF ASIA



Is the Chiku Airport Part of a National Transportation Strategy?

To be Competitive in an International Market, Air Cargo Must be Planned at a National Level



- Taiwan must phase modest investments according to proven opportunities in different areas. The Chiku airport will be an expensive mistake.
- Buttressing the air cargo capacity at CKS is a sound development strategy and in Taiwan's best interest.
- Investments in high speed rail will connect southern Taiwan to Taipei better than an international airport.
- Improvements in local transportation linkages in Kaohsiung will benefit a wider set of interests.

Does the Chiku Airport Make Economic Sense?

Airport Favors Manufacturing But Taiwan Needs R&D

- Taiwan's desire to increase its share of the research-and-development sector conflicts with an assembly and manufacturing industry that begins in main land China.
- R&D has a more promising future and does not need an international airport for its success.

Insufficient Regional Demand

- Chiku assembly plant won't create sufficient demand to support an international airport.
- Chiku airport is destined to be underutilized compared to its cost.
- Surveyed cargo firms aren't jumping to a site at Chiku.

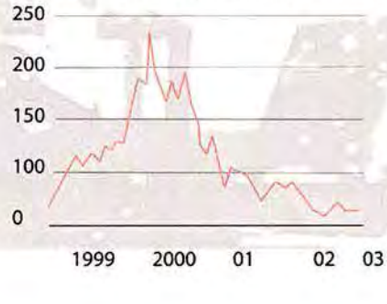
8 of 9 firms: "The Chiku airport will fail--nothing could be clearer."

APX FedEx EVA AIR DHL

Assembly Plant and Airport Are Financially Risky

- Airport and assembly plant are capital intensive and rely on a dangerously narrow economic sector for support.
- China's growing economic strength means less growth in Taiwan's high-tech manufacturing sector.

Stock Price Index of High-Tech Firms: 4 Year Trend



TAINAN COUNTY AIRPORT STUDY

Spring 2003, Environmental Planning Studio, University of California, Berkeley

AIR CARGO AND THE TAIWAN ECONOMY
空運與台灣經濟

Does Taiwan Need Another International Airport?
台灣還需要另一個國際機場嗎？

Chiku Airport Will Weaken CKS
七股國際機場將會削弱中正國際機場的國際競爭力

- Dynamics of competition in the air cargo industry lead to a concentration of traffic at primary airports and volatility at secondary airports
  空運工業的競爭機制導致交通量集中在主要機場，次要機場往往胃納不足。

- The Chiku airport stands to weaken CKS airport's competitiveness as a strategic transshipping hub in Asia
  七股機場將削弱中正國際機場成爲亞太營運中心的競爭性

Is the Chiku Airport Part of a National Transportation Policy?
七股機場是國家交通政策的一部分嗎？

To be Competitive in an International Market, Taiwan Must Plan Air Cargo at a National Level
要在國際市場中競爭，台灣必須以國家尺度規劃航空運輸

- Taiwan must phase modest investments according to proven opportunities in different areas. The Chiku airport will be an expensive mistake.
  台灣必須根據明確的效益評估從事慎重、妥善的投資。七股機場會是一個昂貴的錯誤。

- Buttressing the air cargo capacity at CKS is a sound development strategy and in Taiwan's best interest.
  補強中正國際機場的空運容量是一個明智的發展策略，將帶給台灣最大的利益。

- Investments in high-speed rail will better connect southern Taiwan to Taipei than an international airport.
  高速鐵路在扮演台灣南北交通運輸的功能上將強過一個國際機場

- Improvements in local transportation linkages in Kaohsiung will benefit a wider set of interests.
  改善地方的交通網絡－加強與高雄的交通聯繫將帶來更大的效益

Does the Chiku Airport Make Economic Sense?
七股機場具備經濟的合理性嗎？

Assembly Plant and Airport Are Financially Risky
加工出口區與機場具備經濟的危機性

- Airport and assembly plant are capital intensive and rely on dangerously narrow economic sector for support.
  加工出口區與機場的結合需要密集的資金投注，依賴單一的經濟產業支持，因此具備一定的危機。
- China's growing economic strength means less growth in Taiwan's high-tech manufacturing sector.
  大陸快速發展的經濟力量意味著台灣高科技生產的成長萎縮

Insufficient Regional Demand
區域性的需求不足

- Chiku assembly plant won't create sufficient demand to support an international airport.
  七股加工出口區不能創造足夠的需求來支持一個國際機場

- Chiku airport will be underutilized compared to its cost.
  七股機場的低利用將使之成爲一個低效益的投資

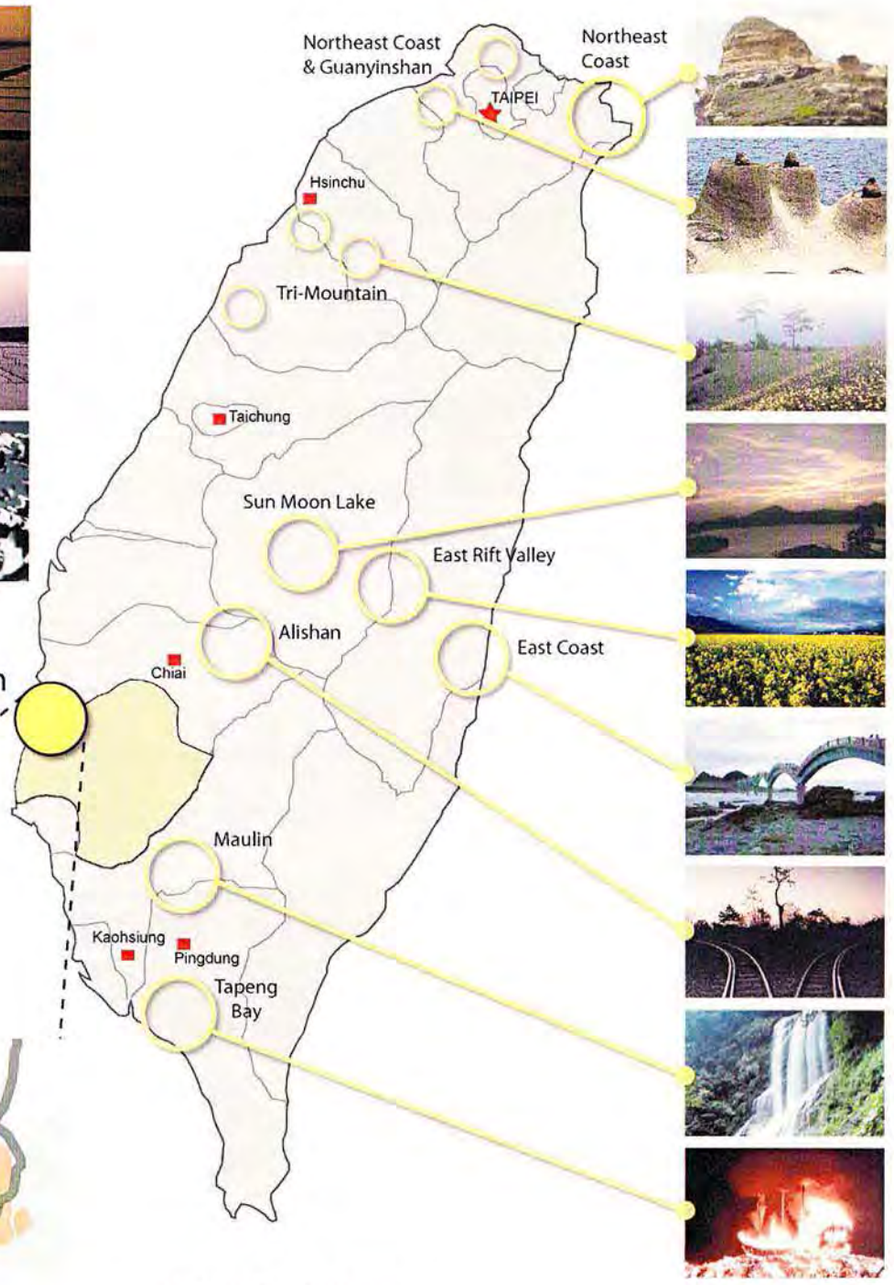
- Surveyed cargo firms aren't jumping to a site at Chiku.
  研究中大部分的空運公司並不看好七股機場

Airport Favors Manufacturing but Taiwan Needs R&D
機場嘉惠「生產」，然而台灣需要「研發」

- Taiwan's desire to increase its share of the research-and-development sector conflicts with an assembly and manufacturing industry that begins in main land China.
  發展加工生產業與台灣增加研發產業的企圖衝突，而生產工業正在大陸崛起

- R&D has a more promising future and does not need an international airport for its success.
  「研發」擁有看好的前途，並且不需要一個國際機場來確保它的成功。

NATIONAL SCENIC AREA
國家風景區



National Scenic Areas:
- National effort to preserve unique landscapes of Taiwan

Proposed Nanyin National Scenic Area:
- Encompasses about 500 square kilometers of fishponds, mangroves, dunes, beaches, and salt ponds
- Provides critical habitat for Black-faced Spoonbill and other waterfowl
- Preserves 16,000 fishing jobs and will create 51,000 new tourism jobs

Airport Undermines the Purpose of the Proposed National Scenic Area:
- Airport noise impacts a significant portion of the proposed Nanyin National Scenic Area, with 55 dB flyovers
- Airport and related growth will develop close to half of the proposed National Scenic Area in Tainan County, and may destroy more fishponds than Binnan
- The current population of Black-faced Spoonbills cannot be sustained if the habitat in the proposed National Scenic Area is not preserved

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NATIONAL SCENIC AREA
國家風景區

National Scenic Areas:
國家風景區

- Represent national effort to preserve unique landscapes of Taiwan
  國家風景區代表了台灣對獨特景觀珍惜所付出的努力

Nanyin National Scenic Area:
南瀛國家風景區

- Encompasses about 500 square kilometers of fishponds, mangroves, dunes, beaches, and salt ponds
  涵蓋了500平方公里的漁塭、紅樹林、沙丘、海灘與鹽田

- Provides critical habitat for Black-faced Spoonbill and other waterfowl
  提供了黑面琵鷺與眾水鳥們的關鍵性棲地

- Preserves 16,000 fishing jobs and will create 51,000 new tourism jobs
  保障一萬六千個漁業工作並且將創造五萬一千個以上的旅遊相關工作！

Airport Undermines the Purpose of the National Scenic Area:
機場違背了國家風景區的初衷

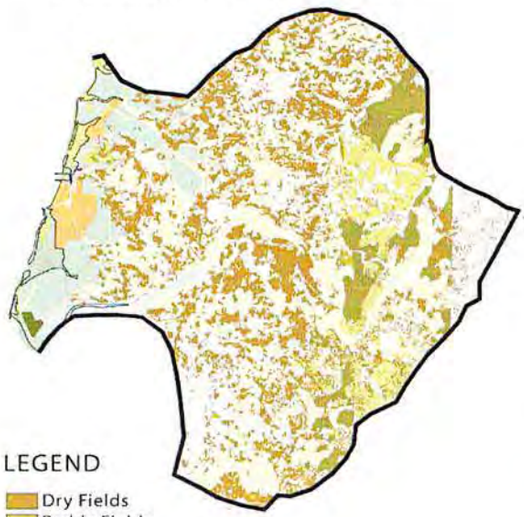
- Airport noise impacts 100% of the Nanyin National Scenic Area, with 55 dB flyovers.
  機場帶來的噪音在55分貝以上的影響範圍擴及整個國家風景區

- Airport and related growth will develop almost 40% of the National Scenic Area in Tainan County, and may destroy more fishponds than Binnan.
  機場與其衍生的相關開發將吞食半個國家風景區，並且可能帶來比濱南工業區更爲嚴重的漁業衝擊

- The current population of Black-faced Spoonbills cannot be sustained if the 150 square kilometers of habitat in the National Scenic Area are not preserved
  如果黑面琵鷺在國家風景區中 150 平方公里的棲地受到傷害，它們將無法維持它們的族群

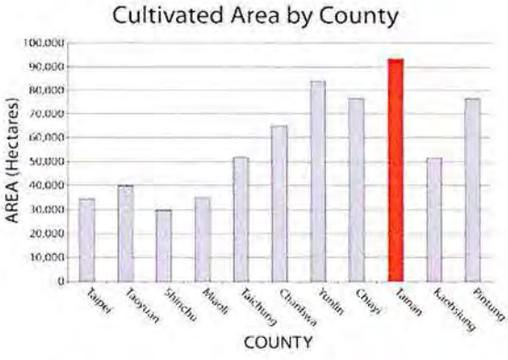
NATIONAL FOOD SECURITY
國家糧食安全

Agriculture of Tainan County

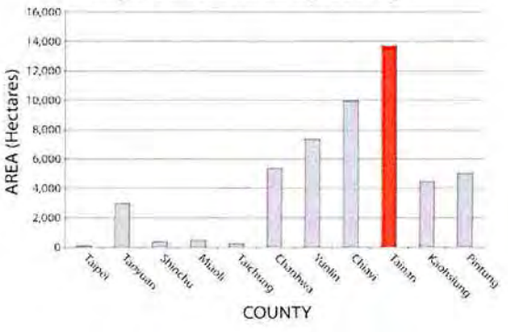


LEGEND
- Dry Fields
- Paddy Fields
- Other Agricultural
- Sensitive Ecosystem
- Forest
- Salt Ponds
- Fish Ponds
- River

Cultivated Area by County



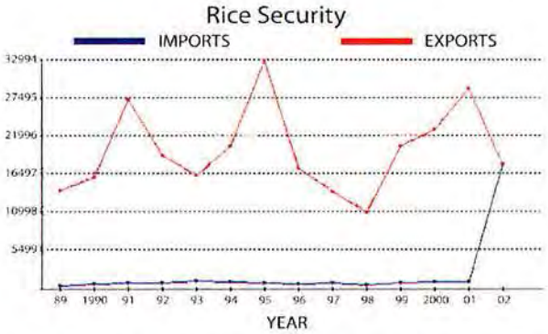
Aquaculture Area by County



- Tainan County is the "Food Bank" of Taiwan, historically supporting national food security
- Tainan is the most productive agriculture county, priding its rich agricultural diversity
- Taiwan exhibits trends leading to decreasing national food self-sufficiency, such as decreased local production and increased import dependency

Agricultural Job Loss

Rice Security



- Development of Chiku Airport undermines Taiwan's National Food Security. With airport induced growth, rapid urbanization will convert agricultural land, divert water resources, and lead to the demise of the fertile Chianan Plain's heartland. Chiku Airport could encourage farmers and fishermen to move towards export, leading to monoculture and decreased interest in supplying local demand.

