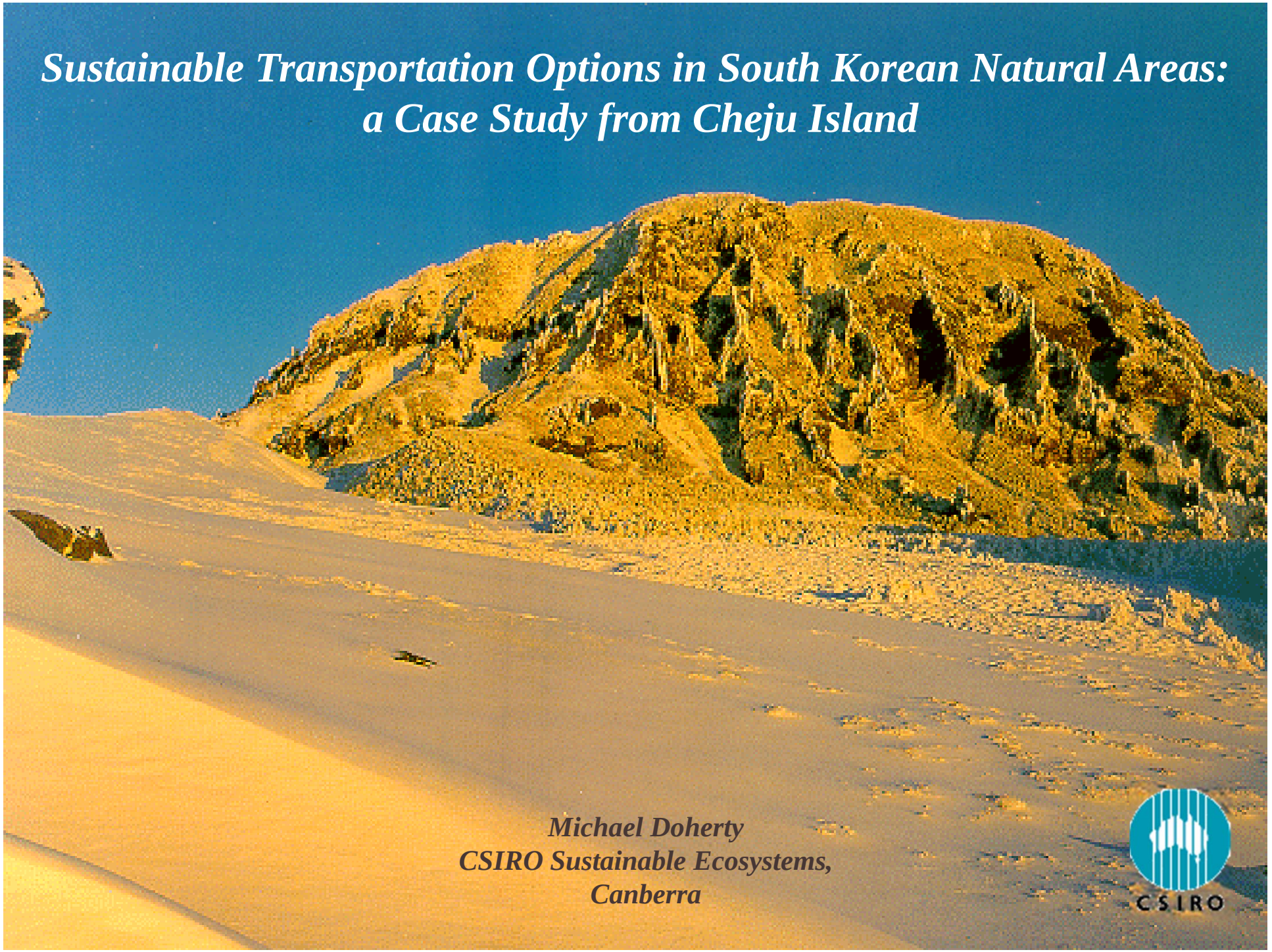
Sustainable Transportation Options in South Korean Natural Areas: a Case Study from Cheju Island



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Canberra

CSIRO

Structure of Talk:

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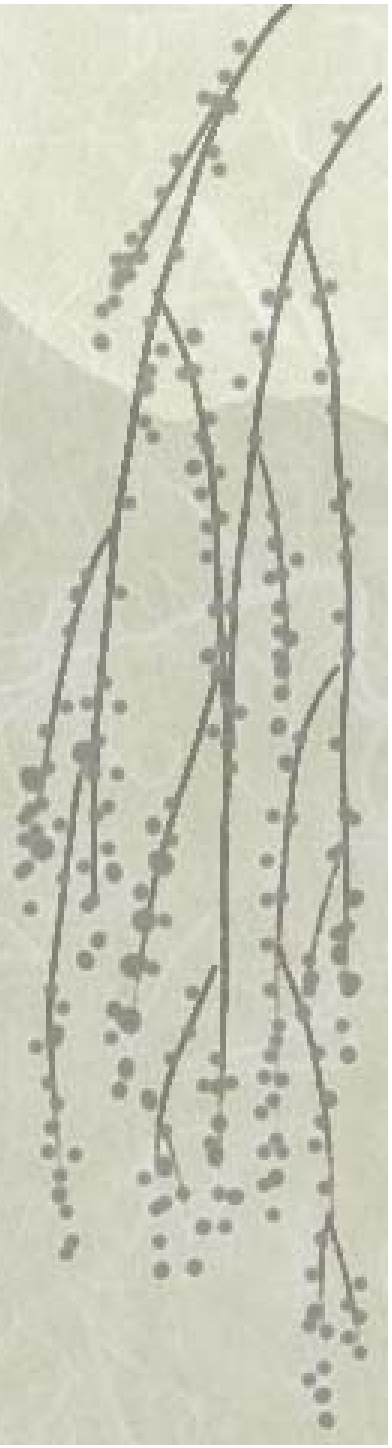


Introduction

- Cheju Island is located off the southern coast of the Republic of Korea (South Korea)
- In the centre of the island lies the 15,000 ha, Hallasan National Park
- High visitation in the park has led to track erosion and serious trampling and high maintenance costs
- Skyrail (Cairns-Kuranda Rainforest Cableway, Wet Tropics World Heritage Area) chosen to undertake a cableway feasibility study by the Cheju provincial government
- A cableway is seen as one way of taking pressure off the track system while allowing visitor access
- June – Nov. 2000, CSIRO Sustainable Ecosystems evaluated flora, fauna and visual impacts as part of the larger study
- Detailed field investigations: Cheju University and Korea Research Institute for Human Settlement (KRIHS)

Background on Skyrail

• Skyrail rainforest cableway –

north of Cairns;
runs from Smithfield (Caravonica Lakes) to Kuranda;
located within Wet Tropics World Heritage Area;
designed and operated with sustainable rainforest tourism as primary focus;

• Construction took just over a year, but preceded by 7.5 year approval process - commenced operation in August 1995

• Helicopters used to install structures - no roads were built in WTWHA for construction or operation

• Total length of 7.5 kilometres - the world's longest gondola cableway

• 4 ‘stations’, constructed in existing clearings & 32 towers, built in isolated clearings of 10 sq.m

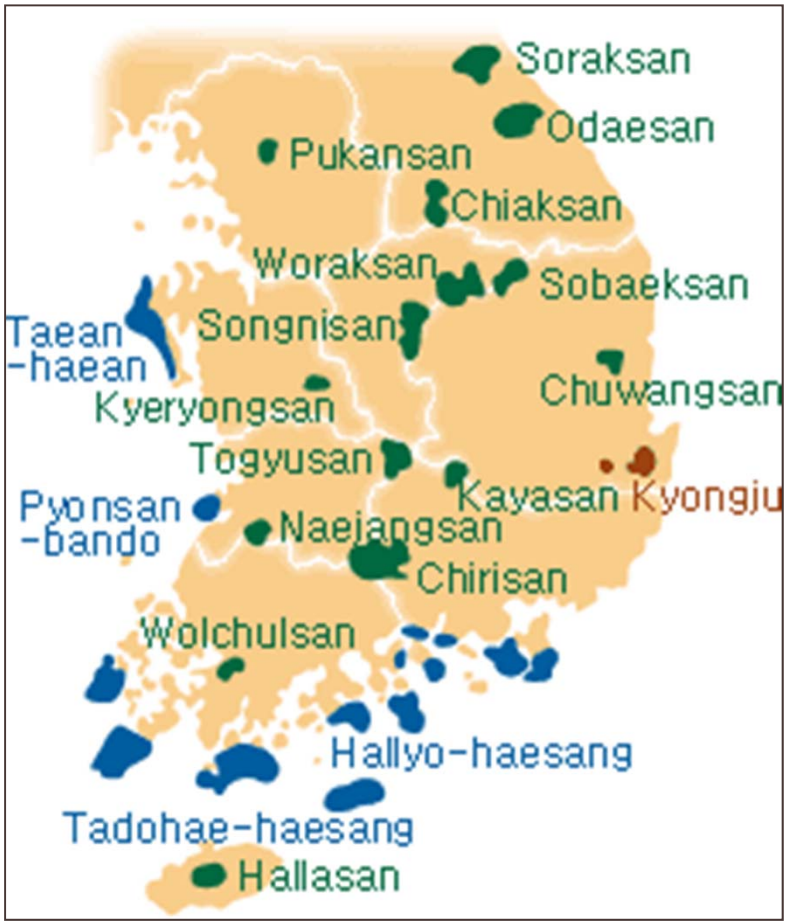
•114 gondola cabins, each holding up to 6 passengers, providing maximum capacity of 700 passengers per hour each direction.

