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## A Study on the Distribution of *Pinus densiflora* in DMZ area

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### DMZ 에서의 소나무 分布에 關한 研究

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#### ABSTRACT

It may be fully known that Korea is the main producing country of pine tree from the pan-Asian viewpoint of the geographical distribution of the pine tree. Through the study on the reason why the pine tree became a tree of the maximum cover degree in Korea and the observation of natural preservation status of all sorts of trees in the DMZ area for nearly 20 years after the Korean Armistice, it has come to know that almost all of the pine tree were banished.

This phenomenon has been resulted by the ecological characteristics of the pine tree itself which has no sprouting power at all, war disasters, deforestation and incendiary fire that have been steadily occurred until now since the time of Armistice.

#### INTRODUCTION

All the taxonomists, ecologists and dendrologists will not deny the fact that *Pinus densiflora* occupies more than 70% of the all forests in Korea.

Although some of *Pinus densiflora* has not been relieved from being withered due to *Dendrolinus spectadilis* and *Thecodiplosis daponicus* in recent years, it is undoubtedly a dominant species growing wild in a vast area of many different environments.

The morphological and taxonomical studies were made by Uyeki H. in 1928, and the results of study on the geographical distribution of *Pinus densiflora* were reported by Yoshioka K. in 1958.

In the performance of the investigation of the DMZ area in South Korea under the financial assistance of Smithsonian Institution, U.S.A., the author came first to aware of the fact red-pine\* disappeared from the whole DMZ area.

The present study started, therefore, in order to investigate the cause why red-pine growing wild everywhere throughout the country was replaced by other broad-leaved tree in the DMZ.

The field investigation was made not only on the whole DMZ area which extends 180 miles

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\* Red-pine means *Pinus densiflora*

from Kanghwa Island in the west to Koujin in the east coast through the central region, but also all over the rear areas; i.e. throughout the east coast of Korea, Honam and Yongnam regions, Koje Is., Wando Is., Hongdo Is. and Jeju Is. for the control of the DMZ area survey.

It is our great pleasure and privilege to have this opportunity to publish the results of our field investigation as mentioned above. At the same time, our special acknowledgement goes to the Smithsonian Institution, Dr. Y. Kang and Dr. E. B. Tyson who have rendered their good offices to our successful performance of the field investigation. We also extend our heartfelt appreciation to all high ranking officers commanding the front line in the DMZ area for their thoughtful help in the implementation of our project as scheduled.

### Geographical distribution of *Pinus densiflora*

As a result of the field investigation all over the Korean peninsula\* and Japan except Hokkai prefecture, it was made known as a matter of fact that red-pine grows wild everywhere throughout Korea.

According to Yoshioka K., *P. densiflora* is distributed around Lake Hungkii of the Sino-Russian border in the north, Laotung peninsula and Reasan of the Shantung peninsula in the west of China, Simokita peninsula in the east of Japan and Yaku Island in the south of Japan.

The pine tree grown wild all over the China mainland are *P. massoniana* and <sup>3</sup>/<sub>4</sub>*P. sinensis*. As shown in the figure of the geographical distribution, the major growing countries of red-pine are Korea, Japan and a part of the China mainland.

The geographical distribution of red-pine has been investigated as described above since 1964 in south Korea.

In Jeju Island situated in the southern extremity of the Korean peninsula, there was found only the forest of an old red-pine at 700m above the sea-level in the west of Mt. Hanra, and *Pinus thumbergii* was grown alone all over the island. Red-pine also grows wild in the islets of Koje, Namhae and Bokil in the south coast, while *P. thumbergii* predominated in most of the islets.

However, in the inland area *P. thumbergii* grows wild around the south of Pohang in the east and the south coast of Taean peninsula in the west, while red-pines shows an overwhelmingly dominant distribution in all other areas. The forest of *P. thumbergii* in the vicinity of Kangnung of the east coast is artificially afforested.