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NATIONAL FOOD SECURITY
國家糧食安全

Tainan County is the "Food Bank" of Taiwan, historically supporting national food security
台南縣是台灣的「糧食銀行」，在歷史上向來守護國家的糧食安全

Tainan is the most productive agriculture county, priding its rich agricultural diversity
台南縣是全台灣最有生產力的農業大縣，具備高產量與農業的「生物多樣性」

- Tainan County has the most cultivated and aquaculture areas in Taiwan
  台南縣擁有全台最大的耕地與水產面積
- Chiku lagoon has exceptionally high rates of fishery yield
  七股潟湖有出奇高的農業生產量與漁獲量
- Tainan County has high agricultural diversity
  台南縣擁有高農業多樣性

Taiwan exhibits trends leading to decreasing national food self-sufficiency, such as decreased local production and increased import dependency
然而由於地方生產量的減少和對進口食品的倚賴，台灣的糧食自給性卻日漸降低

- Agricultural jobs are decreasing
  從事農業人口日漸降低
- WTO impact-increased import rate
  WTO 造成日漸增高的進口率
- Liberalization of agriculture has threatened Taiwan's level of self-sufficiency
  農業自由競爭的結果降低了台灣的糧食自給性
- Small farm households are decreasing, large farm households are increasing
  「小農」減少而「大農」增加

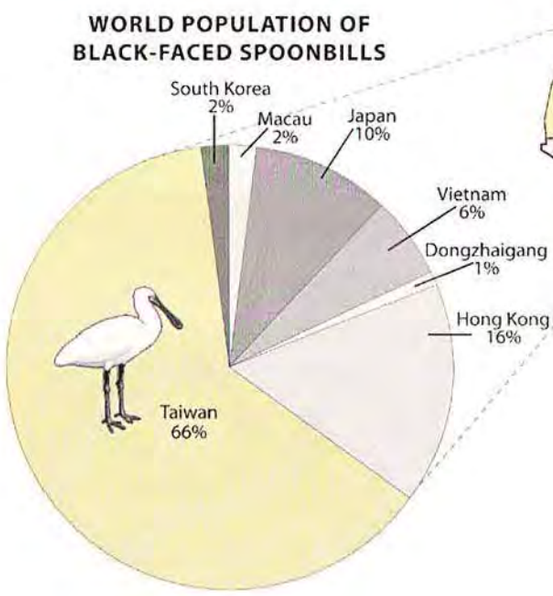
Development of Chiku airport undermines Taiwan's National Food Security
七股機場的建設會侵害國家的糧食安全

- With airport-induced growth, rapid urbanization will convert agricultural land, divert water resources, and lead to the demise of the fertile Chianan plain's heartland
  機場衍生的開發與鄰近土地快速的都市化會吞噬農地並造成對水資源的濫用－爲嘉南平原心臟地帶的沃土帶來浩劫
- Chiku airport could encourage farmers and fishermen to move towards export, leading to monoculture and decreased interest in supply local demand

七股機場將鼓勵地方農漁民從事「出口取向」與高利潤的「單一栽培」生產而非供應地方需求

THE BLACK-FACED SPOONBILL -- TAIWAN'S NATIONAL BIRD
黑面琵鷺 —臺灣之鳥

BLACK-FACED SPOONBILL AS A CULTURAL ICON



- The Black-faced Spoonbill is one of the 50 rarest birds in the world.
- The world population of Black-faced Spoonbills is near 1,000.
- 66% of the world population of Black-faced Spoonbills roost in Chiku lagoon.
- 500,000 to 800,000 tourists visit Tainan County's roosting Black-faced Spoonbills annually.
- From December 2002 to January 2003, a botulism outbreak in Taiwan killed 7% of the world population -- 73 birds. Experts believe lack of fresh food due to insufficient foraging habitat caused the die-off.
- Building an airport in Tainan County jeopardizes the last remaining spoonbill habitat in Taiwan.
- The proposed Nanyin National Scenic Area will preserve the existing spoonbill habitat therefore protecting the current population.
- When touring Chiku in Tainan County, President Chen Shui-bian stressed that such attractions as the Black-Faced Spoonbill Conservation Park, the Chiku Lagoon Water Recreational Area, the Salt Industry Cultural Park and the "blue highway" of Neihai are all listed as focal points of the new National Development Plan. *(Taiwan Headlines, Friday, August 23, 2002)*

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BLACK-FACED SPOONBILL - TAIWAN'S NATIONAL BIRD
黑面琵鷺－台灣之鳥

- The Black-faced Spoonbill is one of the 50 rarest birds in the world.
  黑面琵鷺是全世界最稀有的五十種鳥類之一

- The world population of Black-faced Spoonbills is near 1,000.
  黑面琵鷺在全世界的族群數目僅接近一千隻

- 66% of the world population of Black-faced Spoonbills roost in Chiku lagoon.
  全世界66%以上的黑面琵鷺在台南七股潟湖地區棲息

- 500,000 to 800,000 tourists visit Tainan County's roosting Black-faced Spoonbills annually.
  每年有五十萬到八十萬的遊客專程到七股拜訪黑面琵鷺

- From December 2002 to January 2003, a botulism outbreak in Taiwan killed 7% of the world population -- 73 birds. Experts believe lack of fresh food due to insufficient foraging habitat caused the die-off.
  2002年12月到2003年1月，肉毒桿菌在台灣殺死了73隻黑面琵鷺－全世界7%的族群。

- Building an airport in Tainan County jeopardizes the last remaining spoonbill habitat in Taiwan.
  在台南縣沿海地帶蓋機場對僅存的黑面琵鷺族群棲地必定帶來傷害

- The proposed Nanyin National Scenic Area will preserve the existing spoonbill habitat therefore protecting the current population.
  計畫中的南瀛國家風景區能保護「黑皮」的棲地也因此能保護它們的族群

- When touring Chiku in Tainan County, President Chen Shui-bian stressed that such attractions as the Black-Faced Spoonbill Conservation Park, the Chiku Lagoon Water Recreational Area, the Salt Industry Cultural Park and the "blue highway" of Neihai are all listed as focal points of the new National Development Plan. (Taiwan Headlines, Friday, August 23, 2002)
  陳總統在遊覽七股地區時，曾提出像黑面琵鷺保護區、七股潟湖水上樂園、鹽場文化園區與內海藍色公路這些迷人的點子應列入新的國家重點發展計畫之中。

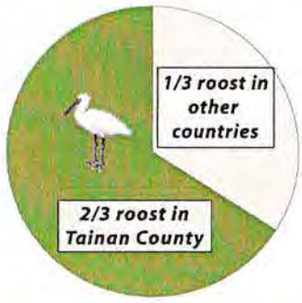
BLACK-FACED SPOONBILL -- EXISTING HABITAT CONDITIONS
黑面琵鷺之棲地現況

Tainan County's Wetlands Support 150 Species of Shorebirds

- Habitat protects 23 shorebird species
- Black-winged stilt and Kentish plover are species of special concern – they breed locally

Tsengwen River Estuary is the Largest Wintering Site of Black-faced Spoonbills in the World

- Each year, number of roosting spoonbills at Tsengwen grows
- Coastal Tainan County provides special habitat for the spoonbill
- Spoonbills need shallow, open water 600-1,000 m^2 in size for roosting
- The site must be secluded and protected from the wind
- Spoonbills roost during the day and forage at dusk, dawn, and at night.

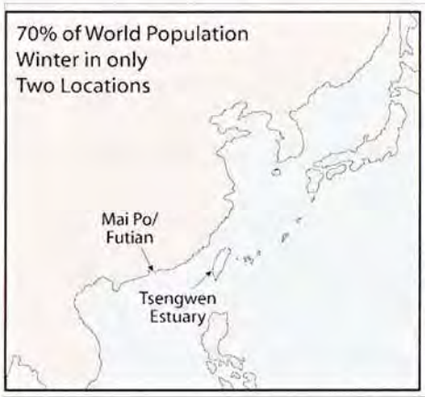


Spoonbills Depend on Fish Ponds 9-14 km from Roosting Site for Food

- Spoonbills eat small fish, mollusks and shrimp, all abundant in coastal Tainan County
- They forage in wetlands, mudflats and salt ponds 5-20 cm. deep
- Spoonbills can fly up to 30 km while foraging

Light, Noise and Raptor-like Behavior Disturb Spoonbills

- Birds mistake airplanes flying overhead for raptors, studies show



Spoonbill Wintering Habitat is Being Lost World-Wide

"Although the 'increase' of BFS is good news, the birds are getting more concentrated to a handful of sites: more than 70% of the global population are now only wintering at two sites with a total area of about 10,000 ha" (Simba Chan, Hong Kong Bird Watching Society Message board, posted 02/25/03).

Dangerously High Number of Black-faced Spoonbills Die of Botulism – Future of Habitat Unsure

In the Recovery Suite (Image: Dr Fang-tse Chan)

- Botulism killed 73 spoonbills at the Tsengwen River Estuary in 2002-2003 season
- Food supply shortage forced birds to eat toxic food, local experts think
- Clearly, ecological reserve cannot support its growing numbers of spoonbills

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BLACK-FACED SPOONBILL – EXISTING HABITAT CONDITIONS
黑面琵鷺的棲地現況

Tainan County's Wetlands Support 150 Species of Shorebirds
台南縣的溼地支持了 150 種水鳥的生活

- Habitat protects 23 "protected species"
  沿海棲地－至少 23 種「保育類」鳥種在此棲息
- Black-winged stilt and Kentish plover are species of special concern – they breed locally
  高翹鴴與東方環頸鴴值得人們特別的關注－它們依賴當地的生態環境繁殖

Tsengwen River Estuary is Largest Wintering Site of Black-faced Spoonbills in the World
曾文溪口是全世界最大的黑面琵鷺越冬棲地

- Each year, number of roosting spoonbills at Tsengwen grows
  每一年在曾文溪口棲息的「黑皮」都在增加
- Coastal Tainan County provides special habitat for the spoonbill
  台南「鹽分地帶」是琵鷺們休養生息的好所在
- Spoonbills need shallow, open water – 600m^2-1,000m^2 in size for roosting
  黑面琵鷺需要淺而開闊的水域－600 到 1000 平方公尺的面積
- They need to be secluded and protected from the wind
  它們需要隔離並免受強風侵襲的棲地
- Spoonbills roost during the day and forage at dusk, dawn, and at night
  它們在白天睡覺，然後在晨昏與黑夜出去覓食

Spoonbills Depend on Fish Ponds 9 km-14 km from Roosting Site for Food
黑皮」依賴距離主棲地 9 到 14 公里的漁塭作爲食物來源

- Spoonbills eat small fish, mollusks, and shrimp, all abundant in coastal Tainan County
  「黑皮」吃小魚、軟體動物和蝦子，這些食物在台南沿海地區非常的豐盛。
- They forage in wetlands, mudflats and salt ponds 5-20 cm. deep
  它們在水深 5 到 20 公分的溼地、泥灘地和鹽田覓食
- Spoonbills can fly up to 30 km while foraging
  黑面琵鷺可以飛到距離主棲地 30 公里遠的地方覓食

Light, Noise, and Raptor-like Behavior Disturb Spoonbills
光線、噪音和「疑似猛禽」的行爲都會驚擾黑面琵鷺

- Birds mistake overhead airplanes for raptors, studies show
  研究顯示鳥類會將飛過的飛機誤會成猛禽

Black-Faced Spoonbill Wintering Habitat is Being Lost World-wide –70% of World Population Winter in Only Two Locations
黑面琵鷺度冬棲地全球性的破壞消失－全球 70%的黑皮僅在兩處越冬

> *"Although the 'increase' of BFS is good news, the birds are getting more concentrated to a handful of sites: more than 70% of the global population are now only wintering at two sites with a total area of about 10,000 ha" (Simba Chan, Hong Kong Bird Watching Society Message board, posted 02/25/03).*
> *「儘管黑面琵鷺族群數量的增加是一個好消息，它們卻日漸集中在屈指可數的棲地－70%的全球族群現在僅在兩處過冬，總面積不過一萬公頃。」 Simba Chan, 香港觀鳥協會, 02/25/03.*

Dangerously High Number of Black-faced Spoonbills Die of Botulism – Future of Habitat Unsure
大量的黑面琵鷺死於肉毒桿菌－棲地未知的未來

- Botulism killed 73 birds at Tsengwen River Estuary in 2002-2003 season
  2002 年底到 2003 年年初，肉毒桿菌在曾文溪口殺死了 73 隻黑面琵鷺

- Food supply shortage forced spoonbills to eat toxic food, local experts believe
  地方專家認爲食物的短缺迫使黑面琵鷺吃「不良品」－有毒的食物

- Clearly, ecological reserve cannot support its growing numbers of black-faced spoonbills
  明顯的，現有生態保護區的劃設並不能支持黑面琵鷺族群的成長。

BLACK-FACED SPOONBILL -- POPULATION PROJECTIONS
黑面琵鷺之族群數量預測

Future of the Black-faced Spoonbill is in Question

- Wetland habitat is rapidly being lost to development
- World population numbers are too small to ensure long-term survival of species
- From December 2002 - Febuary 2003, botulism killed 73 spoonbills roosting in world's largest wintering location, the Tsengwen River Estuary

Taiwan Must Support 2,000-3,300 Spoonbills to Ensure Long-term Survival of Species

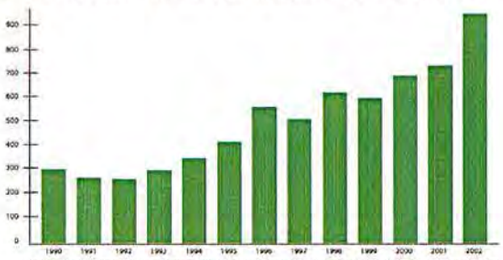
- 3,000 to 5,000 Black-faced Spoonbills are needed for a sustainable world population, estimates show
- Historically, Taiwan has supported 1/2-2/3 of world population, due to its unique environmental conditions

"Obviously, the ecological reserve is not large enough to ensure sources of food for hundreds of Black-faced Spoonbills."

Su Ying-kwei, TSU legislator
Taipei times, Dec 29, 2002

More Roosting Sites Needed in Coastal Tainan Region

Black-faced Spoonbill winter global population estimates, 1990-2002



Black-faced Spoonbill winter global population estimates, 1990-2002. Estimates for 1990 from Kennerly (1990); for 1991, 1992, and 1993 from Gao and Hwang (1994); and for 1999, 2000, 2001, and 2002 from Dahmer and Kelley (2002).

- Main roosting site at Tsengwen River Estuary cannot support growing numbers of spoonbills
- In January 2002, 155 birds migrated to Ssutsao, leaving 427 in main roosting area
- Food shortages forced birds to leave, local experts believe
- At Ssutsao, birds were roosting in strange places, such as up in trees

With More Roosting Sites, Region Could Support 2,200 More Spoonbills

PHOTO COURTESY OF HUANG WEN-HSIN

- Tainan County can support 1,220 Black-faced Spoonbills in 152 km^2 of habitat if proposed roosting sites are created
- Region can support 2,200 Black-faced Spoonbills in 275.75 km^2 of habitat if proposed roosting sites are created

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BLACK-FACED SPOONBILL – POPULATION PROJECTIONS
黑面琵鷺—族群數量預測

Future of the Black-faced Spoonbill is in Question
黑面琵鷺的未來在哪裡？

- Wetland habitat is rapidly being lost to development
  因爲開發，我們的溼地迅速的消失

- World population numbers are too small to ensure the long-term survival of the species
  黑面琵鷺的全球「鳥口」總數過少，不足以確保族群長期的生存。

- From December 2002 Febuary 2003, botulism killed 73 spoonbills roosting in the world's largest wintering location, the Tsengwen River Estuary
  2002年底到2003年年初，肉毒桿菌在曾文溪口殺死了棲息在全球最大的越冬棲地－曾文溪口的73隻黑面琵鷺。

Taiwan Must Support 2,000 – 3,300 Spoonbills to Ensure Long-term Survival of Species
台灣必須支持2,000-3,300
隻黑面琵鷺的生存以確保物種的長期生存

- 3,000 to 5,000 Black-faced Spoonbills are needed for a sustainable world population, estimates show
  研究指出，3,000 到 5,000隻的族群數目是確保世界永續族群的底限

- Historically, Taiwan has supported 1/2 - 2/3 of world population, due to its unique environmental conditions
  在歷史上，台灣獨特的自然生態環境支持了全球1/2 - 2/3黑面琵鷺族群的生存

"Obviously, the ecological reserve is not large enough to ensure sources of food for hundreds of Black-faced Spoonbills." – Su Ying-kwei, TSU legislator, Taipei times, Dec 29, 2002
「明顯的，現有生態保護區的劃設不夠大，以至於不能確保幾百隻黑面琵鷺足夠的食物來源。」－蘇盈貴

More Roosting Sites Needed in Coastal Tainan Region.
台南海岸地帶需要更多的棲地

- Main roosting site at Tsengwen River Estuary cannot support growing numbers of spoonbills
  曾文溪口的主棲地不能支持數目增加中的黑面琵鷺

- In January 2002, 155 birds migrated to Sutsao, leaving 427 in the main roosting area
  2002年1月，155隻黑面琵鷺飛到四草，留下427隻在主棲地。

- Food shortages forced birds to leave, local experts believe
  地方專家認爲食物的短缺迫使黑面琵鷺離開

POTENTIAL FOR SPOONBILL HABITAT EXPANSION
因應黑面琵鷺族群數成長的棲地擴充可能性探討

Spoonbills in Tainan County and Beyond

- Black-faced Spoonbill population in jeopardy: size is small, based in single location
- Need to establish metapopulations elsewhere
- Region can support 2,400 birds -- a sustainable population -- in 305.75km^2 of habitat if new roosting sites shown at right in Chiayi and Yulin counties are created and saltponds converted

Risks of Time, Failure, Injury

If new roosting sites are created, how effective will they be? Will spoonbills expand their range? Will a sustainable population be created?