Physical & Cultural Setting

- Hallasan National Park is one of 20 National Parks in South Korea
- Unlike other South Korean NP's, Halla managed by local not Federal authorities
- Focal point of the 15,000 ha. National Park is Mt. Halla (1950 m) – tallest mountain in South Korea
- NP declared in 1970 for natural, recreational and spiritual values
- One of 3 especially sacred mountains in Korea – others are Kumgangsan (in North Korea) and Chirisan in South Korea
- Korean beliefs, particularly on Cheju, are a mixture of Son Buddhism and Shamanism


Khabarovsk
Harbin
Changchun
Shenyang
Vladivostok
NORTH KOREA
Pyongyang
Demarcation Line
Dalian
Tianjin
Seoul
SOUTH KOREA
Jinan
Zhengzhou
Cheju-Do
Nanjing
Shanghai
Hangzhou
East China Sea
Fuzhou
Taipei
Taiwan
Hong Kong
Okinawa
Hokkaido
Sapporo
Occupied by the Soviet Union in 1945; administered by Russia, claimed by Japan.
Sea of Japan
Honshu
Tokyo
JAPAN
Osaka
Kitakyushu
Shikoku
Kyushu
North Pacific Ocean
30
Tropic of Cancer
East Asia

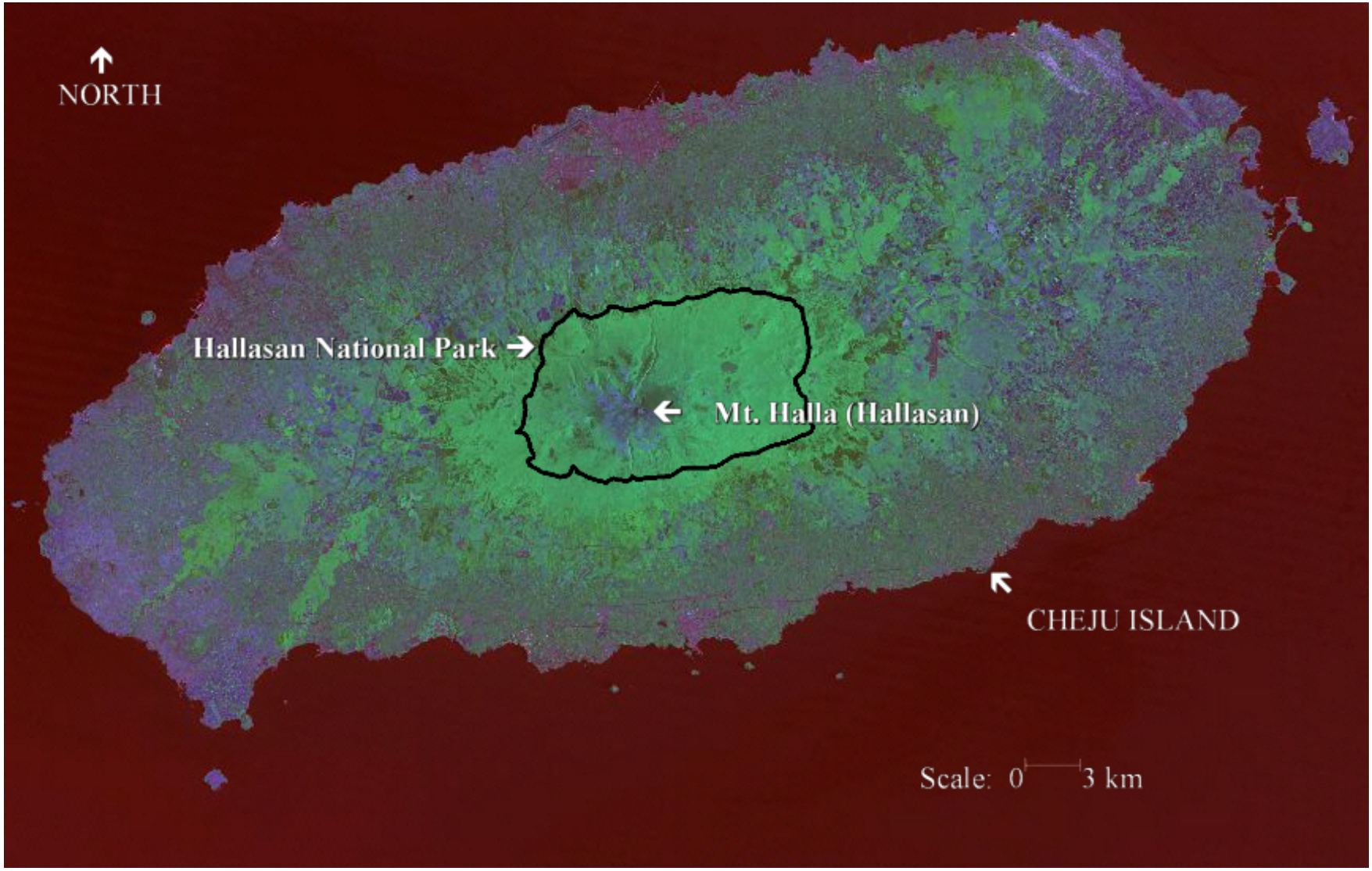
Republic of Korea – Relief Map



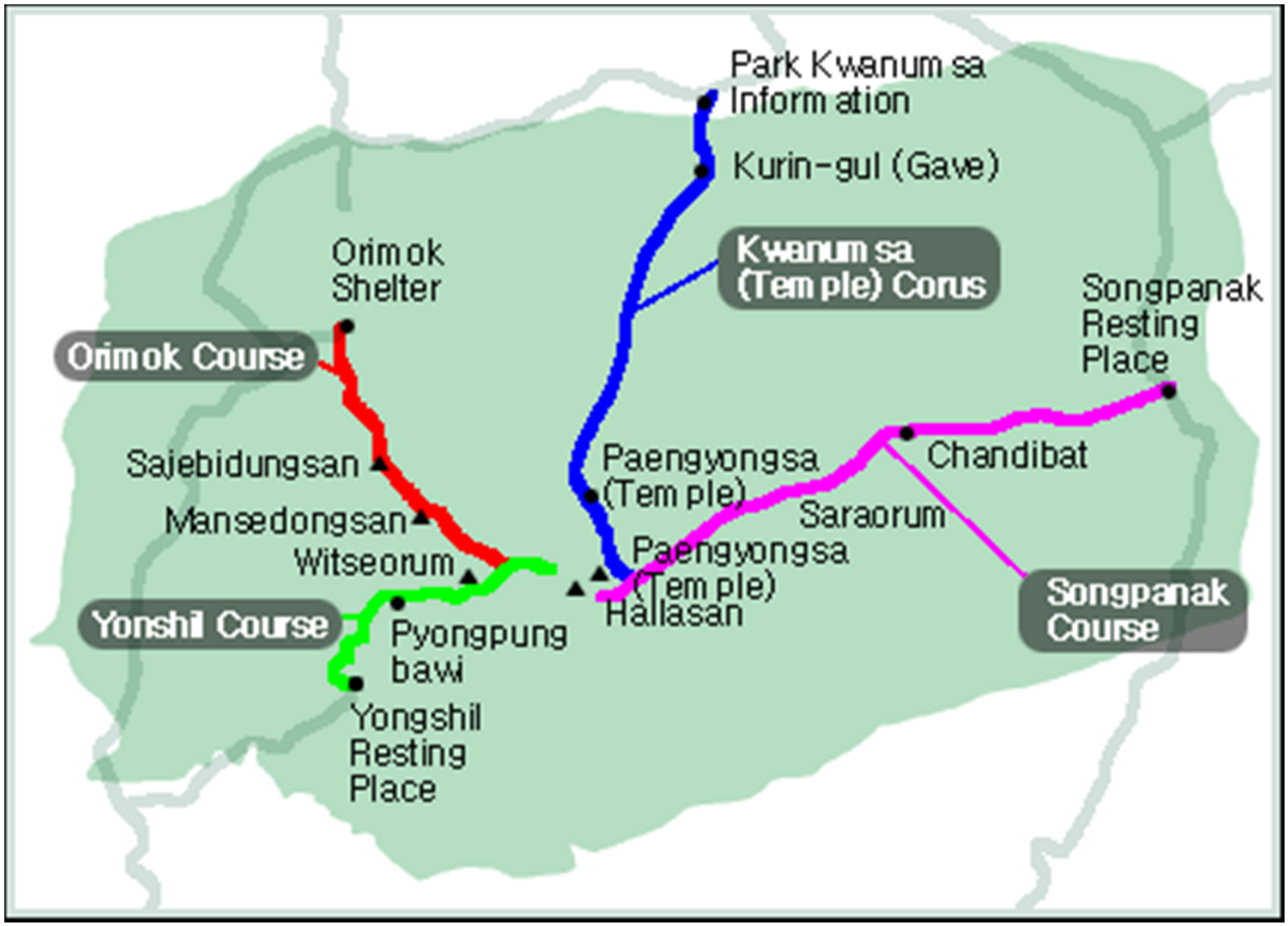
Republic of Korea – National Parks

Major mountain peaks in Korea

Temple of the 500 Buddhas, Yongsil track head



LANDSAT TM image (Bands 1,4,5) of Cheju Island, highlighting remnant vegetation and showing the boundary of Hallasan National Park



Main Walking Tracks in Hallasan National Park

Mt. Halla Summit and Crater Lake

Complex pattern of volcanic activity on Cheju, showing deposits and flows composed of tuff, scoria and basalt, built up in successive layers of material from different flows and eruptions. Most volcanic activity occurred during the Cainozoic, 2 million years ago, although there are historical eruptions recorded between 918-1392 AD. The ‘parasitic’ cones can be seen in red scattered across the island. In all, there are over 360 such cones.

Natural Values – Vegetation & Flora

- Vegetation of Cheju can be classified into 3 broad zones:

  1) low altitude (<500m) broadleaved evergreen subtropical/warm temperate forest

