

Investigation of the Relationship between Succession and Vegetation with Volcano Eruption in Changbaishan

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Introduction:

Objectives:

1. Identify the characteristics of vegetation in Changbaishan
2. Understand the characteristics of succession in Changbaishan
3. Examine how volcano eruption affect the vegetation and succession in Changbaishan

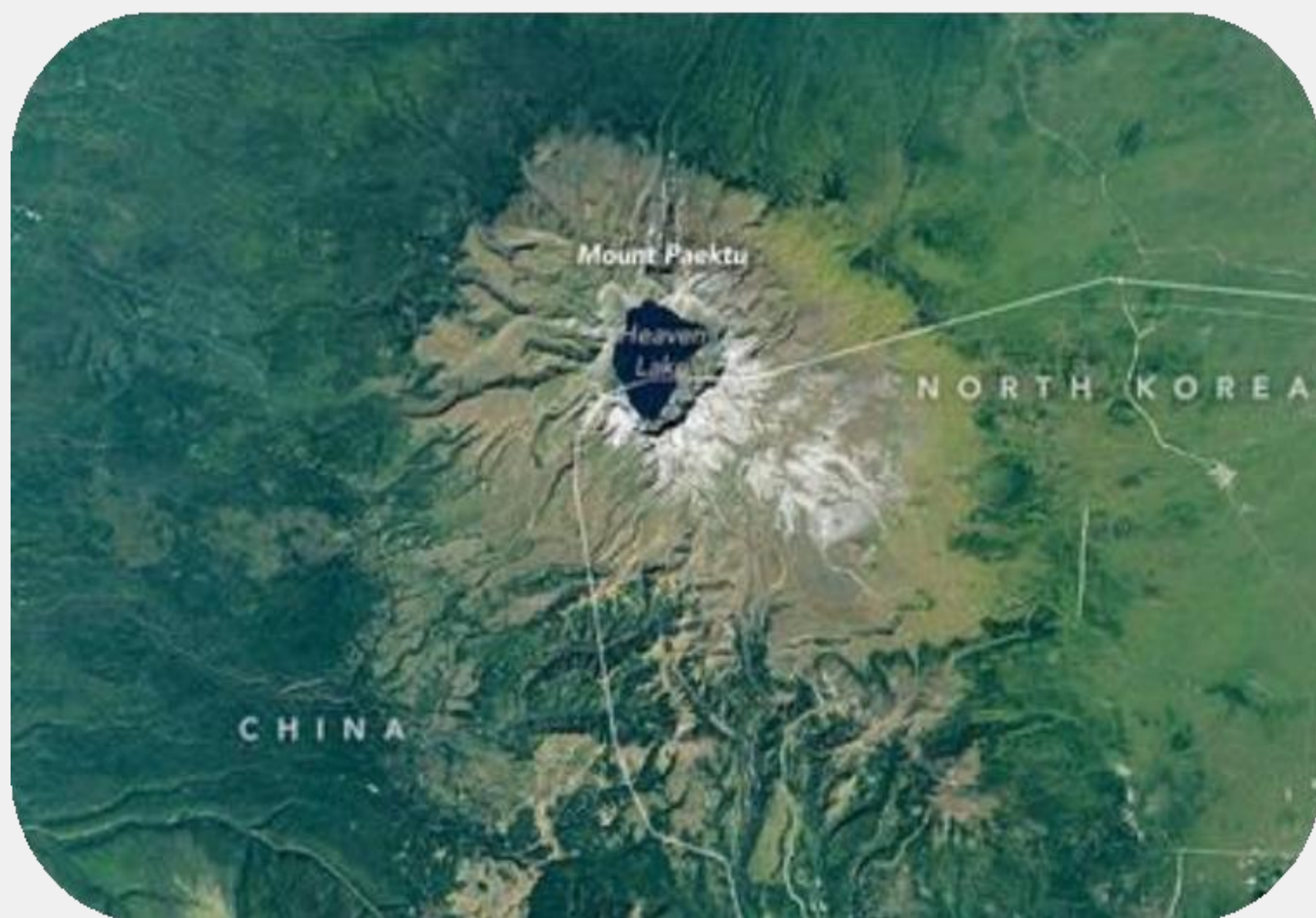


Fig.1 satellite image of Changbai Mountain

Background information :