### Cause of the domination of *Pinus densiflora* in Korea

H. Walter reported that *Pinus sylvestris* which is similar to red-pine in both ecological and morphological aspects is dominant in the European continent because of the following reasons:

- 1) afforestation of a needle-leaf tree abundantly in waste land,
- 2) good use of the needle-leaf tree for construction material,
- 3) strong dissemination of the seeds,
- 4) ready artificial improvement, and

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\* The field investigation in North Korea was made before the end of World War II.

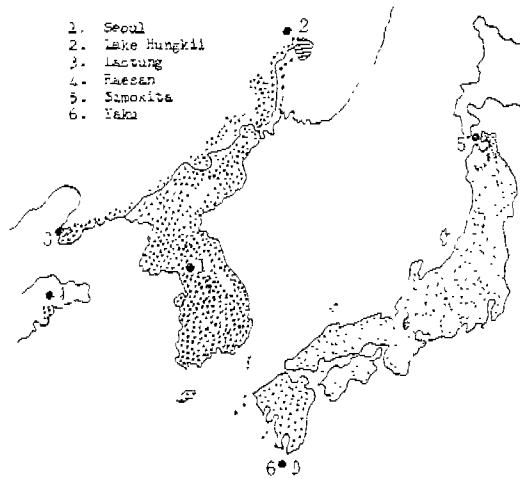


Fig. 1. Distribution area of *P. densiflora* in Southeast Asia

5) growth capability even in barren land where fallen leaves are collected.

K. Yoshioka indicated as follows:

Red-pine has become a dominant species by its ecological characteristics and artificial effects.

#### A. Ecological characteristics

1. Strong dissemination of the seeds.
2. As it is a light plant and grows rapidly at the early stage, it is not overwhelmed by any other trees.
3. Ready growth even in barren land.

#### B. Artificial effects

1. Ready invasion into the post-soil of deforestation
2. Ready invasion into the post-soil of forest fire
3. Ready reforestation

The writer considers the primary factors of the dominant distribution of red-pine in Korea as follows:

#### A. Ecological characteristics

1. Less demand of the temperature, water and nutritious matter.

In view of the fact that red-pine is distributed from latitude 31°N to 45°N, it may be easily presumed that the living limitation of red-pine to the temperature is wide. It grows well anywhere except an extremely damp area. As it has a strong tolerance to dryness, there may be commonly seen those pine trees growing on rocks.

2. Mycorrhizae is a parasite on the root.

H. L. Mitchell reported that, as a result of the experiment on *Pinus strobus*, the growth of the mycorrhizae-infected sapling is better than that of the non-mycorrhizae-infected sapling.

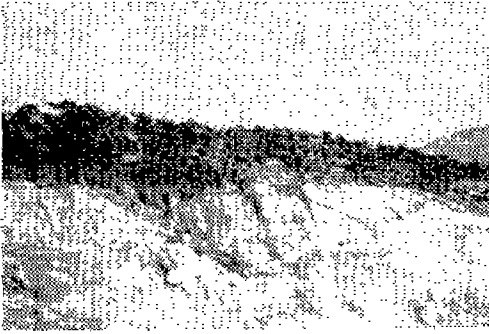


Fig. 2. Pine tree growing on rock  
at Changwi-dong

S. Miyasaki also reported that mycorrhizae seems to have the nature of absorbing a very small amount of water and nutritious matter and supply them to red-pine, because it produces mycellium all the more according to the dryness in barren and dry mineral soil.

### 3. Strong dissemination of the seeds.

The species that has a great over degree next to the red-pine in Korea is probably *Quercus*. The seed of *Quercus* is 50-100 times larger than that of the pine and has a little dissemination because it

rolls down in sloping area, while the pine seed will be dispersed scores of meters away even in the breeze because of its light wings.

## B. Geographical conditions

1. The underground wall rocks of the whole forest in Korea are generally formed of 65% of granites. The soil on the wall rocks of granite is extremely barren and dry. It is natural, therefore, that the red-pine grows thickly on such ground of scanty water supply and less nutritious soil as mentioned previously above.