  2) mid-high altitude (500-1400m) broadleaved deciduous forest

  3) high altitude (>1400 m) needle-leaved evergreen subalpine forest

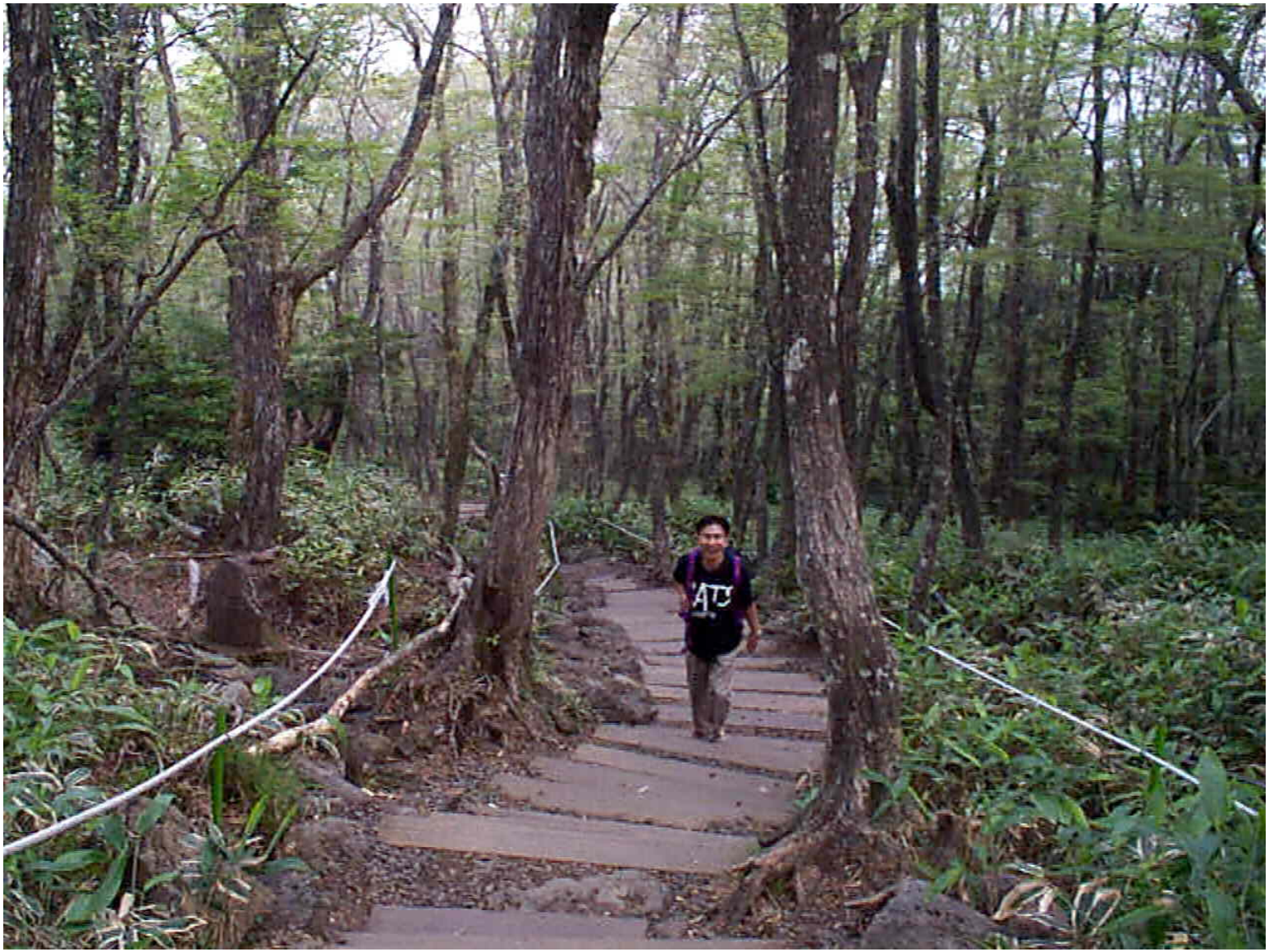
- Hallasan samples only latter 2 zones (800 –1400 m), but also has an alpine area. 2/3 remaining native vegetation on Cheju is in the NP

- Flora has affinities with mainland Korea and Japan (species level) and northern hemisphere generally (generic and family levels)

Natural Values Vegetation & Flora (cont'd)

- Southern global limit for *Diapensia lapponica* var. *obovata*, *Vaccinium uliginosum* and *Empetrum nigrum* var. *japonicum*
- Many plant species of national and international significance
- Flora statistics for Korea, Cheju Island and Hallasan National Park:

	KOREA	CHEJU ISLAND	HALLASAN N.P.
Vascular Flora	4500	1453	753
Endangered Flora	6	4	1
Protected Flora	52	26	6
Cheju Endemics	-	74	19
Korean Endemics	642	230	13
Alpine Plants	380	81	81



Broad-leaved Deciduous Forest of *Carpinus* spp., *Acer* spp. and *Taxus cuspidata* with *Sasa quelpaertensis* understorey. Orimok track, approx. 1000 m altitude

Boulder strewn creek at lower elevation. Orimok track, approx. 800 m altitude

View to the '500 Generals' from Yongsil track, showing mixture of Broad-leaved Deciduous Forest and *Pinus densiflora* Forest at lower elevation. White flowering shrub scattered through area is *Cornus kousa*

Close up view to the ‘500 Generals’ from Yongsil track

Looking toward the coast over low Orums (parasitic volcanic cones)

Sub-alpine Forest of *Abies koreana* with *Sasa quelpaertensis* understorey. Upper area of Kwanumsa track, approx. 1400 m elevation

Krummholz community of *Abies koreana* and *Betula ermanii* var. *saitoana*. Approx 1500 m elevation, near Orimok track

Alpine area near Yongsil track, S.W. of WitsaeOrum. Consisting of shrubberies of *Rhododendron* spp. and *Taxus cuspidata* as well as communities of *Empetrum nigrum*. var *japonicum* and *Juniperus chinensis* var. *sargentii*