- **Years of work**
  Restoration process is complex and takes time -- could be decades to develop a functioning ecosystem. Recreated habitat might never be as diverse.

- **How to move birds?**
  Even if functional habitat is created, how do birds get there?

  Although decoys have been successfully used to attract birds to new roosting sites, the birds were already foraging nearby. All constructed spoonbill habitat will be outside spoonbills' natural foraging area.

  In Jan. 2002, spoonbills relocated to Ssutsao on the fringe of foraging habitat. This shows the birds can migrate, but how far will they go? Stepping stone habitats may be required to gradualllly link areas where metapopulations could exist.

  Physically capturing and relocating birds puts them at risk of stress and injury.

  Relocation may also exceed existing carrying capacity of area already saturated with resident wildlife.

  Reintroduction poses ethical problems; questionable success of captive breeding programs.

Conclusions

Best way to ensure long-term survival of a threatened species is to protect/enhance existing habitat -- we know it works because it's being used.

Airport development and related growth undermines this successful habitat.

Before development can begin, sustainable spoonbill populations must be established elsewhere.





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POTENTIAL FOR SPOONBILL HABITAT EXPANSION
因應黑面琵鷺族群數成長的棲地擴充可能性探討

Spoonbills in Tainan County and Beyond
黑面琵鷺在台南縣以及其他縣市

- Black-faced Spoonbill population in jeopardy: size
  Is small, based in single location
  物種面臨危機：族群數目小並集中於一地

- Need to establish meta-populations elsewhere
  需要爲未來增加的族群數在其他地方建立關聯族群棲地

- Region can support 2,400 birds -- a sustainable population -- in 305.75km2 of habitat if new roosting sites shown at right in Chiayi and Yulin counties are created and saltponds converted
  雲嘉南區域可藉由棲地營造（嘉義、雲林地點、如圖右顯示）以及鹽田轉換成生態棲地方式，創造 305.75 平方公里野生動物棲地，將可以支持兩千四百隻黑面琵鷺—這是可以維持其族群永續生存的數目。

Risks of Time, Failure, Injury
時間、失敗、受傷等危機

- If new roosting sites are created, how effective will they be? Will spoonbills expand their range? Will a sustainable population be created?
  創造新的棲地是否真的有用？黑面琵鷺是否會擴大他們棲地範圍？是否真可能達到永續族群數目？

- Years of work
  Restoration process is complex and takes time -- could be decades to develop a functioning ecosystem. Recreated habitat might never be as diverse.
  這將需要延續數年的工作
  棲地復育過程複雜且需要長期的時間－有時可能需要幾十年來發展一個具生態功能的生態系－而重新創造的棲地其生態多樣性可能會不如預期。

- How to move birds?
  Even if functional habitat is created, how do birds get there?
  如何讓鳥遷徙
  即使棲地成功的被創造，鳥如何遷移到那裏？

  Although decoys have been successfully used to attract birds to new roosting sites, the birds were already foraging nearby. All constructed spoonbill habitat will be outside spoonbills' natural foraging area.
  雖然一些案例顯示誘捕技術已成功的將鳥轉移到新棲地，但鳥其實已經在附近覓食了。所有創造的新棲地必須在原本黑面琵鷺自然覓食區之外。

- In Jan. 2002, spoonbills relocated to Ssutsao on the fringe of foraging habitat. This shows the birds can migrate, but how far will they go?
  Stepping stone habitats may be required to gradually link areas where metapopulations could exist.

在2002年1月，一些黑面琵鷺轉移到四草的覓食區邊緣棲息，這顯示黑面琵鷺會遷徙。但遷徙可以多遠？
聯繫在主要與關聯族群棲地之間，作爲「踏腳石」的數個棲地也許是必要連帶創造的。

Physically capturing and relocating birds puts them at risk of stress and injury.
誘捕與繫放使鳥類面臨身心緊繃壓迫及受傷的生命危機。

Relocation may also exceed existing carrying capacity of area already saturated with resident wildlife.
將鳥類遷移至新棲地可能造成新棲地本身的環境承載量超載。這些棲地亦有自己的「原住民」－在地的野生動植物可能早已使環境的承載量飽和。

Reintroduction poses ethical problems; questionable success of captive breeding programs.
引進新物種到新區域引發倫理上的問題，而誘捕遷徙計劃能否成功也有疑慮。

Conclusions
結論

- Best way to ensure long-term survival of a threatened species is to protect/enhance existing habitat -- we know it works because it's being used.
確定瀕臨絕種動物長期永續生存的最佳方式是保存及改善現有棲地。這種方式已被廣泛使用、且效果良好。

- Airport development and related growth undermines this successful habitat.
機場開發以及其帶動的發展計劃將破壞原有良好、成功的棲地。

- Before development can begin, sustainable spoonbill populations must be established elsewhere.
在開發計劃開始之前，永續的黑面琵鷺族群數目與棲地必須先被建立。

GROWTH IN PROPOSED AIRPORT FOOTPRINT
機場計劃與其衍生發展

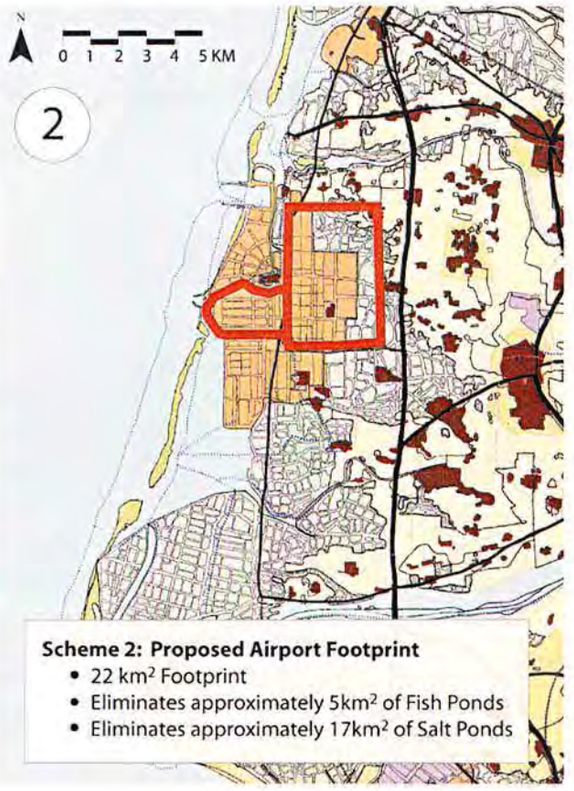
If this is such a good proposal, why does the Airport footprint keep changing?

- The constant change and growth in the proposed airport raises questions about proper planning and impact analysis
- To date other analyses have shown very little impact from the airport--has the analysis kept pace with the changes ?
- As the airport plan continues to grow, the impacts on the environment also increase
- The analysis include in this report is based on Scheme 2

LEGEND

- Existing Road Network
- Main North-South Railroad
- Planned Expressway
- "Blueway" Transportation Network
- Proposed Airport
- Industrial Use
- Urban Areas
- Planned Urban
- Agricultural
- Sensitive Ecosystem
- Salt Ponds
- Fish Ponds
- River
- Spoonbill Roosting Site

Scheme 1: Proposed Airport Footprint
- 15km² Footprint
- Eliminates approximately 5km² of Fish Ponds
- Eliminates approximately 10km² of Salt Ponds



Scheme 2: Proposed Airport Footprint
- 22 km² Footprint
- Eliminates approximately 5km² of Fish Ponds
- Eliminates approximately 17km² of Salt Ponds

Scheme 3: Proposed Airport Footprint
- 28 km² Footprint
- Eliminates approximately 5km² of Fish Ponds
- Eliminates approximately 23km² of Salt Ponds

Scheme 4: Proposed Airport Footprint
- 35 km² Footprint
- Eliminates approximately 5km² of Fish Ponds
- Eliminates approximately 30km² of Salt Ponds

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GROWTH IN PROPOSED AIRPORT FOOTPRINT
機場計劃與其衍生發展

If this is such a good proposal, why does the airport footprint keep changing?
如果說這已經是個優良的計劃，爲何機場選址總是變來變去？

- The constant change and growth in the proposed airport raises questions about proper planning and impact analysis
  機場規劃的持續改變和發展帶來了與合理規劃及影響分析有關的問題。

- To date other analyses have shown very little impact from the airport – has the analysis kept pace with the changes?
  目前根據其他分析結果，機場的影響非常有限， 問題是，這些分析是否跟進了這些變化和發展？

- As the airport plan continues to grow, the impacts on the environment also increase
  隨著機場計劃的不斷擴展，對環境的影響也在增加。

- The analysis included in this report is based on Scheme 2
  此分析作爲本報告的一部分，主要是以方案二爲基礎

Scheme 1: Proposed Airport Footprint
方案一：計劃機場選址

- 15km^2 Footprint
  15 平方公里機場用地

- Eliminates approximately 5km^2 of Fish Ponds
  大約減少 5 平方公里的魚塘

- Eliminates approximately 10km^2 of Salt Ponds
  大約減少 10 平方公里鹽田

Scheme 2: Proposed Airport Footprint
方案二：計劃機場選址

- 22 km^2 Footprint
  22 平方公里機場用地

- Eliminates approximately 5 km^2 of Fish Ponds
  大約減少 5 平方公里的魚塘

- Eliminates approximately 17 km^2 of Salt Ponds
  大約減少 17 平方公里鹽田

Scheme 3: Proposed Airport Footprint
方案三：計劃機場選址

- 28 km^2 Footprint
  28 平方公里機場用地

- Eliminates approximately 5km 2 of Fish Ponds
  大約減少 5 平方公里的魚塘

- Eliminates approximately 23km^2 of Salt Ponds
  大約減少 23 平方公里鹽田

Scheme 4: Proposed Airport Footprint
方案肆：計劃機場選址

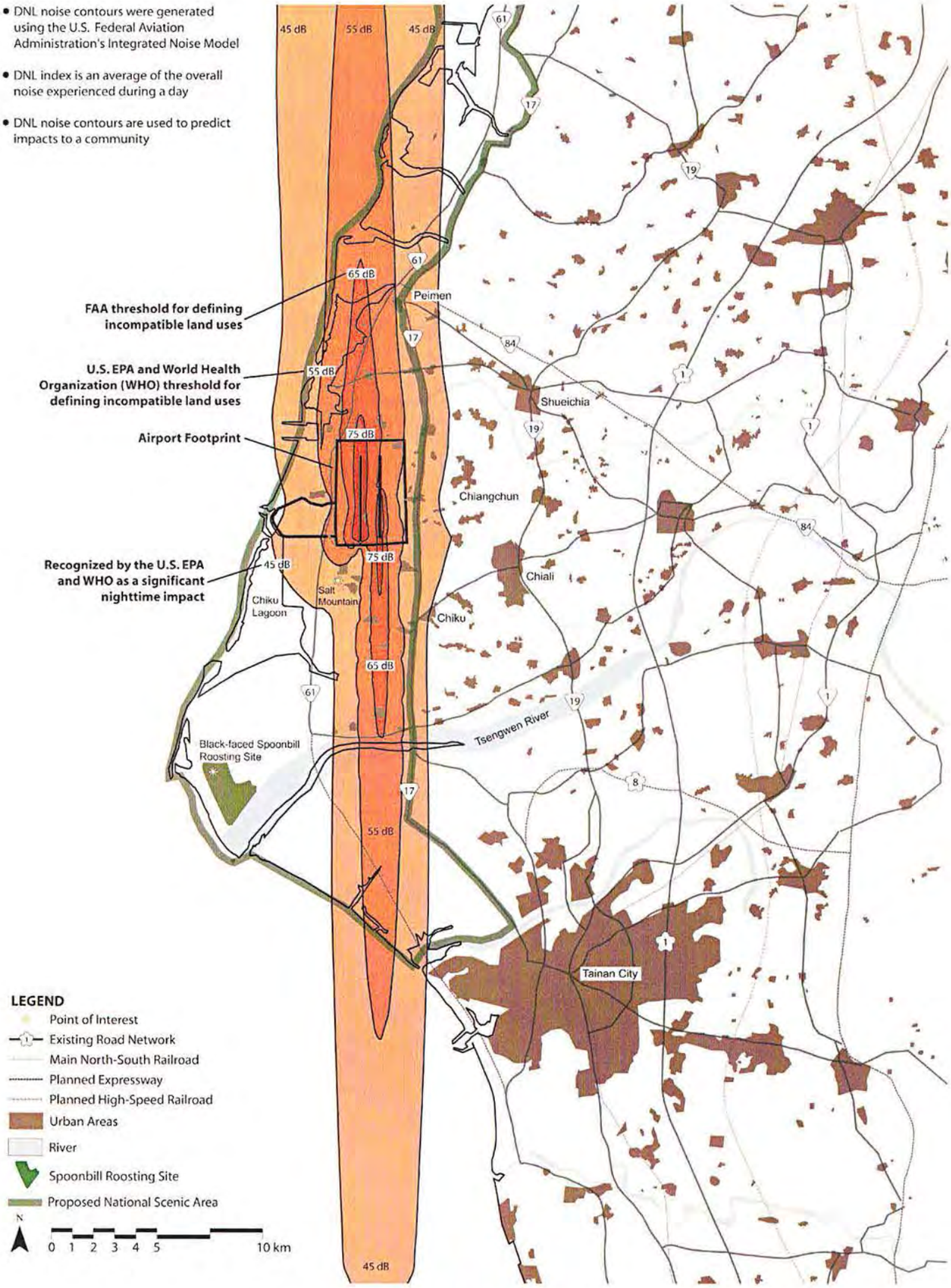
- 35 km^2 Footprint
  35 平方公里機場用地

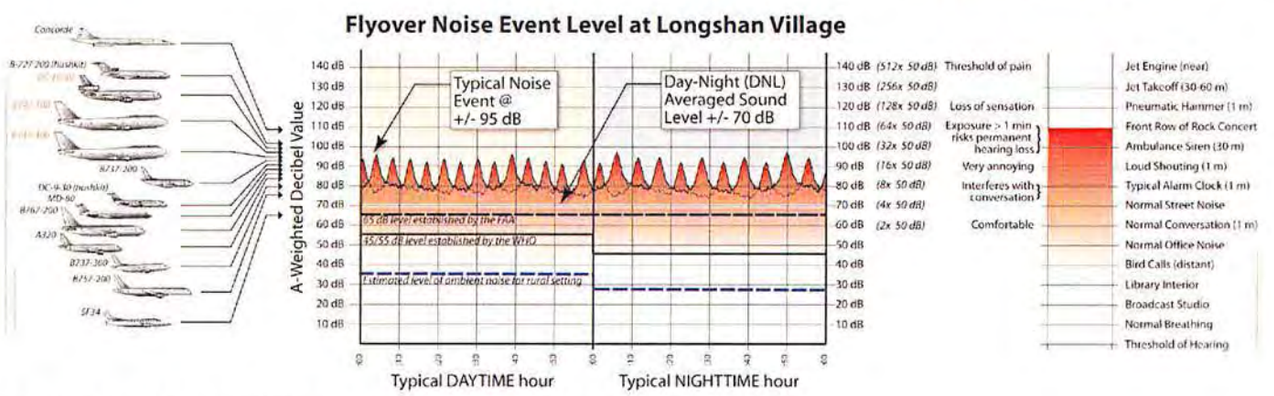
- Eliminates approximately 5 km^2 of Fish Ponds
  大約減少 5 平方公里的魚塘

- Eliminates approximately 30 km^2 of Salt Ponds
  大約減少 30 平方公里鹽田

AIRPORT DNL NOISE CONTOURS – UCB ESTIMATES
七股國際機場日夜平均噪音質—柏克萊加大評估

- DNL noise contours were generated using the U.S. Federal Aviation Administration's Integrated Noise Model
- DNL index is an average of the overall noise experienced during a day
- DNL noise contours are used to predict impacts to a community





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AIRPORT DNL NOISE CONTOURS – UCB ESTIMATES
七股國際機場日夜平均噪音質一柏克萊加大評估

- An airplane is projected to land or takeoff every 5 minutes during the day, according to our model.
  根據本模型的預測，七股國際機場日間飛機起飛頻率爲每五分鐘一班。