### 2. Little precipitation

The annual rainfall in Korea is relatively little as compared with that of Japan and Formosa. What is more important is little rainfall in the months of March and April which greatly restricts the growth of other trees, but the pine that has the least demand of water grows well in spite of the scanty rainfall.

## C. Consequences of artificial effects

1. The Korean people have a strong thought of respecting the red-pine from ancient times. As the pine forest is dry and where little weeds grow, there inhabits no animals and vipers. Therefore, our ancestors planted the red-pine in the vicinity of villages and tombs from old times. This traditional custom of the Korean people might have expanded greatly the area of the pine forest throughout the country.

### 2. The pine trees as a unique timber

The pine timber has been exclusively used as a unique material for the construction of building, bridge, furnitures and fixtures, etc. This fully suggests the fact that the most comprehensive efforts had been made to some extent to foster the red-pine.

3. Expansion of pine forest caused the fields which was made after burning away forestry for cultivation or after accidental forest fire.

As reported by S. Honda in 1912, the red-pine expanded its cover degree all the more after burning away for cultivation. In other words, the population growth makes it necessary eventually to reclaim new arable land. Such reclamation, however, can be only possible in the forest of broad-leaved tree. As already reported by Lee and Monsi in 1963, no one intends to reclaim the pine forest due to the fact that the crops do not grow well the deforested soil of

the pine forest.

The field burnt away for cultivation is created by tilling without fertilization for 2 or 3 years, leaving those organic matters caused by the first fallen leaves when they are dried up and reclaiming new forests and fields. The old reclaimed land left as it was becomes the most suitable for the seed of red-pine which has a strong dissemination power to infiltrate into it.

### Geographical distribution of *Pinus densiflora* in the DMZ area

The DMZ indicated in this paper represents actually the survey area which forms almost similar geographical features to the DMZ area 4-5km on the south of the South Limit Line immediately adjacent to the DMZ area.

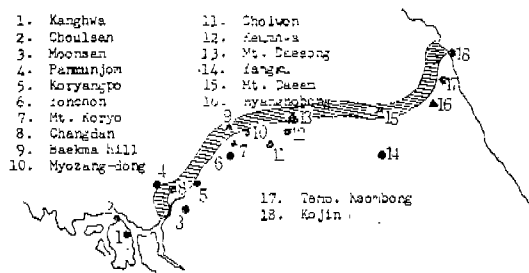


Fig. 3. Horizontal line represents the DMZ, vertical line indicates the area in the south DMZ, and dotted line is the area where pine-tree is now growing wild.

The area starting from Kanghwa Island in the west to Koujin in the east coast which covers 180 miles distance is divided into five zones for the convenience sake as follows: 1) Kanghwa Island Area, 2) Moonsan Area, 3) Yonchon-Cheolwon Area, 4) Yangku-Hyangnobong Area and 5) East Seashore Area.

#### (1) Kanghwa Island Area

In Choulsan-Ri in the northern end of Kanghwa Island, there runs Han River at about 2km distance from where North Korean farm villages can be overlooked. Therefore, the island is one of the most important strategic points to defend the free South Korea against the aggression of the North Korean Communist Regime. There can be seen a few pines but none of pine forest in the mountains within the so-called Civilian Off-Limits Area in the northern part of the island.

However, there are many pine forests in the flat area of the central and southern regions in the island, while all of the mountains 200-300m above the sea-level are completely barren. (Plate 1.a,b)

#### (2) Moonsan Area

The writer visited the DMZ in Moonsan Area in 1960 and was surprised to see the fact that pine trees were completely banished away from the whole area. The species newly invaded into the area where there were once rice paddy field and road were *Robinia pseudacacia* and

*Quercus*. A great deal of *Salix* invaded into the humid post-soil of the rice-paddy field. (Plate 1.c,d,e,f and plate 2.a)

(3) Yonchon-Cheolwon Area

Pine forest could be seen only in the vicinity of Koryangpo along the DMZ line. Pine trees were banished away from most of this area. If there is any pine tree in this area, it may grow mainly on steep rock mountains, precipitous cliff or in the south of Mt. Koryo in the vicinity of Myozang-dong. (Plate 2.b,c,d,e,e,f)

(4) Daesongsan-Hyangnobong Area

This area is the steepest region which forms the main Taebaek Range where the front line passage and position of the ROK Army is in mountains and Pouch Bowl respectively.