View to Halla summit, Yongsil track

Natural Values - Fauna - Introduction

- Cheju Island & southern lowlands of Korean peninsula –

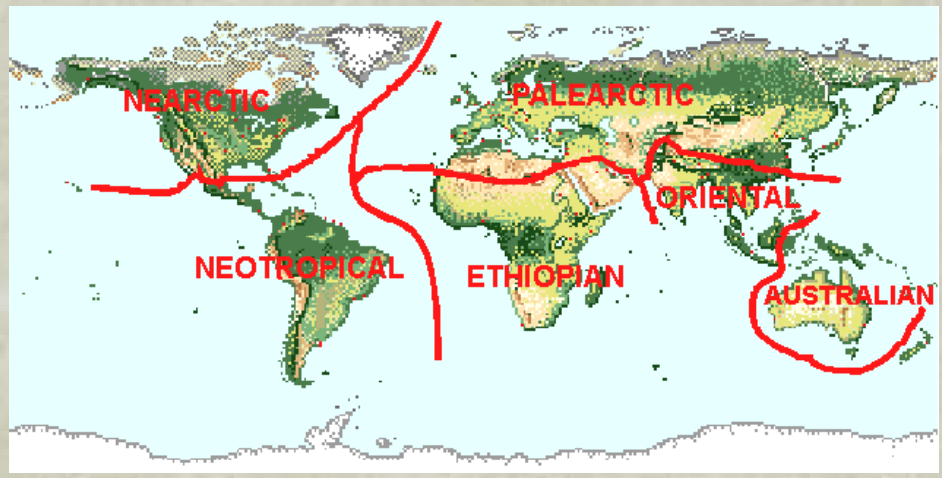
  transition zone between Palaearctic and Oriental Zoological Regions

- Fauna of Cheju Island –

  closely related to fauna of central China, Japan and Russia due to zone of direct contact in the north & milder climate of Cheju

- Composition of Cheju fauna:

  9 species of amphibians, 11 species of reptiles, 16 species of mammals, 281 species of birds, and 3,315 species of invertebrates



Fauna - Birds

- 1971: total number of bird species recorded in Korea was 366
- Recent estimates as high as 417 species
- 281 bird species occur or have occurred on Cheju Island
- Hallasan National Park 2000: 11 Internationally Protected Species observed:

Aix galericulata (Mandarin Duck)
Milvus lineatus (Black-eared Kite)
Aquila clanga (Greater Spotted Eagle)
Accipiter soloensis (Chinese Goshawk)
Accipiter gularis (Japanese Sparrow Hawk)
Accipiter nisus (Eurasian Sparrow Hawk)
Buteo buteo (Japanese Buzzard)
Falco peregrinus (Peregrine Falcon)
Falco tinnunculus (Common Kestrel)
Pitta brachyura (Fairy Pitta)
Terpsiphone atrocaudata (Japanese Paradise-Flycatcher)

Fauna - Mammals

• 95 species of mammals in Korea (including marine) - 42 listed as rare, vulnerable or endangered

• 16 species of mammals on Cheju Island

• Field studies in 2000: 10 mammal species within Hallasan National Park.

• Five were endemic to Cheju -

Mustela sibirica quelpartis (Cheju Siberian Weasel)
Apodemus chejuensis (Cheju Striped Field Mouse)
Micromys minutus hertigi (Old World Harvest Mouse)
Crocidura dsinezmi quelpartis (Cheju White-Toothed Shrew)
Sorex shinto chejuensis (Cheju Shinto Shrew).

• Cheju White-Toothed Shrew presumed extinct since the 1970's

• However, 14 observations of this species made during recent field surveys.

Fauna – Amphibians and Reptiles

- Amphibian: 6 families and 9 species
- Reptiles: 5 families and 11 species
- Field surveys in 2000 recorded 5 amphibian species and 8 reptile species
- One amphibian species is endemic to Cheju Island. This amphibian is *Hynobius quelpartensis*, a rare Salamander.
- Three species of reptiles are considered rare:

  a skink (*Scinella laterale laterale*);

  two species of snake (*Amphiesma vibakari ruthveni* and *Sibynophis chinensis*)

- *Scincella laterale laterale* and *Amphiesma vibakari ruthveni* are in decline in many other parts of South Korea, but are relatively stable on Cheju Island.

Fauna – Invertebrates

- 25 families, 301 genera and 3,315 species of invertebrates on Cheju
- 18 vulnerable invertebrate species 10 of which endemic to Cheju
- Most of the endemic species are Coleoptera (beetles)
- The remaining endemics are from the Order's:

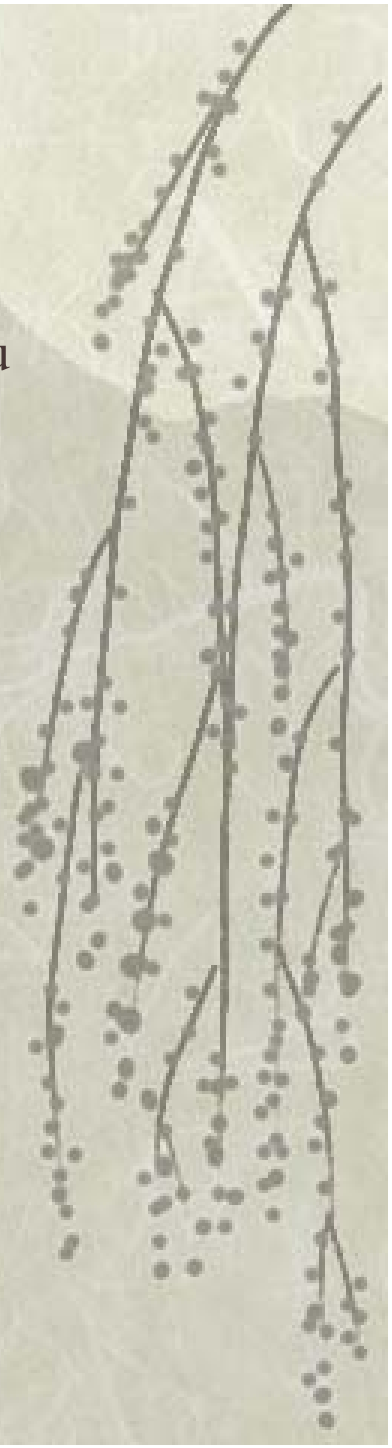
  Dermaptera (earwigs)

  Neuroptera (lacewings)

  Mecoptera (scorpionflies) and

  Lepidoptera (butterflies and moths)

- Rare and threatened invertebrates all belong to the Order Lepidoptera (butterflies and moths)



Historical Impacts

- The land that now comprises Hallasan National Park has undergone two distinct periods of relatively recent human disturbance:

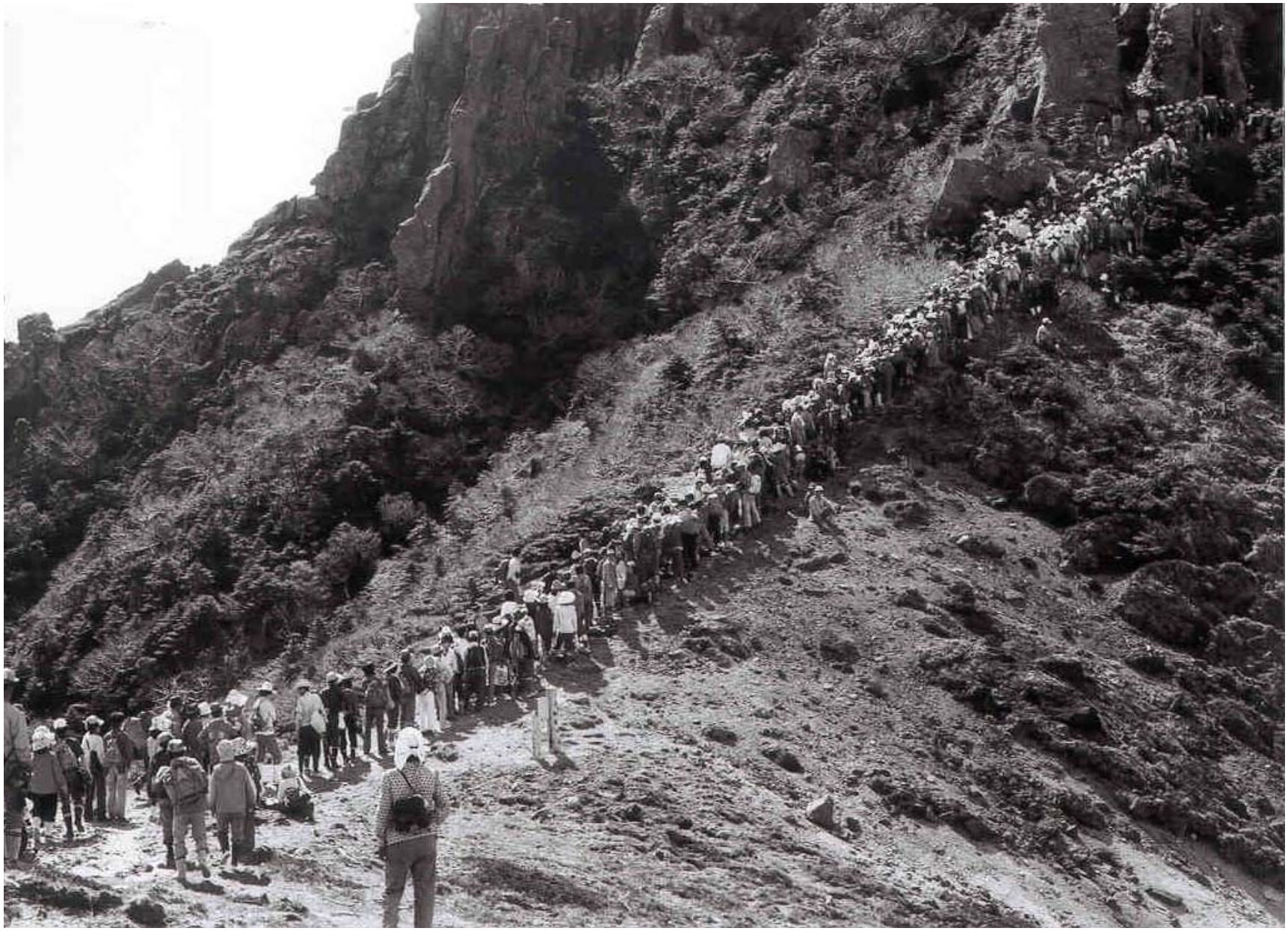
  long period of impact from clearing, grazing and burning on the lower slopes and grazing and burning in the subalpine zone, dating back some hundreds of years (at least to the Mongol era);