- The decibel scale is logarithmic; therefore, an increase of 20 decibels represents an increase of 100 times in intensity.
  分貝尺度與其對應的聲波強度爲對數關係，換言之，每增加 20 分貝，聲波強度則會相應增至原來的 100 倍。

- Day-night average sound level (DNL) noise contours were generated using FAA's Integrated Noise Model.
  日夜音量噪音分佈圖根據美國聯合航空管理局之整合噪音模式產生。

- DNL index is an average of the overall noise experienced during a day.
  日夜音量指標得自一天內噪音平均值。

- DNL noise contours are used to predict impacts to a community.
  日夜音量噪音分佈圖在此被用于預測噪音對週邊社區的影響。

AIRPORT DNL NOISE CONTOURS – CONSULTANTS' DATA
七股國際機場日夜平均噪音質—顧問公司資料

- DNL noise contours were generated using the U.S. Federal Aviation Administration's Integrated Noise Model
- DNL index is an average of the overall noise experienced during a day
- DNL noise contours are used to predict impacts to a community

Recognized by the U.S. EPA and WHO as a significant nighttime impact — 45 dB

U.S. EPA and World Health Organization (WHO) threshold for defining incompatible land uses — 55 dB

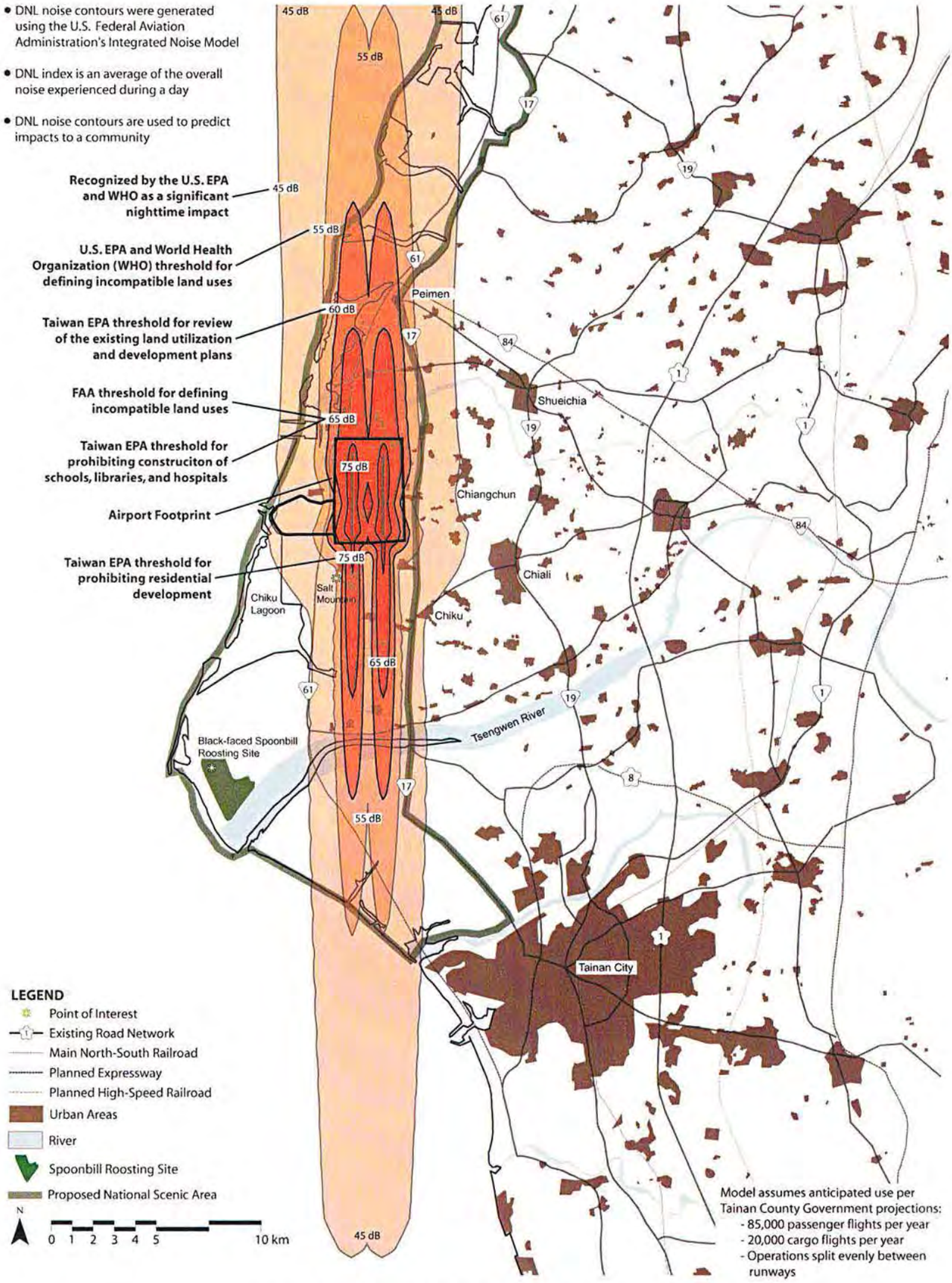
Taiwan EPA threshold for review of the existing land utilization and development plans — 60 dB

FAA threshold for defining incompatible land uses — 65 dB

Taiwan EPA threshold for prohibiting construciton of schools, libraries, and hospitals — 75 dB

Airport Footprint

Taiwan EPA threshold for prohibiting residential development — 75 dB



LEGEND

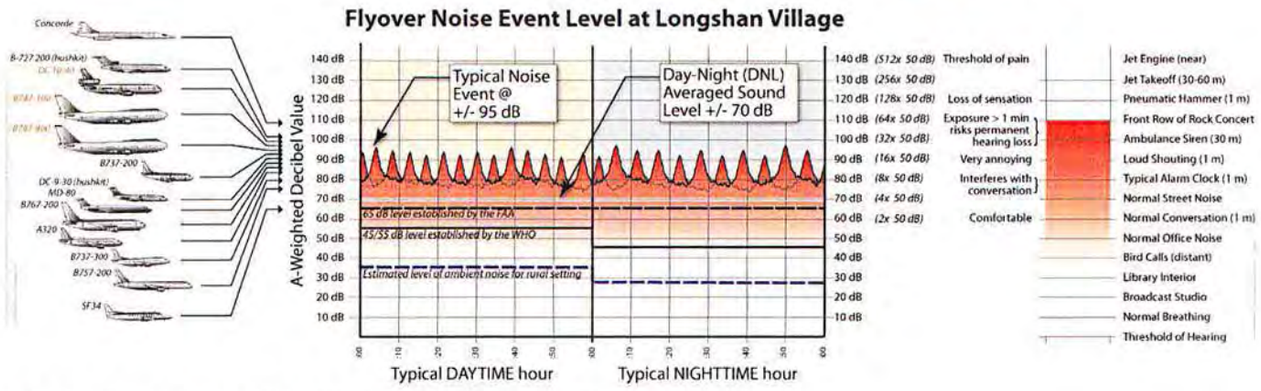
- Point of Interest
- Existing Road Network
- Main North-South Railroad
- Planned Expressway
- Planned High-Speed Railroad
- Urban Areas
- River
- Spoonbill Roosting Site
- Proposed National Scenic Area

N

0 1 2 3 4 5 10 km

Model assumes anticipated use per Tainan County Government projections:
- 85,000 passenger flights per year
- 20,000 cargo flights per year
- Operations split evenly between runways

Flyover Noise Event Level at Longshan Village



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AIRPORT DNL NOISE CONTOURS – CONSULTANTS' DATA
七股國際機場日夜平均噪音質—顧問公司資料

- An airplane is projected to land or takeoff every 5 minutes during the day, according to our model.
  根據本模型的預測，七股國際機場日間飛機起飛頻率爲每五分鐘一班。

- The decibel scale is logarithmic; therefore, an increase of 20 decibels represents an increase of 100 times in intensity.
  分貝尺度與其對應的聲波強度爲對數關係，換言之，每增加 20 分貝，聲波強度則會相應增至原來的 100 倍。

- Day-night average sound level (DNL) noise contours were generated using FAA's Integrated Noise Model.
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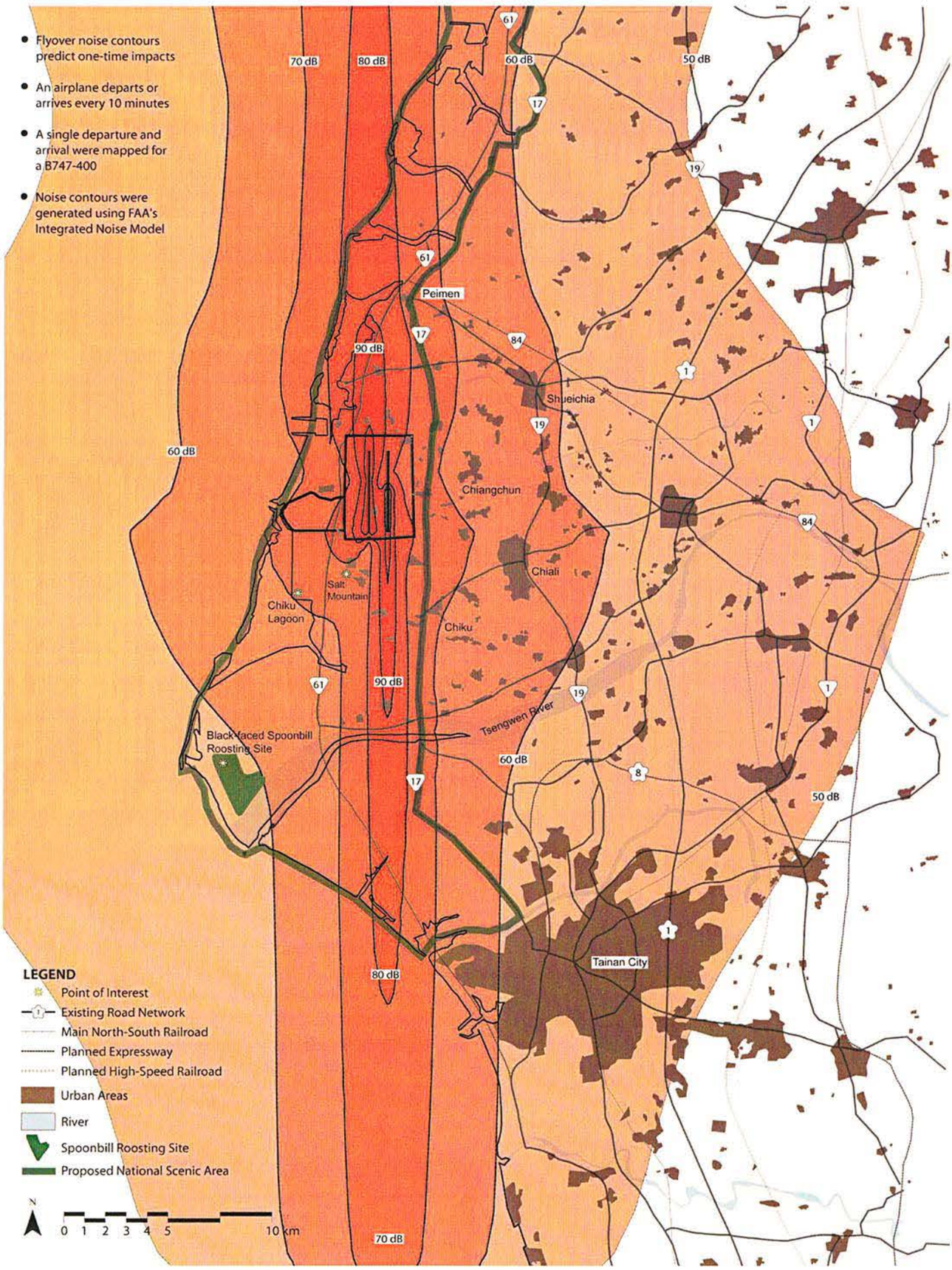
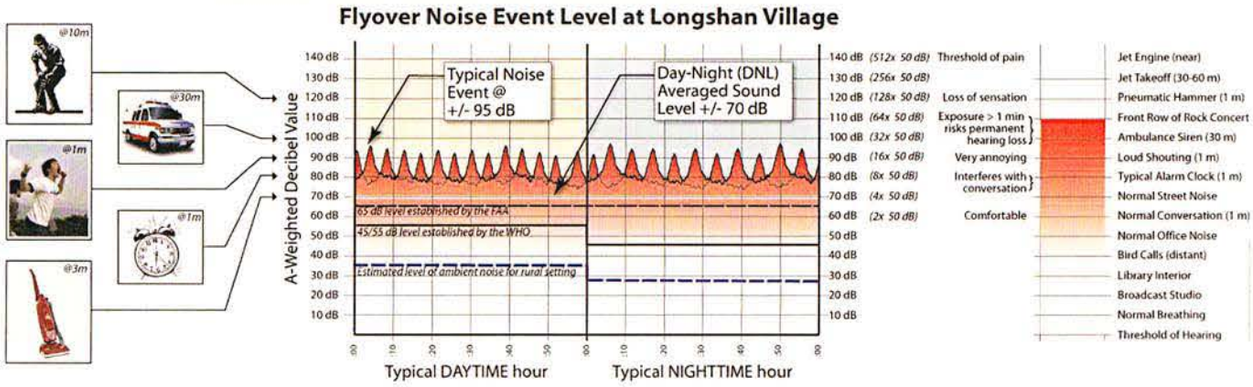
- DNL index is an average of the overall noise experienced during a day.
  日夜音量指標得自一天內噪音平均值。

- DNL noise contours are used to predict impacts to a community.
  日夜音量噪音分佈圖在此被用于預測噪音對週邊社區的影響。

AIRPORT FLYOVER NOISE CONTOURS
七股國際機場飛機行經噪音分佈圖





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AIRPORT FLYOVER NOISE CONTOURS
七股國際機場飛機行經噪音分佈圖

- Flyover noise contours predict one-time impacts.
  飛機行經噪音分佈圖適用于預測單次噪音影響。
- An airplane departs or arrives every 10 minutes.
  每十分鐘將有一架飛機起飛或降落于七股國際機場。
- A single departure and arrival were mapped for a B747-400
  本圖顯示波音 747-400 型號飛機單次起飛及降落形成的噪音分佈圖。
- Noise contours were generated using FAA's Integrated Noise Model.
  本圖所用噪音分佈圖乃使用美國聯合航空管理局之整合噪音模式產生。

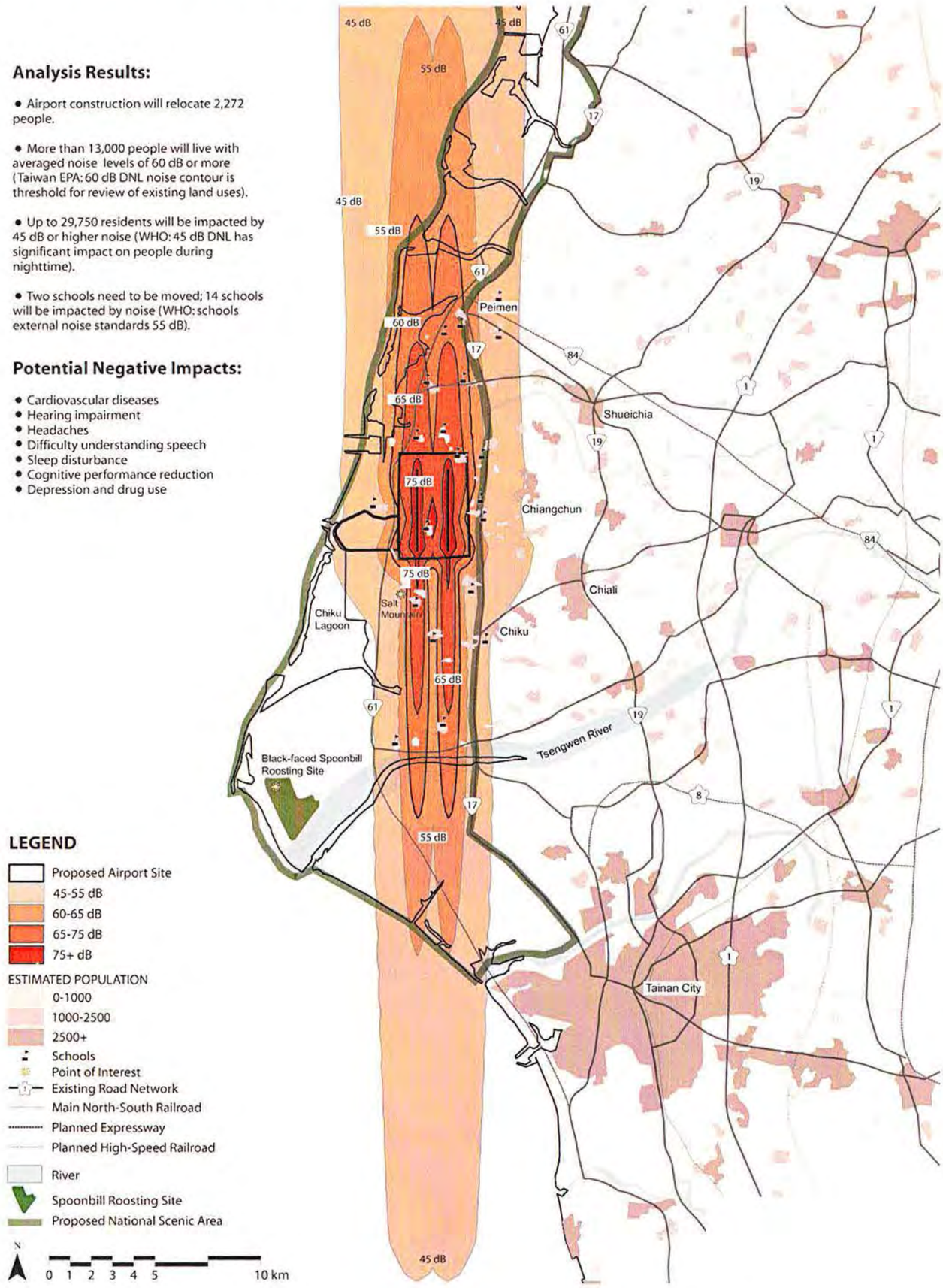
AIRPORT NOISE IMPACTS – RESIDENTS
七股國際機場噪音對居民的影響