Changbaishan is a large stratovolcano which located in the border between China and North Korea. The highest point of Changbaishan reach around 2,700m and there's a large crater lake called "heaven lake" on top of it. Changbaishan is one of the famous tourist attraction in Jilin Province and have rich landscape and species.

Around 946 AD, the largest explosion occurred in Changnaishan and affected as far as northern Japan.(Wei, Liu & Gill, 2013). After that, several eruptions were recorded in 1597, 1668 and 1702 (Dachang, 1986). And those eruptions may contribute the formation of vegetation and succession of Changbaishan.

Relationship of volcano eruption and vegetation succession :

After volcano eruption, lava, ash, tephra and others things destroyed the vegetation (Zhou, et al., 2016b). And lava will cover the land and harden into rock. Then, primary succession begins to happen. Pioneer species like lichens begins to grow on rock and turn it into soil. Then, when soil is deep enough, moss, ferns, grass, shrubs and small tree will alternatively to grow one by one. Finally, climax community will form. Therefore, primary succession took place after volcano eruption in general.

However, some other factors may affect the above process, including the affected areas, severity and frequency of volcano eruption, the material comes from volcano eruption, and the degree of soil formation. (Zhou et al., 2016b). Lands being covered by lava and form into rock required more times to weathering to grow plant, while lands covered by other types of material will soon can be developed from small trees to forest.

Characteristics of vegetation in Changbaishan :

Changbaishan's highest altitude is 2691m which provides various climatic and topographic condition. The vegetation changes along the altitudinal gradients and divided into different vegetation zones, including conifer-boardleaf mixed forest zone (600-1,150m), coniferous forest zone (1,150-1,700), birch forest zone (1,700-2,000) and alpine tundra zone (around 2,000) (Fang et al., 2016), which is a common completed vertical vegetational belts In temperate zone.

However, vertical vegetational distribution only appears in the northern slope with a clear dividing line. While eastern slope appears scattered distribution. Western and southern slope appears less completed distribution (Zhou et al, 2016a).