  a shorter period of impact from hiking and mountaineering initiated in the late 1960's and early 1970's.

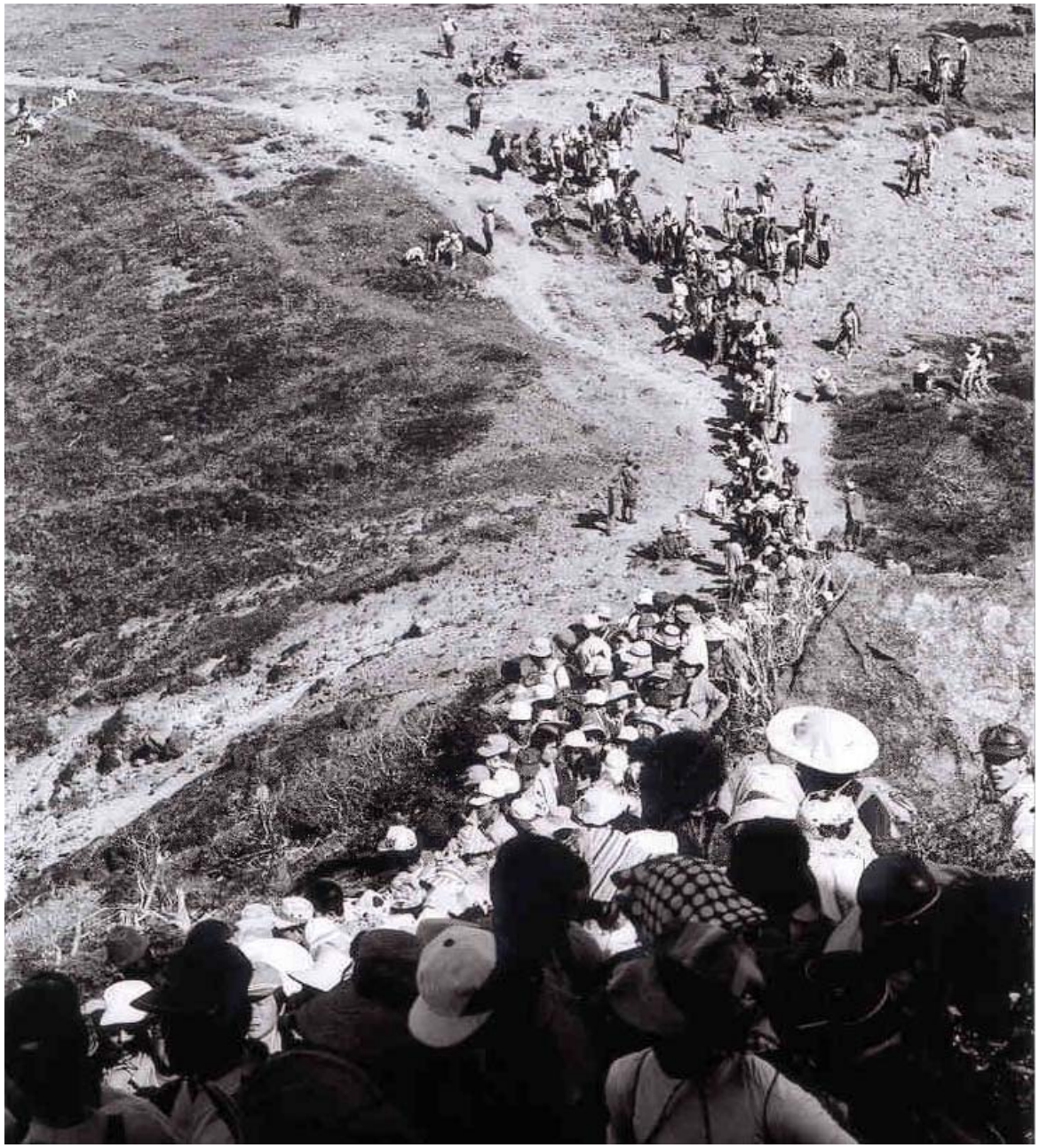
- Problems with erosion and impacts on significant plants in summit area
- General track erosion and deterioration
- 1965: MBC TV broadcasting station sponsored Royal Azalea Festival
- 1972: "1100 road" led to better access to trails of Orimok and Youngsil
- 1986: closure of short western access route to Mt. Halla from WitsaeOrum
- 1988: Grazing within National Park ceases
- 1994: closure of long southern access route to Mt. Halla from WitsaeOrum

Crater Lake - 1964

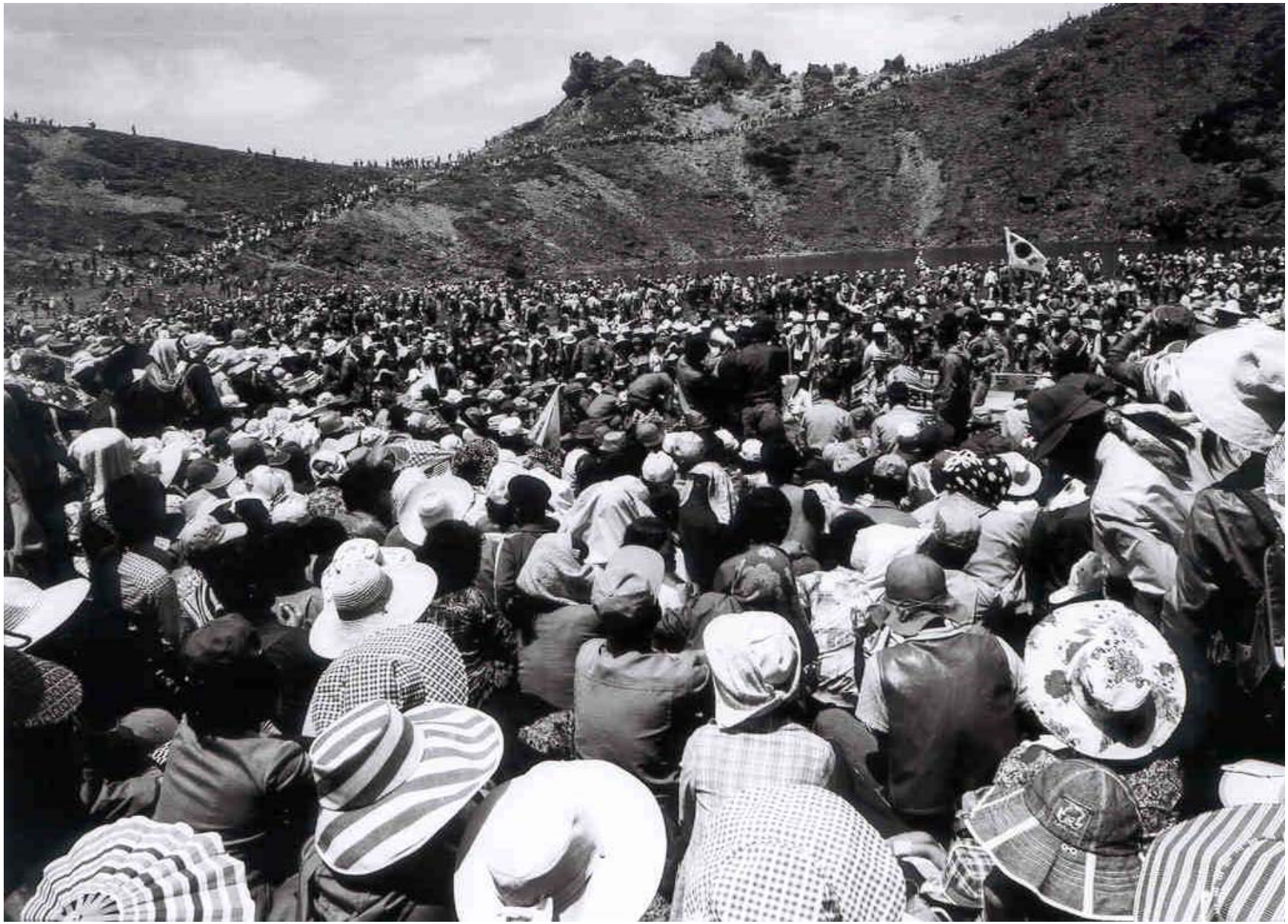
Hi Ho, Hi Ho, its off to the Azalea Festival we go…