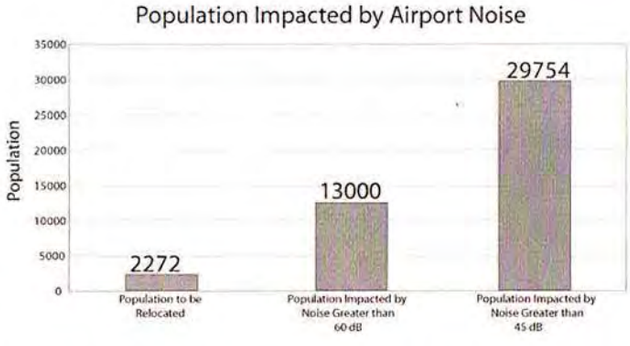
Analysis Results:

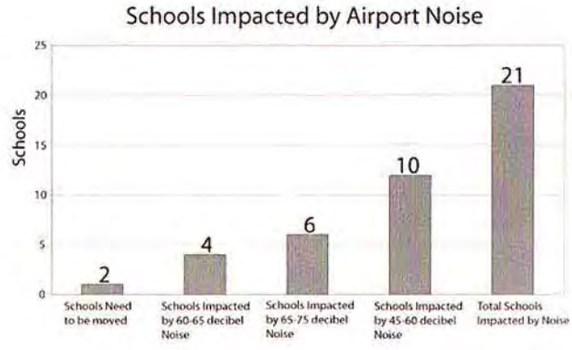
- Airport construction will relocate 2,272 people.
- More than 13,000 people will live with averaged noise levels of 60 dB or more (Taiwan EPA: 60 dB DNL noise contour is threshold for review of existing land uses).
- Up to 29,750 residents will be impacted by 45 dB or higher noise (WHO: 45 dB DNL has significant impact on people during nighttime).
- Two schools need to be moved; 14 schools will be impacted by noise (WHO: schools external noise standards 55 dB).

Potential Negative Impacts:

- Cardiovascular diseases
- Hearing impairment
- Headaches
- Difficulty understanding speech
- Sleep disturbance
- Cognitive performance reduction
- Depression and drug use







TAINAN COUNTY AIRPORT STUDY

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AIRPORT NOISE IMPACTS – RESIDENTS
機場噪音對居民的影響

- Airport construction will relocate 2,272 people
  依據統計結果，由於機場建設，2272 名居民需要被遷移。

- More than 13,000 people will live with averaged noise levels of 60 dB or more (Taiwan EPA: 60 DNL noise contour is threshold for review of existing land uses).
  超過一萬三千人的日常生活將會受到 60 分貝以上噪音的影響（台灣環保署將日夜平均噪音 60 分貝做爲檢視土地使用臨界值。

- Up to 29,750 residents will be impacted by 45 dB or higher noise (according to WHO, 45dB and higher noise would cause significant impacts on people during night time, while 55dB and higher noise would have significant impact on people during daytime).
  多達 29750 名居民將會受到 45 分貝或以上噪音的影響。 世界衛生組織認爲，45 分貝以上噪音在夜間對人有顯著影響，而 55 分貝以上的噪音則在白天對人有明顯的影響。

- Two schools needs to be moved; 14 schools will be impacted by noise (WHO: schools external noise standards 55 dB).
  兩所學校需要被拆遷，而多達 14 所學校會受到不同程度的噪音影響（根據世界衛生組織規定、學校室外噪音值爲 55 分貝）。

Potential Human Impacts from Noise:
噪音對人的潛在影響

Noise-related public health threats (WHO):
根據世界衛生組織，與噪音有關的公共健康危害如下：

- Cardiovascular disease ---"there has been a tendency for blood pressure to be higher among persons living in proximity to airports" –WTO, "Community Noise,"Stockholm, 1995
  心血管疾病---機場附近居民的血壓有比非機場附近居民血壓高的傾向

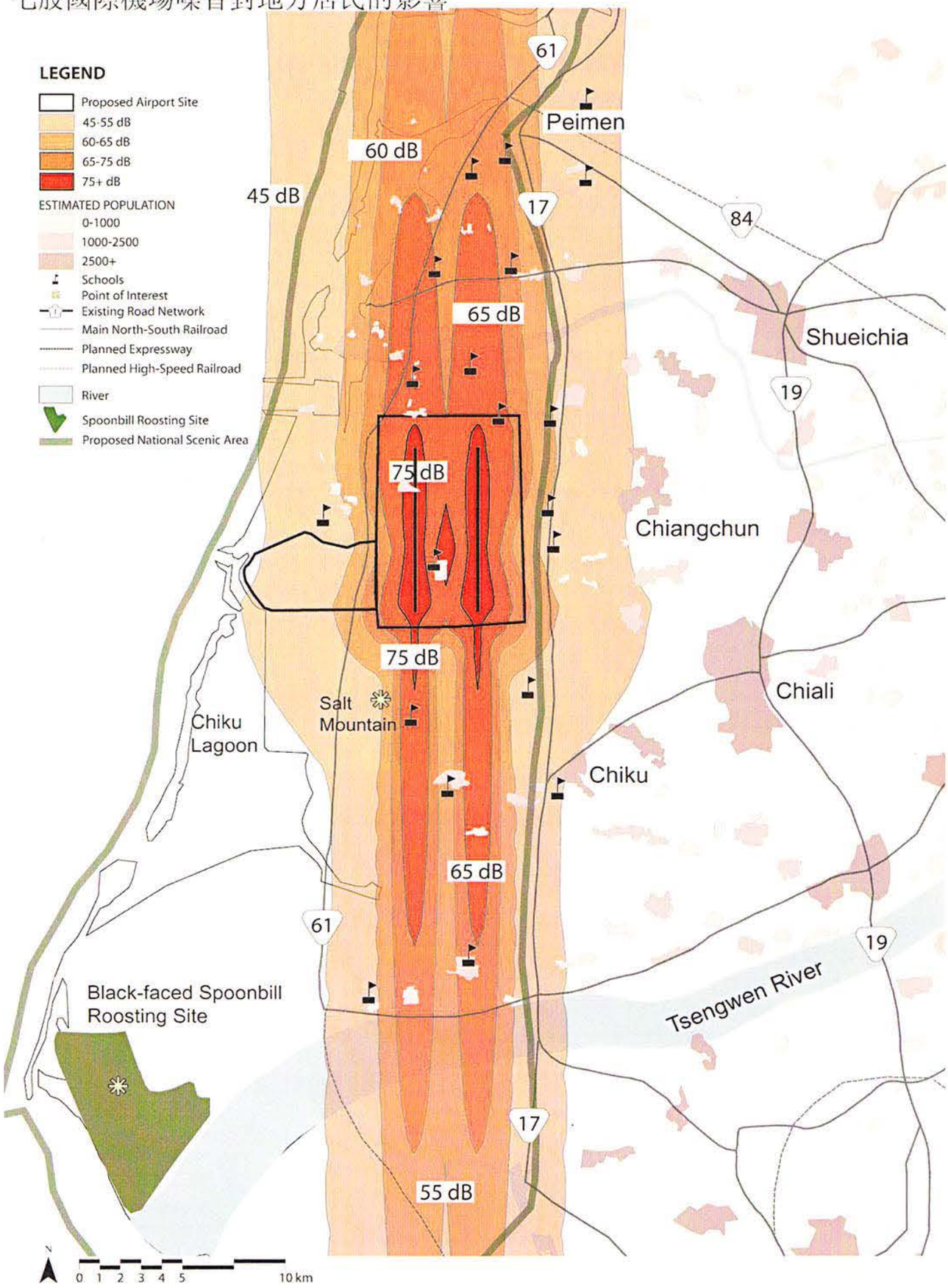
- Hearing impairment (including irreversible impairment)
  聽力損傷（包括永久性的聽力損害）

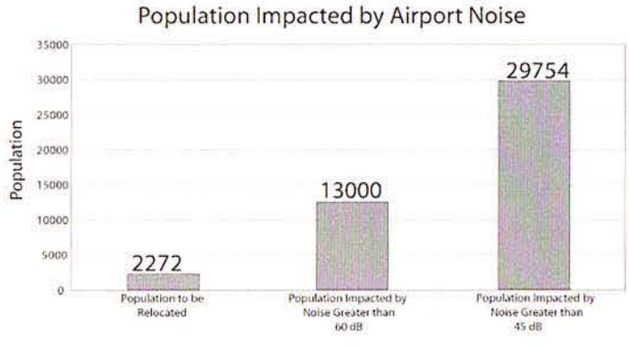
- Headaches
  頭痛

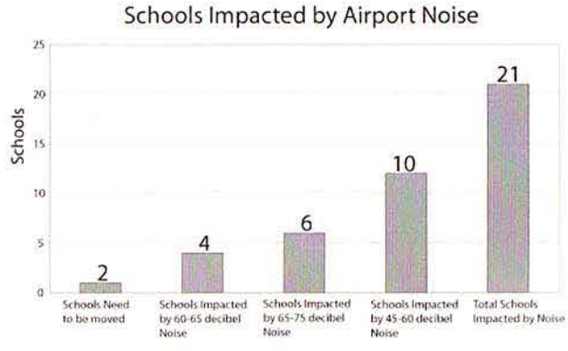
- Difficulty understanding speech (which can impair language acquisition among children)
  理解授課的困難，因而削弱了兒童與少年接受知識的能力

- Sleep disturbance (with resulting impairment in physiological and mental functions) -- "For unaccustomed young and middle-aged participants, awakening reactions start occurring from at least 50-55 db LAmax indoors, probably even at lower levels....At 65 dB LAmax, 10% of the noise events would produce a wake up, maybe among one third of the exposed persons...."

AIRPORT NOISE IMPACTS – LOCAL RESIDENTS
七股國際機場噪音對地方居民的影響







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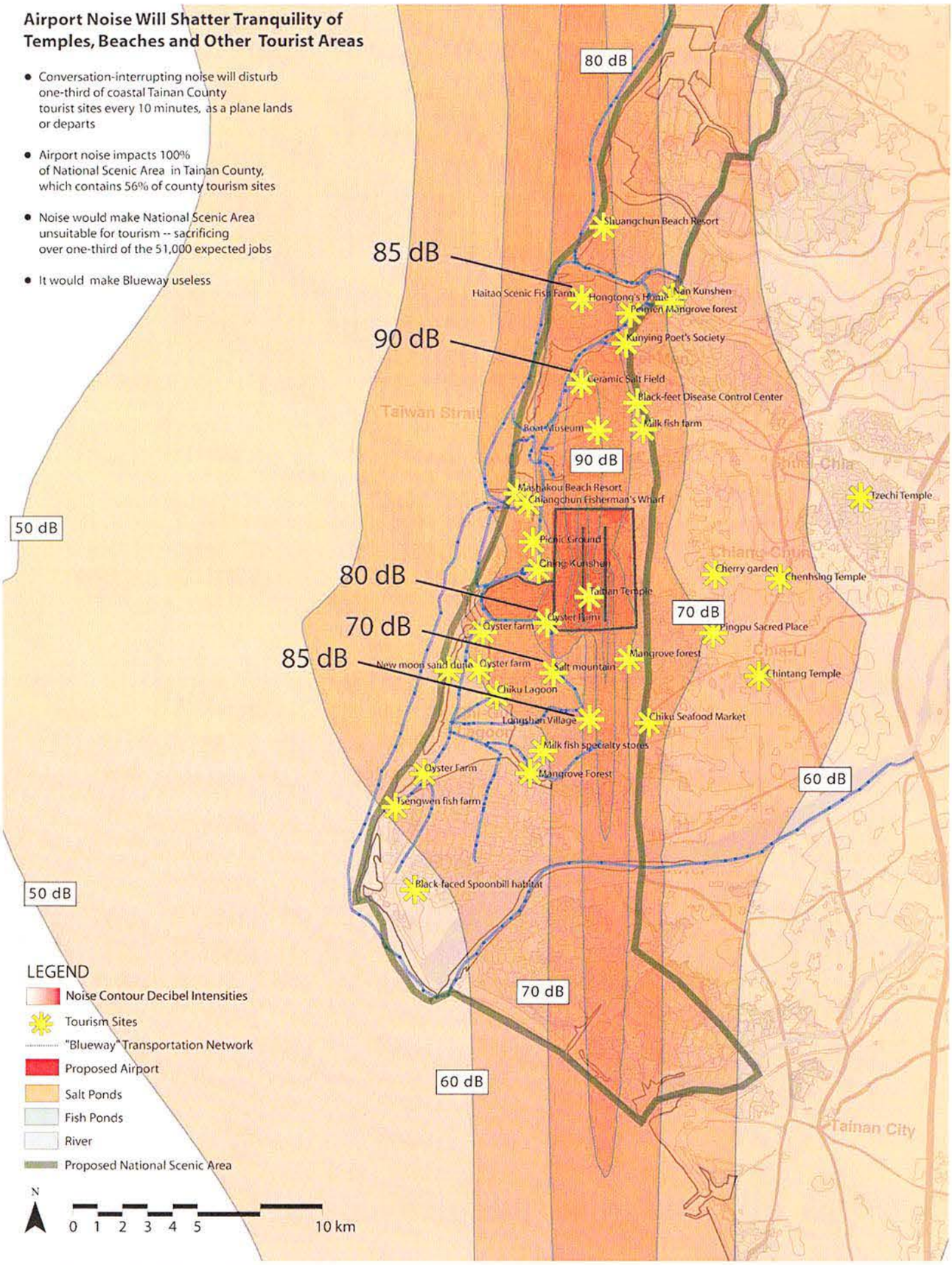
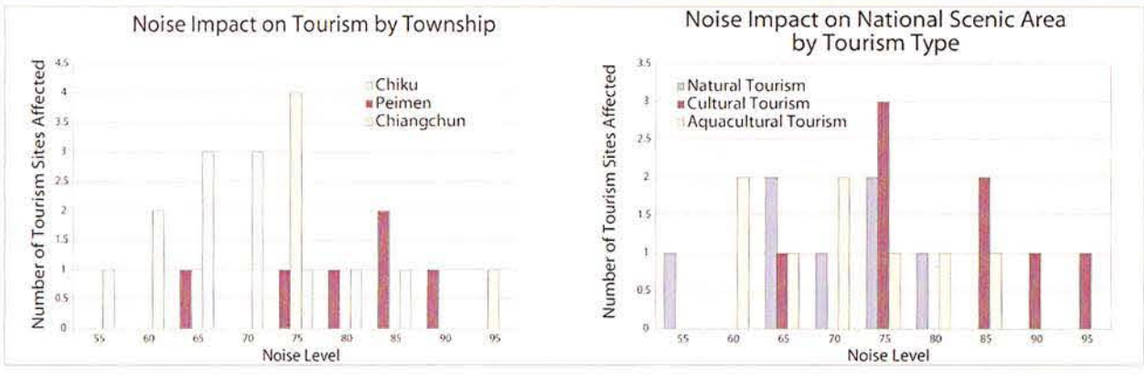
擾 ------ “根據世界衛生組織的調查研究，對於不習慣於噪音的年輕人和中年人，當內噪音達到 50-55 分貝或者更低時，他們就會被吵醒。 當噪音達到 65 分貝，對於 30%暴露在噪音下的人來說，有 10%的噪音事件會把他們吵醒……”