During the Korean War the mountain ridge was used as traffic road and became the hot place for fighting. The valleys have been abandoned since the war. Consequently, no pine trees could be seen in the vicinity of the pass and mountain ridge of the front line, while there grow some pine trees in the valleys and other mountains distant from the military roads. (Plate 3. a,b,c)

(5) Tp. Keombong-Koujin Area

This area covers the lean and long flat region facing the east sea and whole east foot of the Teabaek Range. There is a pine forest of more than 5-100 years old pine trees in three places along the roadside of the flat region, the forest of *Pinus thumbergii* planted along the seashore and a vast pine forest throughout Whajinpo. However, all of the pine trees around the mountain foot were deforested to the extent that there could be seen no trace of a red-pine forest. There is only the forest of an aged pine tree in the vicinity of Keombong Temple which was burnt down during the Korean War. (Plate 3. d.e.) Plate 3 f shows the typical pine tree as a control at Jinburi 25km away from the south of the DMZ.

**Reason of the banishment of red-pine from the DMZ area**

It is noticeable fact that all of the trees in the DMZ area have been steadily deforested in order to strengthen the defensive works against the infiltration of communist guerrillas which has been occurred frequently in recent years. In addition, an incendiary fire work is also carried out concurrently in order to remove herbs. In spite of the deforestation and incendiary fire, such broad-leaved trees as *Quercus*, *Lespedeza* and *Robinia* etc. are not withered but regrown every year, while pine tree is belighted without regrowth. This may fully justify the reason why pine trees banished away from the DMZ area.

The Korean War brought about bitter disasters to the forest land in the north of Imjin River of Moonsan Area, thereby red-pine was banished. In the banished place of red-pine in Moonsan Area, the forests of *Quercus* and *Robinia* have been formed. In the neighboring hills of Maji Op there can be seen charcoal here and there within the broad-leaved forest which bespeaks the forest fire caused by the war disasters. And also there can not be seen even a single piece of lumber used for houses in Changdan which was once a small town, but only stone fence and foundation stone. At present *Robinia* and *Salix* infiltrate into this area. In 200m hill at the intermedate point toward Changdan across the Freedom Bridge, there is

*Pinus rigida*, half of which is burnt down and the rest half continues to grow. This proves clearly the war disasters during the Korean War and that *Pinus rigida* has the regrowing power.

The Beakma Hill in the vicinity of Cheolwon is well known for its fierce battle ground during the Korean War. At present, however, red-pine grows wild abundantly in this hill area, because the seeds of pine trees in other neighboring plateaus which were not suffered from the war disasters flew into the Baekma Hill area. Since the Armistice in 1953 it has been steadily propagated and preserved well because this area is designated as Demilitarized Zone.

### Experiment on the sprouting pine trees

The pine tree has no sprouting power, in general, as mentioned previously above. The following experiments were performed in order to obtain the substantial data concerning the sprouting power of the pine tree.

#### Experiment 1

5—6 year old red-pine stems were cut at 15cm height above the ground. None of the stems was sprouted as shown below:

Date	Locality	No. of material	Age	Sprouting
Apr. 3, 64	Changwi-dong	20	5—6	None
	Mt. Kowhang	10	"	"
May 1, 64	Changwi-dong	20	"	"
	Mt. Kowhang	10	"	"

After this experiment, the writer picked up the stumps at Uminae in the vicinity of Seoul in 1967 and observed that many of them were sprouted. It was considered, therefore, that the pine tree might be a new varietas. From old times this place has been called as "Uminae" which means the sprouting of pine tree in literal translation.