You should have seen the queue last year…



It'll be less crowded in the crater for sure…



Crater Lake - 1974

State of upper part of closed shorter access to Summit, circa 1985

Lower part of closed shorter access to Summit, in 2000

Active land slips in treeless area NW of summit, 2000

Visitor Impacts & Management

- Significant damage has occurred on all four main track systems – Orimok, Yongsil, Kwanumsa and Songpanak

- Old track systems around the summit area are still eroding, despite significant efforts at stabilisation

- Dr. Edward Kim from Skyrail researched visitor numbers in Hallasan:

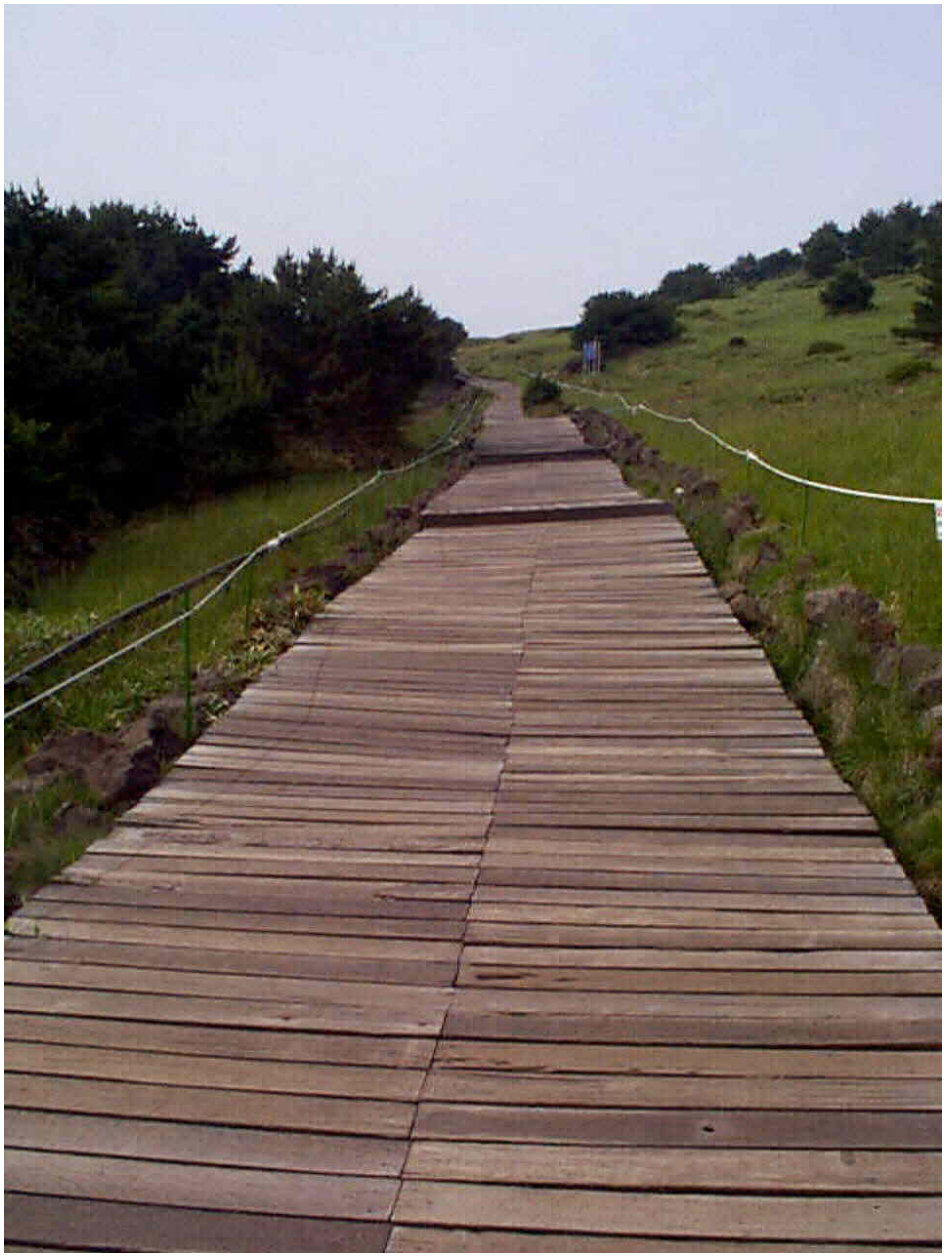
  1995-1999: > 2.3 million people visited Hallasan National Park

  Major peaks in visitation occurring in January (19%), May (15%) and October (11%) and to a lesser extent August (8%)

Approximate round numbers of users on tracks:

	1998	1999
• *Orimok*:	350,000	200,000
• *Yongsil*:	150,000	125,000
• *Songpanak*:	50,000	125,000 (access to summit re-opened 1999)
• *Kwanumsa*:	25,000	25,000

Hardwood steps and gravel used for soil stabilisation. Orimok track



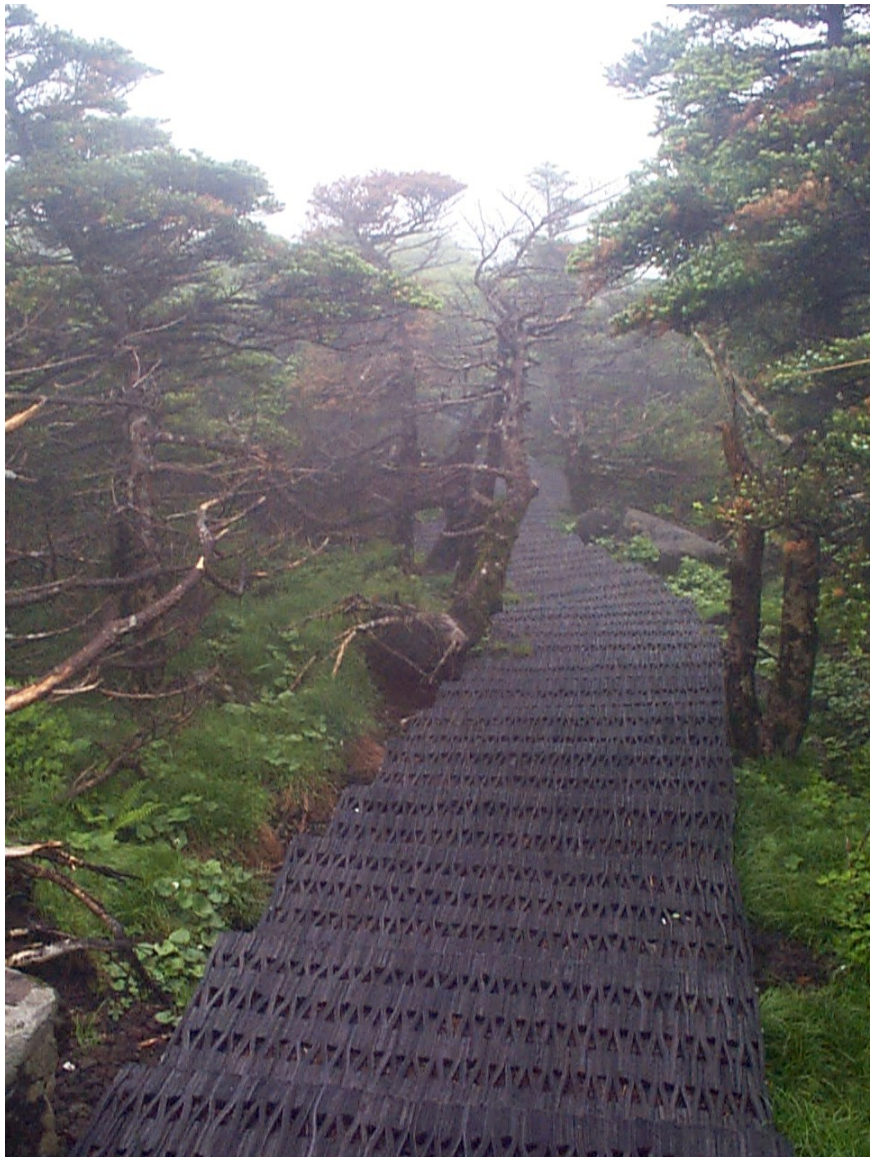
Boardwalk. Orimok track

Large paving stones and hessian-like bags used for soil stabilisation, Orimok track