- Cognitive performance reduction (reading, attention, problem-solving, memorization, proofreading, motivation) -- Academic performance of children at schools within the noisiest part of the LAX air corridor lagged behind students at quieter schools after four years of exposure to noise, according to a 1980 study published in American Psychologist.
學生認知能力下降（包括閱讀、注意力、問題解決、記憶力、校對與學習動力等方面）--------根據美國心理學家在 1980 年所發表的研究，在 4 年洛杉磯機場空中噪音的影響之下，最嚴重地區的學生學業成績要比較爲安靜學校的學生成績要差。

- Depression and drug use -- “Person exposed to more than 70 dB LAeq, outdoors, report greater difficulties in falling asleep and a more extensive use of sleeping pills and ear plugs as compared to persons living in a more quiet area. Psychosocial well-being in terms of depression was reported to be worse among persons living in apartments facing a noisy street.”
憂鬱症和藥物使用---- “相較於生活在較爲安靜環境的人群，暴露在 70 分貝以上室外噪音的人較難入睡，而且往往需要服食安眠藥或使用耳塞來幫助睡眠” “生活在受噪音干擾街道附近的人群罹患憂鬱症的機會要比其他人要高。

AIRPORT NOISE IMPACTS -- TOURISM
七股國際機場對觀光旅遊業的影響





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AIRPORT NOISE IMPACTS – TOURISM
機場噪音對旅遊觀光業的影響

- Airport Noise Will Shatter Tranquility of Temples, Beaches and Other Tourist Areas
  機場噪音將危害當地寺廟，海濱休憩區及其他景點的寧靜氛圍。

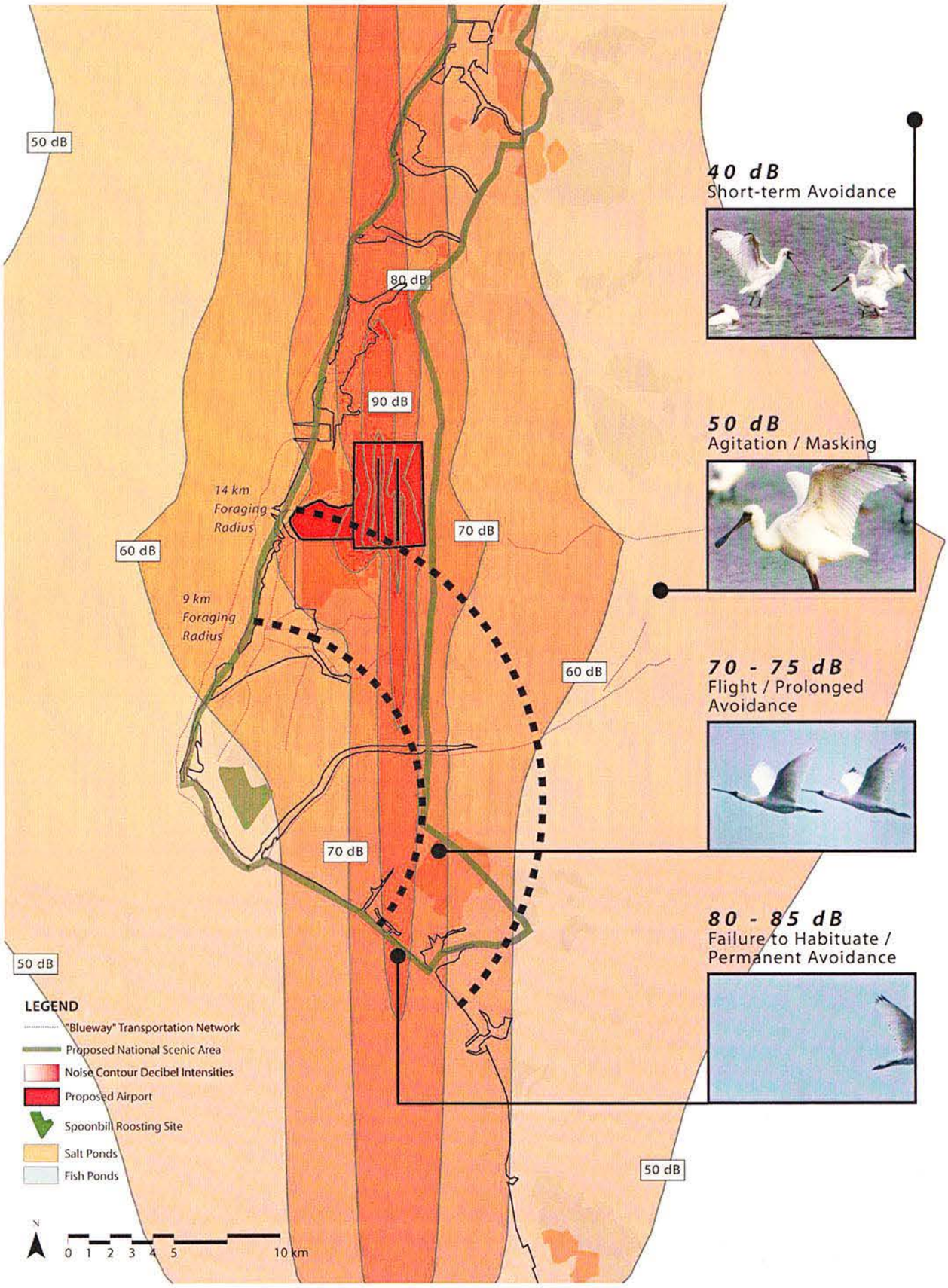
- Conversation-interrupting noise will disturb one-third of coastal Tainan County tourist sites every 10 minutes
  台南沿海觀光區三分之一的景點將每隔十分鐘受到飛機起飛或降落的噪音騷，達到影響交談的程度。

- Airport noise impacts 100% of Nanyin National Scenic Area in Tainan County, which contains 56% of county tourism sites
  機場噪音將影響到南瀛國家風景區內所有景點，即全縣 56%的主要景點。

- Noise would make National Scenic Area unsuitable for tourism – sacrificing over one-third of the 51,000 expected jobs
  機場噪音影響下的國家風景區將不再適宜發展旅遊觀光業。其預測的 51000 個工作機會會減少三分之一。

- It would make the Blue Way useless
  來自機場的噪音會嚴重影響藍色公路的使用。

AIRPORT NOISE IMPACTS -- BLACK-FACED SPOONBILL
七股國際機場噪音對黑面琵鷺的生態衝擊



- Noise from a single landing or departing flight creates a sound wall that hinders birds from accessing prime habitat and foraging areas
- Airport noise will significantly affect Black-faced Spoonbill behavior:
  - -40 dB causes short-term avoidance
  - -50 dB causes masking / agitation
  - -70-75 dB causes flight / prolonged avoidance
  - - 80-85 dB causes failure to habituate / permanent avoidance
- Black-faced Spoonbill prefers habitat protected from noise, artificial light, and raptors -- planes can resemble raptors and might cause fear and flight

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AIRPORT NOISE IMPACTS - BLACK-FACED SPOONBILL
機場噪音對黑面琵鷺的影響

Noise from Landing/Departing Flights Creates a Soundwall that Hinders Birds from Accessing Prime Habitat and Foraging Areas
飛機起降的噪音造成「音牆」－影響鳥類接近主棲地與覓食區的「導航」

Airport noise will significantly affect Black-faced Spoonbill behavior:
機場噪音將影響黑面琵鷺的生態行爲：

- 40 dB causes short-term avoidance
  40 dB 造成短暫的趨避行爲
- 50 dB causes masking / agitation
  50 dB 遮蔽其他聲音訊息，增加鳥類被天敵攻擊的機會 / 劇烈的鼓翅
- 70-75 dB causes flight / prolonged avoidance
  70-75 dB 導致飛離 / 長期的趨避行爲
- 80-85 dB causes failure to habituate / permanent avoidance
  80-85 dB 放棄棲地 / 永久的趨避行爲

Black-faced Spoonbill prefers habitat protected from noise, artificial light, and raptors – planes can resemble raptors and might cause fear and flight
黑面琵鷺的棲地需要避免噪音、人工光源與猛禽攻擊－「疑似猛禽」的飛機導致不必要的恐懼與飛離。

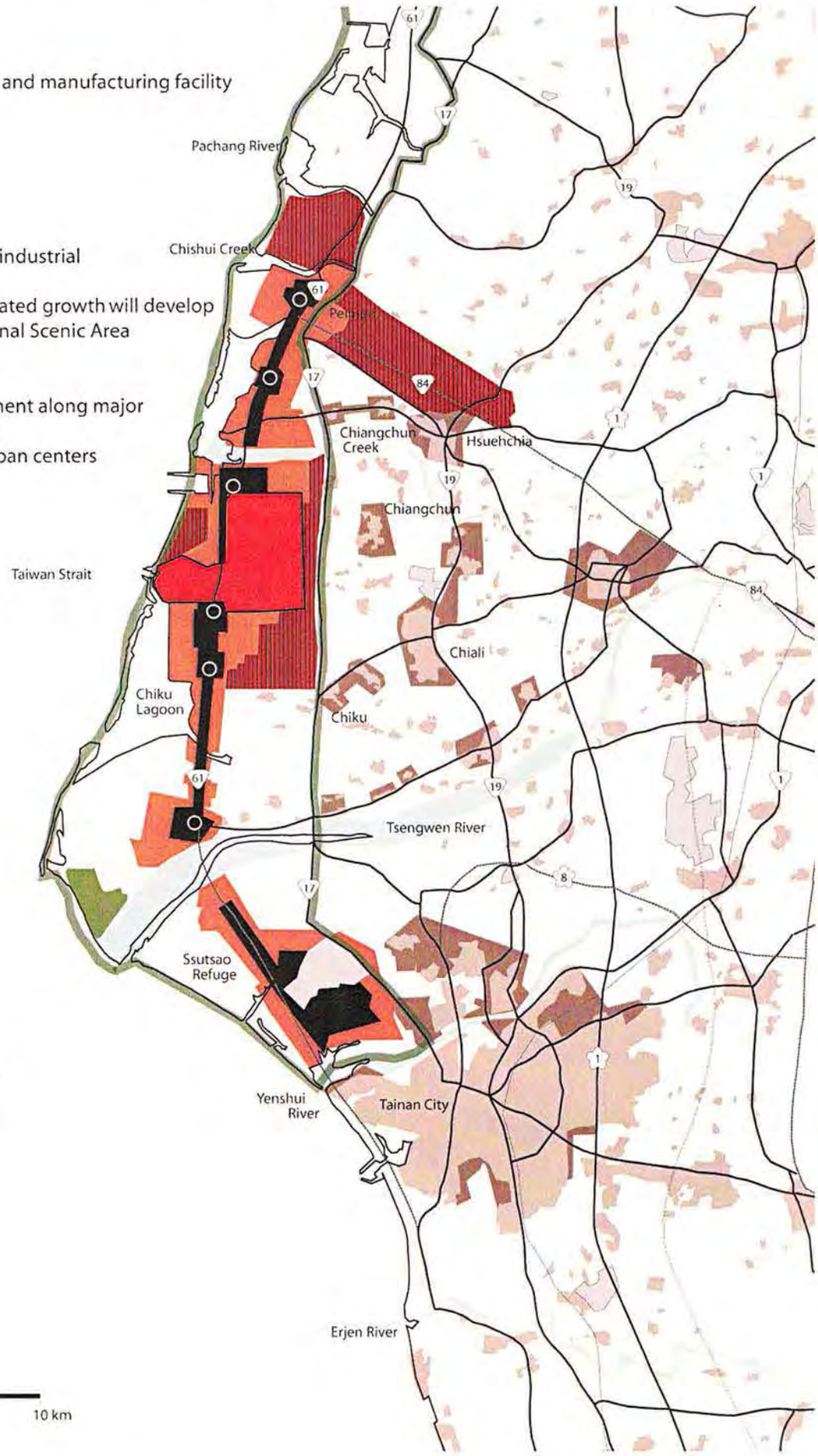
AIRPORT-INDUCED GROWTH – EXISTING ROAD NETWORK
七股國際機場衍生發展—既存公路網絡

Proposed Airport:
- 22km² Footprint
- Includes free-trade zone and manufacturing facility

Induced Growth:
- 250,000 Jobs
- 500,000 Residents

Related Development:
- 25km² to 50km² of light industrial
- 40km² of residential
- Proposed airport and related growth will develop close to half of the National Scenic Area

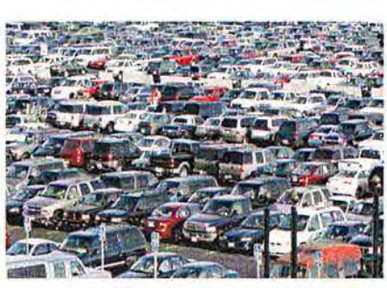
Spatial Distribution:
- Ribbon sprawl development along major transportation corridors
- Expansion of existing urban centers



LEGEND
- Highway Interchange
- Existing Road Network
- Main North-South Railroad
- Planned Expressway
- Planned High-Speed Railroad
- Proposed National Scenic Area
- Proposed Airport
- Industrial Use
- Urban Areas
- Urban Expansion
- 25km² Light Industrial
- 50km² Light Industrial
- 90km² Light Industrial
- River
- Spoonbill Roosting Site

N
0 1 2 3 4 5 10 km

Warehouses



Parking

Low Lying and Expansive Development

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AIRPORT-INDUCED GROWTH – EXISTING ROAD NETWORK
七股國際機場衍生發展—既存公路網絡

The airport footprint is 22km^2
機場涵蓋面積爲 **22km^2**

Expected induced growth will bring:
機場衍生開發將帶來

- 250,000 jobs
  250,000 個工作機會
- 500,000 residents
  500,000 個居住機會

Related Development
相關發展

- 25km^2 to 50km2 of light industrial (warehouses, parking, complexes)
  25km^2 to 50km2 輕工業發展（倉儲、停車等）
- 40km^2 of residential
  40km^2 住宅面積