#### Experiment 2

The green shoot on the main stem of 7—8 year old red-pine was cut 3cm from the end. The result of this experiment showed that the two lesses more than ten (10) shoots per tree were sprouted on August 1. This was the sprouting from the short shoot located under the two leaves and sprouting occurs.

Locality	No. of material	No. of sprouting per tree	Min. sprouting shoot per tree	Max. sprouting shoot per tree
Changwi-dong	10	10	6	11
Mt. Kowhang	10	10	8	10

#### Experiment 3

The whole leaves of 5—6 year old red-pine were removed in order to observe its resprouting process. This experiment was performed with three sample trees at Changwi-dong on July 28,

1964. The results of the experiment are as follows:

Locality	Removal of leaves (%)	Resprouted	Withered
Changwi-dong	100	None	Weithered
Mt. Kowhang	100	"	"

### Discussion and Conclusion

This paper is prompted by the disappearance of red-pine from the whole DMZ of Moonsan Area. It is felt quite strange that the pine tree which covers more than 70% of the forests and fields throughout the country can no longer be seen at all in the vast area in the north of Imjin River south of the DMZ. At the moment when charcoal produced by forest fire was found in the forest land of Moraena and Maji Op, it was enough evidence for the writer to presume that the war disasters banished all of the pine tree. The pine tree is withered by forest fire regardless of its size. Therefore, it can not be denied that the pine tree is very weak in its life as compared with *Quercus*, *Lespedeza* and *Robinia*. In order to prove the fact that the whole forests and fields area were completely burnt down by the war disasters during the Korean War, the writer inquired directly General H. Chang and General K. Choung who are the commanding officers in this front line area as well as many other officers who are familiar about the disasters in the area. All of these war veterans assured what the present writer convinced.

As a result of the field investigation throughout 180 miles of the DMZ area conducted thereafter, it was made known that the pine tree was also banished away from the whole area 3-4km south of the DMZ line except a part of the central mountainous area. This banishment of the pine tree was resulted by an exhaustive deforestation and incendiary fire in order to defend against any further infiltration of the North Communist guerrillas into the south. If the pine tree had the sprouting power like *Quercus*, *Lespedeza* and *Robinia*, it might have survived escaping from entire deforestation of pine tree.

As proved by the three experiments as described above, most of the pine trees have no sprouting power. Therefore, it is eventually withered by lumbering and forest fire. This contrasts markedly with the reason why the pine tree became the dominant species as explained previously above.

### 摘 要

一部山岳地帶를 除外한 全 DMZ의 南限界線에서 南方 5~8km의 넓이로 소나무가 完全히 驅逐되었 다. 이 現象은 다시 다음의 二區域을 나누어서 考察되어야 한다.

1. 臨津江 바로 北方인 UN軍管轄地區에는 現在 樹齡 13年生以下の 참나무, 아까시아 등의 潤葉樹만으 로 構成되어있는데 이것은 6.25動亂時의 激戰火 때문에 소나무가 모두 燒失되고 再生을 못한 탓이 다. 勿論 위의 潤葉樹는 모두 更新되었음을 알 수 있다.
2. 高浪浦以東의 全 DMZ線에서는 戰時의 戰火와 休戰後의 伐採 및 放火等으로 소나무가 完全히 追放된 것이다.



3. 소나무의 萌芽力이 없음을 實證하는 若干의 實驗을 하여서 소나무는 一旦 山火 또는 伐採를 當하면 다시는 自然 更新이 않되는 것을 뒤받침하였다.
4. 楊口北方의 中部戰線의 山岳地帶에서는 戰時에도 現在도 거의 放任되어 있는 溪谷에 소나무가 生殘하고 있다.
5. 江華島에서는 部落近方의 百米未滿의 山野에는 松林이 尙存하지만 300m以上の 山에는 人爲的인 伐採 때문에 亦是 追放되었다.
6. 東海岸의 DMZ線에서는 金鳳寺附近에 아직 少面積의 老松林이 있고 또 杆城北方의 平坦部에 老松林(數百本)이 있는데 모두가 保護를 받고 있어서 追放을 免한 것이다.

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