Shelter at WitsaeOrum

Hardened group area at WitsaeOrum

Composting toilets at WitsaeOrum



Rubber matting near Halla summit

Monorail line, on left of picture, used for transport of rehabilitation materials. Orimok track

Monorail transporting hessian bags to WitsaeOrum

Traffic congestion on the Orimok track, near WitsaeOrum, mid-week on a rainy day

Existing track damage. Songpanak track

Options for Managing Visitor Impact

- If management of Hallasan National Park is to be assisted rather than hindered or complicated by the construction of a cableway, it should fulfil the following criteria:
  - it either stabilises or reduces visitor impact in the National Park;
  - it reduces visitor impact on the Mt. Halla summit area particularly;
  - it does not conflict with or compromise existing natural, cultural and social values;
  - it is constructed with minimal environmental impact in relation to
    flora, fauna, noise and visual impact;
  - it potentially subsidises track maintenance;
  - it educates the public about the values of the National Park and its management problems.

Options for Managing Visitor Impact (cont'd)

- Visitor numbers and track usage in Hallasan National Park are already high and difficult to manage
- Net effect of any cableway construction should be to move a significant proportion of people from the existing track system to the cableway
- If a cableway attracts a 'new' type of visitor rather than alleviating the pressure of existing usage, it will create a new impact and will not contribute to solving the existing track management problems

Cableway Evaluation

- Proposed cableway construction: three primary components:

  A bottom station facility where the cableway would commence;
  The cableway itself including pylons and
  A top station facility.

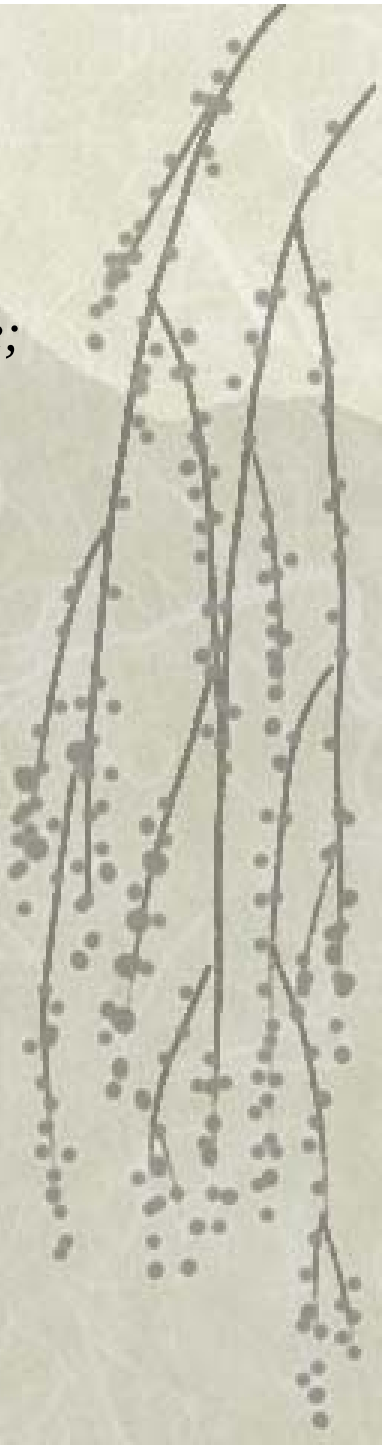
- Cheju government/Skyrail gathered existing and new economic and environmental data on a variety of potential routes

- First step: eliminate routes with fundamental economic and environmental constraints - high wind velocities, geotechnical constraints or combinations - prohibitive costs etc.

- Left three potential routes for further evaluation - Yongsil, Orimok and Kwanumsa.

- Initial matrix developed that identified the potential impacts of a cableway at construction, operation or maintenance phases

- A second detailed matrix was then developed using the Rapid Impact Assessment Matrix (RIAM) of Pastakia and Jensen (1998)

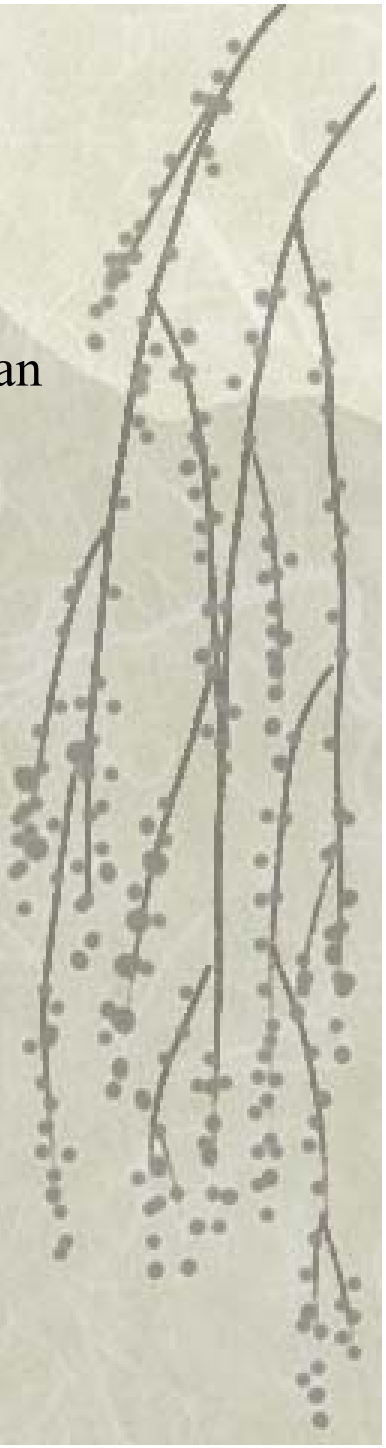


Cableway Evaluation (cont'd)

- Considering all values, the Yongsil route was the preferred route for a cableway, if one was to be constructed in Hallasan National Park
- Within the Yongsil route option, three further options were developed in relation to the placement of the top station facilities, in order to avoid sensitive alpine areas or minimise visual impact
- However, all of the three route options were assessed in the absence of any track closures or other ancillary management actions that could be implemented as a part of a wider management plan that may or may not include a cableway
- Summit area most sensitive environment in NP and still in disrepair
- Cableway could not sensibly go anywhere near the summit area

Cableway Evaluation (cont'd)

- A concentration of 'conservation required', Cheju endemic, Korean endemic species and uncommon alpine plant communities on and around the Orums around the summit of Mt. Halla
- Significantly less impact if construction of cableway facilities occurred closer toward the *Abies koreana* treeline, if a cableway were to proceed.
- Highly significant visual impact if constructed above the treeline
- Potential conflict between track users and cableway patrons
- Cableway alone will not solve management problems



First view to Halla on Yongsil Track – ‘a’ and ‘b’ cableway options would be in viewscape, ‘c’ would be at treeline on right, out of sight

Management Options for Mt. Halla

a) maintain and fully stabilise the popular Orimok Track to WitsaeOrum;

b) stabilise and re-organise the facilities at WitsaeOrum - less visual impact;

c) close the Yongsil Track beyond the 500 Generals viewing area and preclude access to WitsaeOrum from this point;

d) close the much less used Kwanumsa Track past the lava tube area;

e) close the Songpanak Track beyond Azalea Fields;

f) stabilise and re-organise the facilities at Azalea Fields - less visual impact;

g) close off all access to the Summit area in the short term – longer term, limited number Ranger guided walks - Azalea Fields to the Eastern edge of the Summit;

h) build upon the existing knowledge base and investigate the World Heritage potential of Hallasan National Park;

Management Options for Mt. Halla (cont'd)

then either:

i) to cater for increasing demands, construct the Yongsil route cableway to a point at the treeline and create a detailed and informative visitor interpretation facility at the bottom station, stressing the importance and fragility of the alpine and Summit areas and the reasons why access is currently restricted.

or

j) investigate the possibility of increased Federal funding for the management of Hallasan National Park or indeed the actual transfer of management to the Federal National Parks Authority. World Heritage listing may facilitate this process.