Ribbon sprawl development along major transportation corridors
沿著交通動線的帶狀開發

Expansion of existing urban centers
現有市鎮中心的擴張

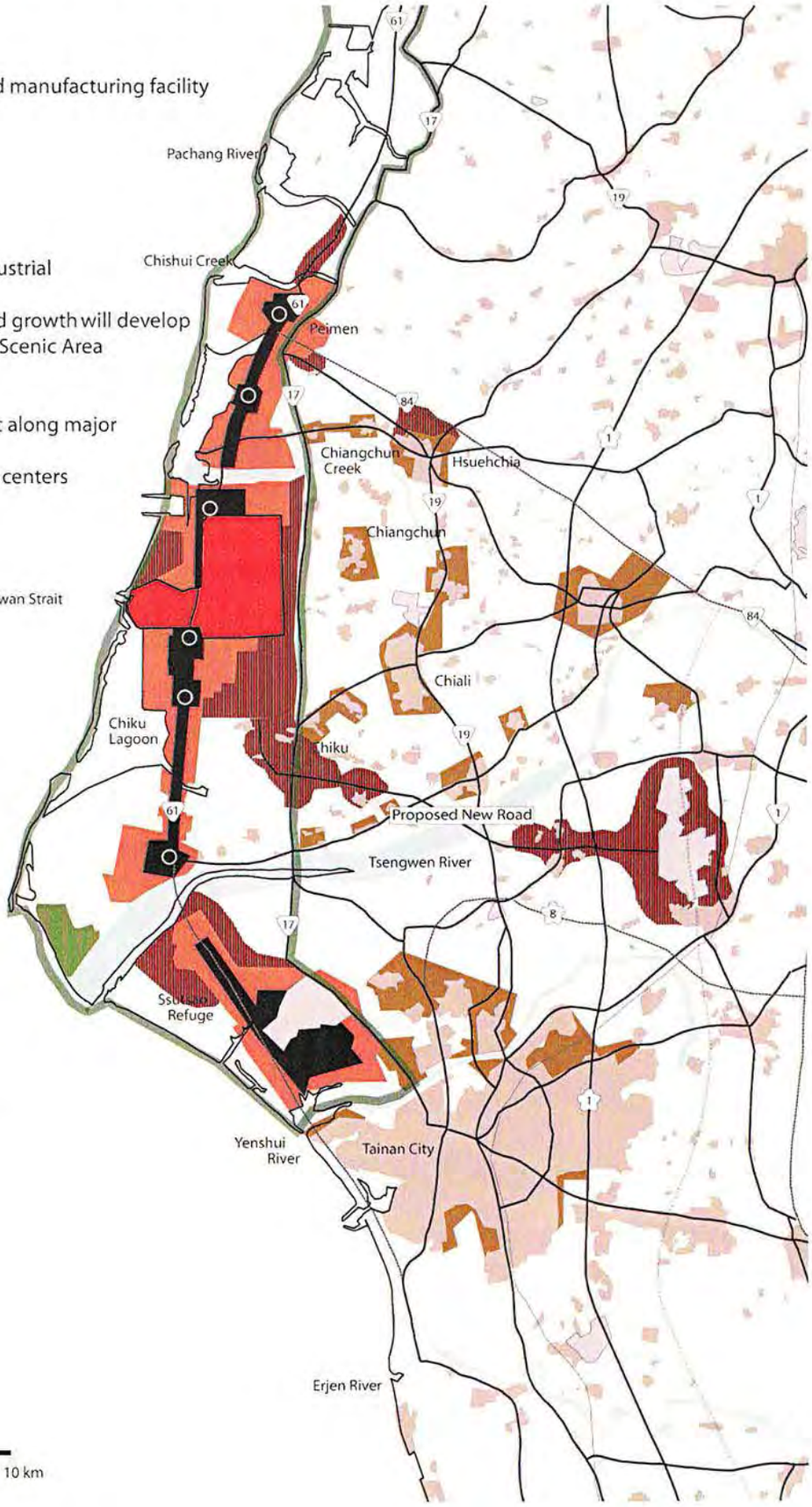
AIRPORT-INDUCED GROWTH - PROPOSED ROAD SCENARIO
七股國際機場衍生發展—新建道路影響模擬

Proposed Airport:
- 22km² Footprint
- Includes free-trade zone and manufacturing facility

Induced Growth:
- 250,000 Jobs
- 500,000 Residents

Related Development:
- 25km² to 50km² of light industrial
- 40km² of residential
- Proposed airport and related growth will develop close to half of the National Scenic Area

Spatial Distribution:
- Ribbon sprawl development along major transportation corridors
- Expansion of existing urban centers



LEGEND
- Highway Interchange
- Existing Road Network
- Main North-South Railroad
- Planned Expressway
- Planned High-Speed Railroad
- Proposed National Scenic Area
- Proposed Airport
- Industrial Use
- Urban Areas
- Urban Expansion
- 25km² Light Industrial
- 50km² Light Industrial
- 90km² Light Industrial
- River
- Spoonbill Roosting Site

N

0 1 2 3 4 5 10 km

Warehouses

Parking

Low Lying and Expansive Development

TAINAN COUNTY AIRPORT STUDY

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AIRPORT-INDUCED GROWTH – PROPOSED ROAD SCENARIO
七股國際機場衍生發展—既存公路網絡

The airport footprint is 22km^2
機場涵蓋面積爲 22km^2

Expected induced growth will bring:
機場衍生開發將帶來

250,000 jobs
250,000 個工作機會

500,000 residents
500,000 個居住機會

Related Development
相關發展

25km^2 to 50km2 of light industrial (warehouses, parking, complexes)
25km^2 to 50km2 輕工業發展（倉儲、停車等）

40km^2 of residential
40km^2 住宅面積

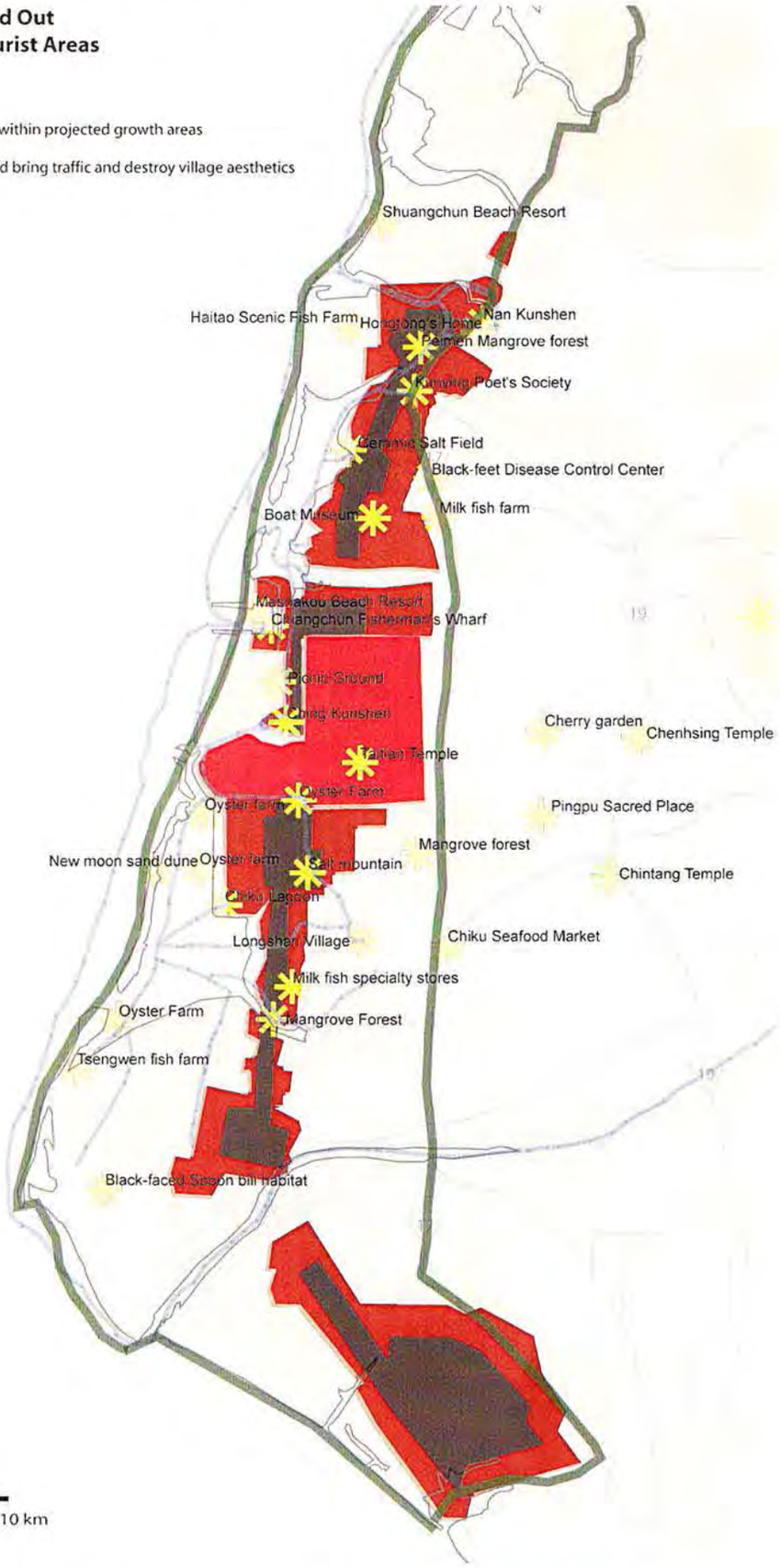
Ribbon sprawl development along major transportation corridors
沿著交通動線的帶狀開發

Expansion of existing urban centers
現有市鎮中心的擴張

AIRPORT-INDUCED GROWTH IMPACTS ON TOURISM
七股國際機場衍生發展對觀光旅遊業的影響

Airport-Related Growth Will Crowd Out Villages, Fish Ponds and Other Tourist Areas

- Airport will displace Taitian Temple
- 42% of coastal Tainan County tourism sites are within projected growth areas
- Warehouses, assembly plants and housing could bring traffic and destroy village aesthetics
- Development could replace sites such as:
  - Chiangchun Fisherman's Wharf
  - Salt Mountain, Long-san Village
  - Chiku Seafood Market
  - Boat Museum



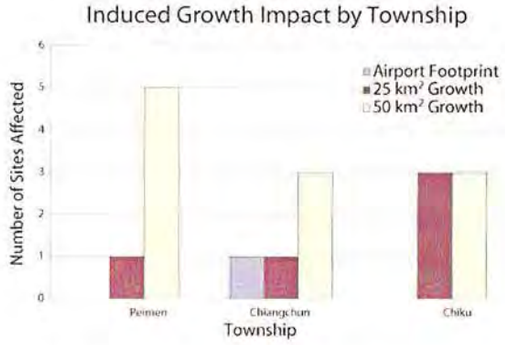
LEGEND

- Tourism Sites
- Existing Road Network
- Main North-South Railroad
- Planned Expressway
- Planned High-Speed Railroad
- "Blueway" Transportation Network
- Proposed Airport
- Proposed National Scenic Area
- Salt Ponds
- Fish Ponds
- River
- 50 km² Induced Growth
- 25 km² Induced Growth

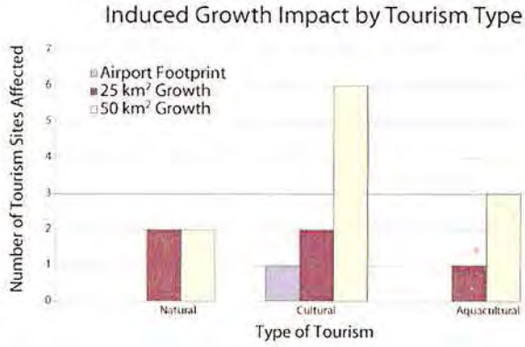
N

0 1 2 3 4 5 10 km

Induced Growth Impact by Township



Induced Growth Impact by Tourism Type



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AIRPORT-INDUCED GROWTH IMPACTS ON TOURISM
機場衍生發展對旅遊觀光業的影響

- Airport-Related Growth Will Crowd Out Villages, Fish Ponds and Other Tourist Areas.
  機場及其相關土地開發會將漁村，魚塘及其它旅遊觀光景點排擠出局。

- Airport will displace Taitian Temple
  七股國際機場場址將迫使將軍鄉代天府遷址。

- 42% of coastal Tainan County tourism sites are within projected growth areas.
  台南縣沿海地區近 42%的主要旅遊觀光景點在預測的土地開發區域內。

- Warehouses, assembly plants and housing could bring traffic and destroy village aesthetics
  倉庫，工廠，及住宅區開發所帶來的繁忙交通會使當地漁村的獨特風光黯然失色。

- Development could replace sites such as Chiangchun Fishermen's Wharf, Salt Mountain, Long-san Village, Chiku Seafood Market, and the Boat Museum.
  機場週邊未來的土地開發將威脅到台南縣多處旅遊觀光景點， 例如鹽山，龍山村，七股海產街，以及漁船展覽館。

AIRPORT GROWTH IMPACTS -- AQUACULTURE

七股國際機場衍生開發對水產養殖業的衝擊

Analysis Results:

- Airport and associated growth would eliminate more than 33% of Tainan County's fish and salt ponds
- Tainan County has almost 203 km², or 20,000 hectares, of fish ponds
  - 22.4 km² will be lost to the airport footprint alone
  - 67.53 km² will be lost to the airport footprint and related growth
- Loss of these harvests will cost NT$928.2 Million (US$27.3 Million) each year
- These ponds represent irreplaceable value that the Tainan coast is uniquely situated to provide. They significantly contribute to the national environmental security of Taiwan

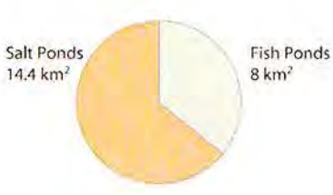
LEGEND

- Proposed Airport
- 25 km² Development
- 50 km² Development
- Proposed National Scenic Area
- Salt Ponds
- Fish Ponds
- River

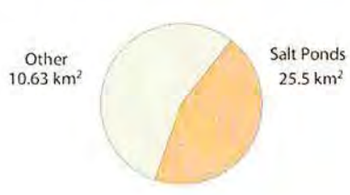
N

0 1 2 3 4 5 10 km

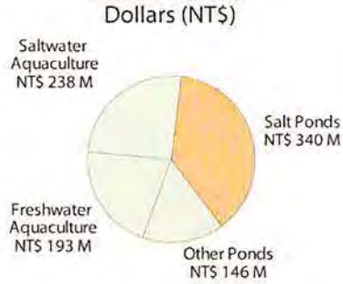
Loss of Aquaculture from Proposed Airport Footprint



Loss of Aquaculture from Proposed Airport Footprint and Associated Growth



Annual Aquaculture Loss in Current Dollars (NT$)



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AIRPORT GROWTH IMPACTS – AQUACULTURE
機場發展對水產養殖業的影響

Airport and associated growth would eliminate more than 33% of Tainan County's fish and salt ponds.
七股國際機場及其衍生開發將取代台南縣 33%的魚塘及鹽塘。

Tainan County has almost 203 square km, or 20,000 hectares, of fishponds. 台南縣現有近 203 平方公里(即 20000 公頃)的魚塘。

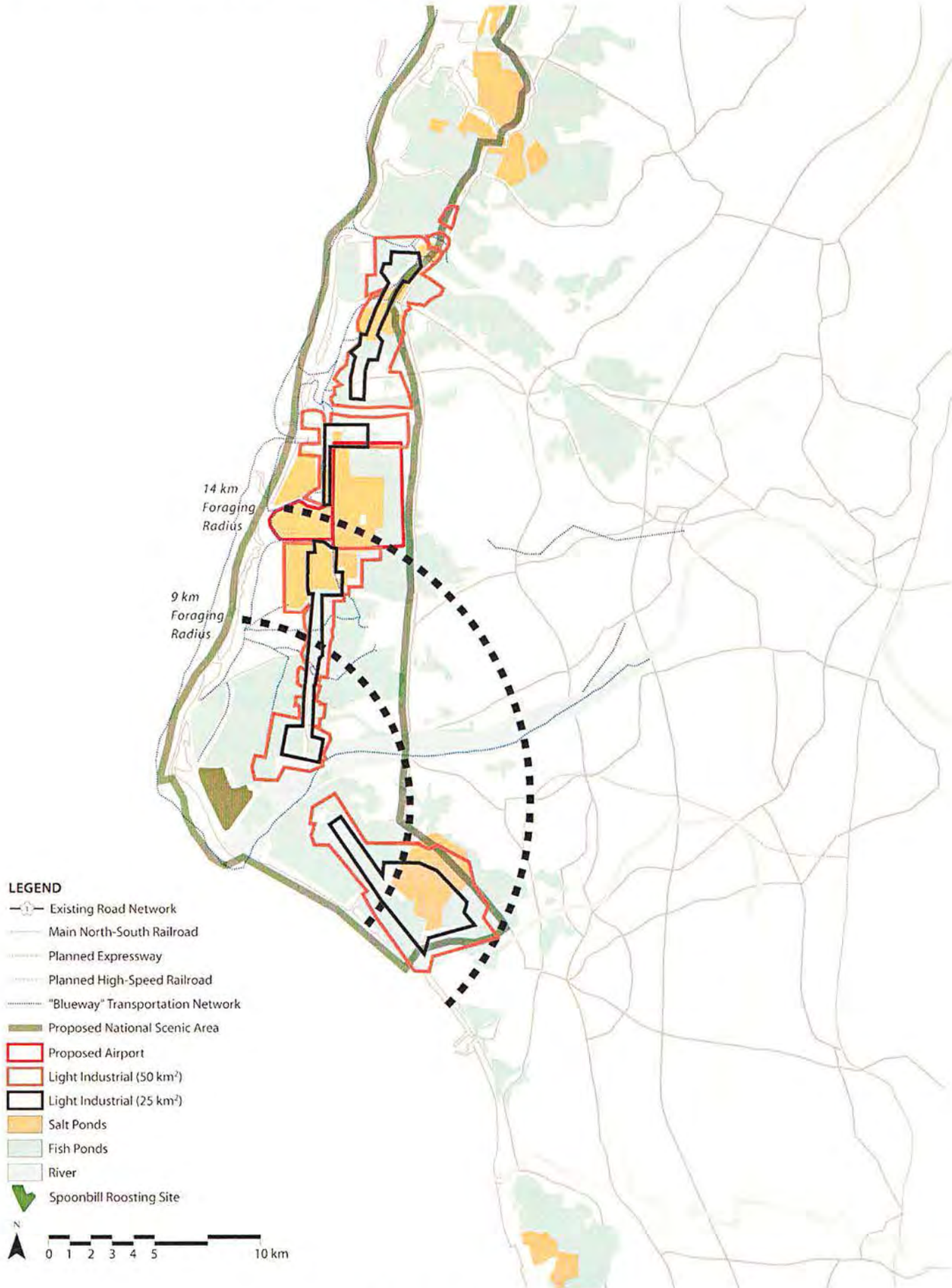
- 22.4 km2 will be lost to the airport footprint alone
  僅機場場址本身就將侵佔 22.4 平方公里的魚塘。