- Without this re-think of the entire track system, the construction of a cableway would only cause greater impacts and add another layer of complexity to the management of Hallasan N.P.

Le sentier métallique surélevé installé pour atténuer l'érosion due au passage des touristes dans le secteur du Mont Kosciusko.
The raised steel walkway constructed to alleviate damage to and erosion of recreational walking tracks in the Mount Kosciusko area

World Heritage Potential

•Republic of Korea has 5 World Heritage Properties, all inscribed for Cultural values:

- •Sokkuram Buddhist Grotto (1995)
- •Haeinsa Temple Changgyong P'ango, Depositories for the Tripitaka Koreana Woodblocks (1995)
- •Chongmyo Shrine (1995)
- •Ch'angdokkung Palace Complex (1997)
- •Hwasong Fortress (1997)

•Given the geomorphological history and botanical significance of Mt. Halla (as well as its spiritual value), there is potential for Hallasan National Park to be eligible for inclusion on the World Heritage List

•An adequate evaluation of the World Heritage values of Mt. Halla needs to be made by comparison with other similar areas, both in Korea and overseas, i.e. it needs to be evaluated relatively.

World Heritage Potential (cont'd)

- Values of Mt. Halla should be evaluated against other high mountain areas in both South and North Korea - ultimately, a joint ROK-DPRK proposal to nominate the high mountain areas of Korea?

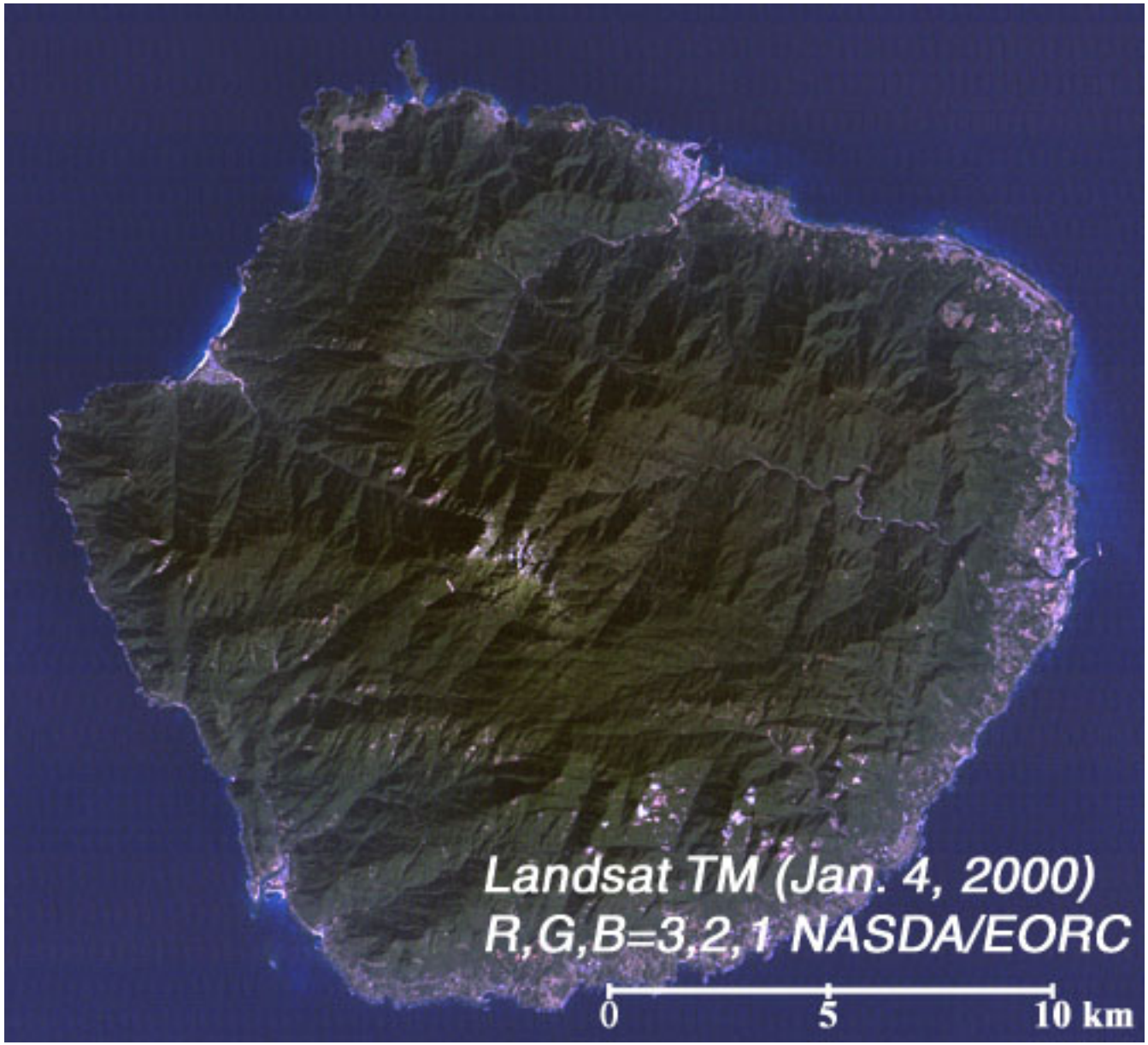
- Hallasan would be complimentary to Yakushima (Yaku-Island) World Heritage property in Japan, inscribed on the World Heritage List in 1993

- The interior of Yakushima rises to almost 2,000m and is the highest mountain in southern Japan.

- Like Cheju, the climate varies from sub-tropical, warm temperate to cool temperate, tending to sub-alpine. However, the predominant bedrock is granite, but small areas of sandstone and shale occur.

- Vertical vegetation distribution is distinct, with sub-tropical vegetation near the coastline, and warm temperate, temperate, cool temperate and sub-alpine species further inland as altitude increases.

Location of Yakushima (Yaku Island)



Yakushima (Yaku Island) World Heritage Area

Conclusions

- Without integrated track and visitor management strategy, construction of a cableway would only compound existing problems
- In the absence of a strategy, a technological solution cannot achieve the objectives desired for the management of Hallasan National Park
- Permanent and temporary strategic track closures and hardening existing tracks would go a long way toward managing existing visitor impacts, at least in the short term
- In the long term, a cableway may still need to be seriously contemplated if visitor numbers increase steadily as they have done
- South Korean Federal Government recently allocated a grant of 20 million Won (A$30,000.00) for track maintenance and rehabilitation in Hallasan
- Although not a large amount of funding, this is the first sign that the Korean Federal government is willing to spend money in Hallasan National Park

And a final word on culture and tourism…

"Grandfather Stones", known as Harruban, are found all over the island, in sizes ranging up to 3 m in height and were traditionally found at the entrances to Cheju villages ….

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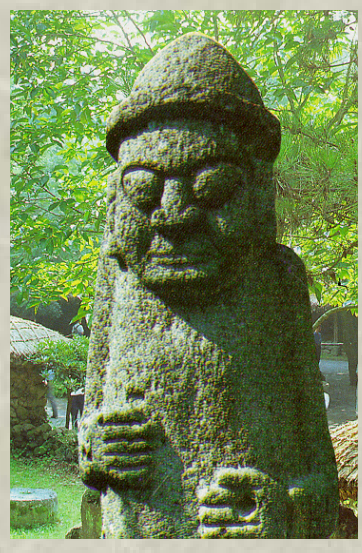

Small carved tuff Harruban now also form the stock-in-trade of tourist shops on a much smaller scale ***but***…

They are now being tastefully used for other novel purposes…

Acknowledgements

Information on the status, distribution and ecology of the flora and fauna of Cheju Island and Hallasan National Park was derived from a combination of published literature, as well as expert opinion and survey data provided by ***Dr. Hong-Shik Oh (Cheju National University, Cheju), Professor Suk-Chan Koh (Cheju National University, Cheju) and Dr. S-J Kang (Chungbuk University, Seoul).*** *Additional views on Korean alpine plant ecology were sought from* ***Dr. Woo-Seok Kong (KyungHee University, Seoul). Jung Hoon Han*** *from the* ***University of Queensland*** *was invaluable as a general and scientific translator in Korea and assisted with the translation of Korean articles in Australia.* ***Mr. Peter James*** *from* ***C&B Group Cairns*** *was Project Manager for the duration of the work, on behalf of Skyrail, and kept the work on track.* ***Ms. Inge Newman*** *at* ***CSIRO Sustainable Ecosystems*** *library in Canberra determinedly tracked down Korean and Japanese journals and articles for us.*