- 67.53 km2 will be lost to the footprint and airport-related growth
  機場場址，聯同由其衍生的土地開發，共將侵佔 67.53 公里的魚塘。

Loss of these harvests will cost NT$928.2 Million (US$27.3 Million) each year.
魚塘的喪失將爲台南沿海漁業收入帶來九億貳千八百二十萬新台幣(合貳千七百三十萬美金)的損失。

These ponds represent irreplaceable value that the Tainan coast is uniquely situated to provide. They significantly contribute to the national environmental security of Taiwan.
台南縣沿海地區獨特的地理位置賦予當地魚塘及鹽塘不可取代的價值。保護這些魚塘及鹽塘對保障全台灣的環境質量意義深遠。

AIRPORT GROWTH IMPACTS -- BLACK-FACED SPOONBILL
七股國際機場衍生開發對黑面琵鷺的生態衝擊



- Loss of habitat will threaten the survival of the Black-faced Spoonbill
- Black-faced Spoonbill requires 600 - 1,000 m^2 of water for roosting, with at least a 9-to-14 km^2 foraging radius
- Airport footprint will take 22 km^2 of prime spoonbill habitat
- 35% (62 km^2) of existing Tainan County habitat will be destroyed from airport and associated growth
- 30% (19 km^2) of existing habitat will be lost within 9-kilometer foraging area
- Air and water pollution from industrialization and urbanization could contaminate spoonbills and other wildlife, making them vulnerable to disease and reproductive harm.

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AIRPORT GROWTH IMPACTS - BLACK-FACED SPOONBILL
機場衍生開發對黑面琵鷺的影響

Loss of Habitat Will Threaten Survival of the Black-faced Spoonbill
棲地喪失將威脅黑面琵鷺的生存

- Black-faced Spoonbill requires 600 m^2 of water for roosting, with a 9-to-14 km foraging radius
  黑面琵鷺需要半徑 9 到 14 公里，面積 600 m^2的水域作爲棲地。

- Airport footprint will take 22 km^2 of prime spoonbill habitat
  機場本身將併吞 22 km^2 的黑面琵鷺重要棲地

- 35% (62 km^2) of existing Tainan County habitat will be destroyed by airport and associated growth
  台南縣現有的黑面琵鷺棲地將有 35% (62 km^2) 被機場與其衍生的開發破壞

- 30% (19 km^2) of existing habitat will be lost within 9-km foraging area
  在 9 公里的覓食半徑範圍中，30% (19 km^2)的棲地將會消失。

- Air and water pollution from industrialization and urbanization could contaminate spoonbills and other wildlife, making them vulnerable to disease and reproductive harm
  工業與都市化造成的空氣與水污染將毒害黑面琵鷺與其他的生物－降低它們抵禦疾病的能力與繁殖力，使它們變得體質脆弱

COMPARATIVE ANALYSIS: BINNAN, CHIKU AIRPORT AND NSA
比較分析：濱南工業區、七股國際機場、南瀛國家風景

		BINNAN INDUSTRIAL COMPLEX	CHIKU INTERNATIONAL AIRPORT	NANYIN NATIONAL SCENIC AREA
Ecology 生態	**Air Pollution (tons/year)**	• SO_x 44,185 • NO_x 24,799 • CO_2 28 million • PM_{10} 4,890	• SO_x 58,990 • NO_x 601,800 • CO_2 186,320 • CO 301,538 • CH 22,780	UCB Estimate*: • NO_x 1,700 • CO 15,500 • PM_{10} 70
	Water Demand and Pollution (daily)	• 190,000-320,000 m^3 water demand • 160,000 m^3 wastewater	• 63,000 m^3 demand • 55,000 m^3 wastewater	UCB Estimate**: • 18,000-89,000 m^3 demand • 30,000 m^3 wastewater
	Spoonbills and Habitat	• Over 45 km^2 of spoonbill foraging habitat lost	• 52 km^2 of spoonbill foraging habitat lost	• Spoonbills and habitat protected
Economics 生產	**One-time Construction Costs**	• NT $413 billion	• NT $143 billion	• NT $2.8 billion
	Annual Op/Maint. Costs	• No public costs	• NT $6 billion	• NT $1.9 million
	Jobs Produced	• > 30,000 jobs *(majority in construction)*	• 40,000 - 52,000 jobs (2,384 foreign laborers) *(most jobs provided in construction in first 5 years)*	• 51,000 induced jobs: ~ 45,000 in tourism ~ 6,000 in aquaculture
	Annual Revenue Generated	• NT $414 billion *(Production)* • NT $38 billion *(Tax revenue)*	• NT $18 billion	• NT $34 billion
	Lost Opportunity Cost	• Inability to build airport or encourage tourism	• Diminishes scenic tourism, replaces ponds	• Forestalls extensive development, industry
Equity 生活	**Community Impacts**	• Potential for 2 schools to be moved	• By 2011: 4 schools impacted by 60-75 dB*** • By 2021: 9 schools impacted by 60-75 dB	• Secured Community Livelihood • Potential disturbance from tourism
	Impacts on Local Jobs	• Loss of 600 household aquaculture jobs • Threat to 16,000 aquaculture jobs	• 46 km^2 of fishponds will be lost from airport and induced growth • 18,500 jobs lost in fisheries and tourism	• 51,000 induced jobs: ~ 45,000 in tourism ~ 6,000 in aquaculture

** Calculated from an estimated share of tourism-caused pollution in a comparable U.S. coastal tourism site, Monterey County*
*** Estimated from U.S. individual and hotel room water use/sewage flows*
**** Taiwan law states schools, libraries, and hospitals are not allowed as the principal land use in areas with noise levels between 60-75 dB.*

	BINNAN	AIRPORT	NATIONAL SCENIC AREA
Ecology 生態	−	−	+
Economics 生產	+/−	+/−	+
Equity 生活	−	−	+

TAINAN COUNTY AIRPORT STUDY

Spring 2003, Environmental Planning Studio, University of California, Berkeley

COMPARATIVE ANALYSIS: BINNAN, CHIKU AIRPORT AND NSA

比較分析：濱南工業區、七股國際機場、南瀛國家風景區

	濱南工業區	七股國際機場	南瀛國家風景區
空氣污染（噸/年）	▪ SOx 2,300,000 ▪ NOx 1,300,000 ▪ CO2 28,000,000 ▪ PM10 250,000	▪ SOx 58,990 ▪ NOx 601,800 ▪ CO2 186,320 ▪ CO 301,538 ▪ CH 22,780	UCB Estimate*: ▪ NOx 1,700 ▪ CO 15,500 ▪ PM10 70
需水量與污水排放量（每日）	▪ 190,000-320,000 m^3需水量 ▪ 160,000 m^3污水排放量	▪ 63,000 m^3需水量 ▪ 55,000 m^3污水排放	柏克萊加大評估** ▪ 18,000-89,000 m^3需水量 ▪ 30,000 m^3污水排放
黑面琵鷺與棲地	▪ 四十五平方公里以上黑面琵鷺覓食棲地消失	▪ 五十二平方公里以上黑面琵鷺覓食棲地消失	▪ 黑面琵鷺和棲地被保護
一次興建成本	▪ NT $4130 億	▪ NT $1430 億	▪ NT $28 億
年運作與維護成本	▪ 沒有公共成本	▪ NT $60 億	▪ NT $19 億
工作機會提供	▪ 30,000 工作 (主要在工程興建)	▪ 40,000-52,000 工作 (2,384 外籍勞工) (前五年主要工作在工程興建)	▪ 51,000 工作延伸: 45,000 旅遊業工作以及 6000 農業工作
年收益	▪ NT$4140 億 (生產) ▪ NT $380 億 (稅收)	▪ NT $180 億	▪ NT $340 億
損失機會成本	▪ 無法興建機場或鼓勵觀光業發展	▪ 魚塭被取代、優質風景消失	▪ 阻斷工業擴充發展
社區影響	▪ 一間學校將被遷移 ▪ 二十間學校被噪音影響	▪ 在 2011 年時、四間學校將在六十到七十五分貝影響範圍內*** ▪ 在 2021 年時、九間學校將在六十到七十五分貝影響範圍內*	▪ 社區居民生活保障 ▪ 旅遊業帶來的可能干擾
地方工作機會影響	▪ 失去六百個家庭農業工作機會 ▪ 威脅一萬六千農業工作機會	▪ 四十六平方公里魚塭可能會因機場衍生發展而消失 ▪ 失去一萬八千五百個漁業與觀光業工作機會	▪ 五萬一千個衍生工作機會：包括四萬五千個旅遊業與六千個農業工作機會

* 旅遊所引起的污染量是根據同樣是海岸旅遊勝地的加州 Monterey 縣經驗所做的推估。

** 這數據是以美國旅遊區的客房數所需水量與廢水排放量做推估。

***台灣法律要求學校、圖書館、醫院不能建在六十到七十五分貝噪音範圍內

ALTERNATIVE STRATEGY - INTERNATIONAL TOURISM
台南沿海三日遊

Keys to International Tourism in Tainan County

Accommodations
- Cultural
- Upscale
- Hostel Type
- Family

Food
- Restaurants
- Markets
- Convenience

Transportation
- Regional
- Local

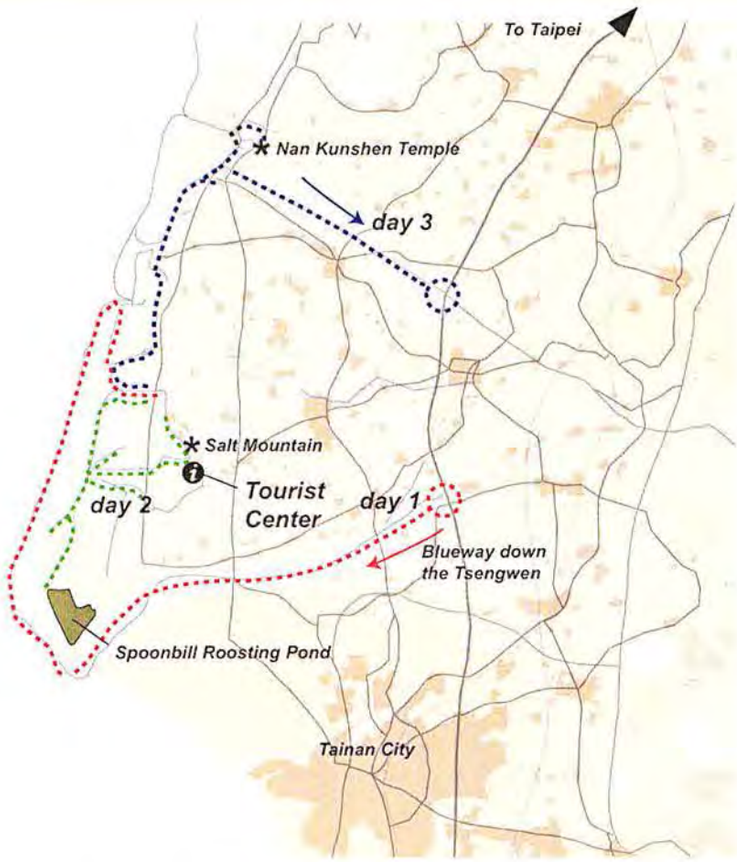
Language
- Signage
- Consumer Labeling
- Public Interaction

Services
- Telephone
- Internet
- Currency Exchange
- Post Office
- Convenience
- Taxi

Cultural Awareness

Shopping
- Night Market
- Tourism Retail
- High-end Retail

Sights
- Natural
- Historical
- Cultural
- Recreational



The 3 Day Tour of Coastal Tainan County

Tourism in Southern Taiwan requires a sustainable approach to regional development that incorporates multi-modal transportation and highlights the existing and expanded Blueway.
- Jeremy Thomas, Owner CASA Tours

DAY 1
Arrive from Taipei or Tainan City
Blueway on Tsengwen River

HIGHLIGHTS
- *Tseng Wen River*
- *Blueway boat down river, into coastal estuary*
- *Black-faced Spoonbill lagoon*
- *Chiku Lagoon*
- *Fish ponds and oyster farming*
- *Tour of historic Tainan coast*
- *Tainan cultural center*
- *Great seafood and comfortable accommodations*

DAY 2
Salt Mountain, Spoonbill Pond, Longshan Village

HIGHLIGHTS
- *A Blueway tour from your hotel at the Tainan Cultural Center*
- *A visit to the Spoonbill viewing deck*
- *The Tsengwen fish farm*
- *The famous Salt Mountain*
- *Longshan village*
- *The mangrove forest*
- *Chiku seafood market*
- *Catch your own lunch*
- *An evening at the Tainan Cultural Theater*

DAY 3
Nan Kunshen Temple, Peimen

HIGHLIGHTS
- *Take the Blueway to Chiangchun Fisherman's Wharf*
- *The Ceramic Salt Field*
- *Peimen Mangrove Forest*
- *Haitao Scenic Fish Farm*
- *Nan Kunshen Temple*
- *Scenic journey through the bread basket of Taiwan back to Taipei*

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ALTERNATIVE STRATEGY – INTERNATIONAL TOURISM

台南沿海三日遊

HIGHLIGHTS OF DAY 1
Arrive from Taipei or Tainan City
Blueway on Tsengwen River
第一天：暢遊曾文溪段的藍色公路
乘船沿河而下到曾文溪出海口、遠眺黑面琵鷺棲地、繞遊七股潟湖、瞭解牡蠣養殖、驚艷於潟湖豐富的漁業生態・坐遊這歷史海岸、緬懷先人登陸足跡、體驗豐富沿海文化特色、更別忘了嘗試這裏世界級的海鮮料理・

HIGHLIGHTS OF DAY 2
Salt Mountain, Spoonbill Pond,
Longshan Village
第二天：鹽山、黑面琵鷺、龍山村
藍色公路將繼續帶您到黑面琵鷺賞鳥亭、細睹黑面琵鷺水中或沉睡、或嬉戲的曼妙舞姿・參觀深具特色美國塭仔、瞭解台南縣魚塭開墾歷史・攀爬鹽山的樂趣將使您樂而往返、而台鹽的鹽滷池、台鹽冰棒等更是不能錯過的在地體驗・以反濱南聞名的龍山村、這裏你會遇到純樸親切的漁民・而特殊紅樹林成長環境、揮舞的招潮蟹將令你盛嘆台南沿海世界一級的生態體系・

HIGHLIGHTS OF DAY 3
Nan Kunshen Temple, □Peimen
第三天：北門、南鯤紳廟
搭乘藍色公路號到將軍漁港、感受熱鬧的漁貨交易氣氛・參觀瓦盤鹽田、悠遊於一望無際的馬賽克地景・看紅樹林、海濤園觀光魚塭・全國聞名的南鯤紳廟當然無法錯過・別忘了參觀烏腳病醫院紀念館、帶您認識台灣早期環境流行病學先驅・