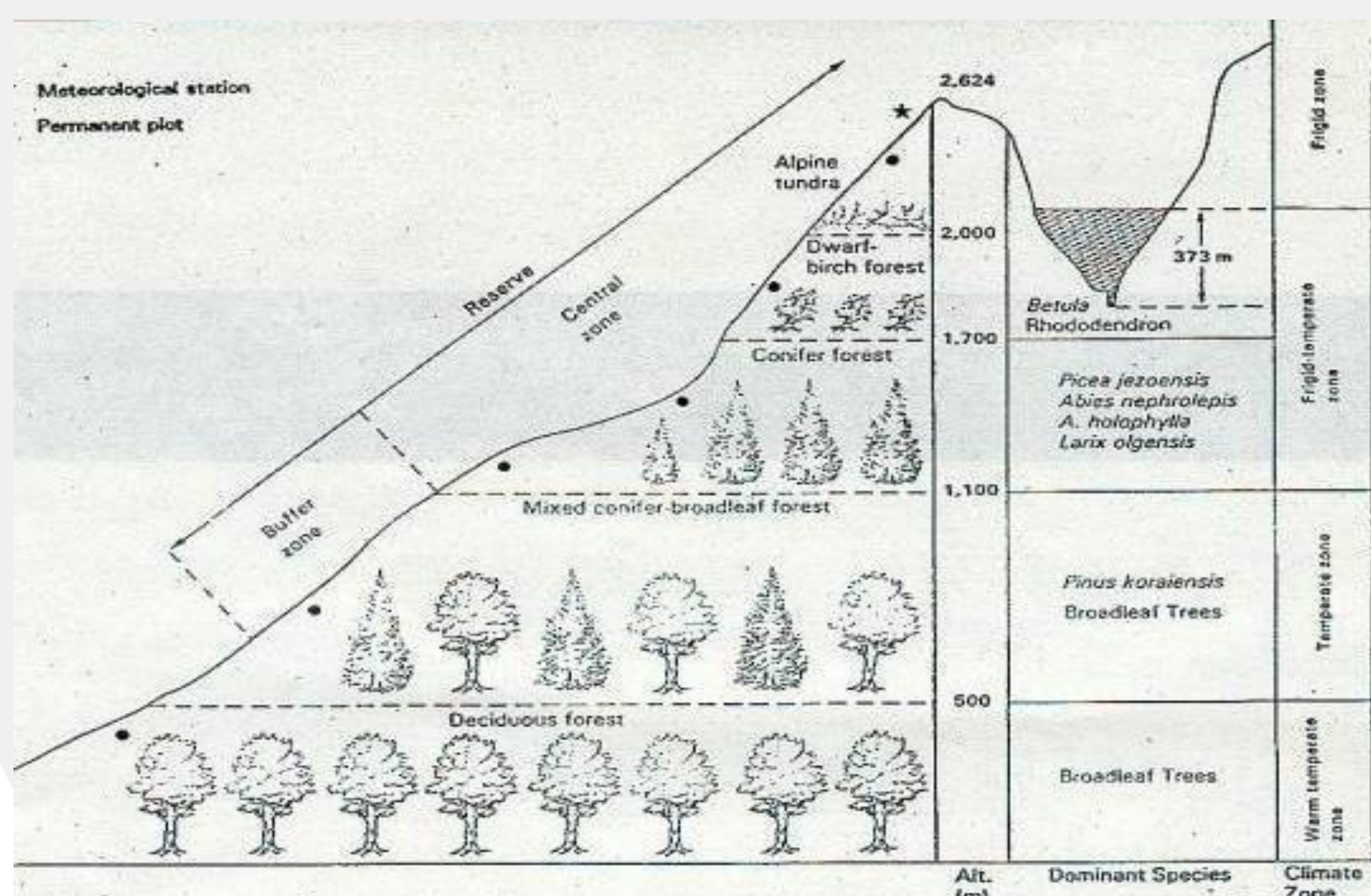


Fig.2 Altitudinal zonation of vegetation on north slope of Changbai Mountain (Zhao, n.d.)

Vegetation succession in Changbaishan after volcano eruption"

Research suggested the Millennium Eruption of Changbaishan has wipe out a great amount of forest but different degrees among different slope. The most seriously damage was the east slope and being damaged for other eruptions afterwards. It can be proved by the vegetation type which is mainly larch forest on the eastern slope, while compare with other slopes which performs a completed vertical vegetational belts In temperate zone. And it is suggested that larch forest is the transitional community established in the process of secondary succession (Dai et al., 2008, Jin et al., 2013).

Moreover, by identifying pollen spore and carbonized wood in the eastern slope in the underground, can be found that the history of original vegetation which is the usual vegetational belt in temperate zone. While compare with the evidence of volcano eruption in Changbaishan through tephrostratigraphy, it can conclude that eruption did occurred and buried most of the original vegetation in eastern slope on Changbaishan (Dai et al., 2008, Jin et al., 2013, Sun, et al.,2017).

Reference:

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 Figure 1. Reprinted from Volcano Discovery. (n.d.) Changbaishan volcano eruptions. Retrieved <https://www.volcanodiscovery.com/changbaishan-eruptions.html>
 Figure 2. Reprinted from Zhao Shidong. (n.d.) Biodiversity and Conservation of Changbai Mt. Biosphere Reserve; Current Status, Problems and Perspectives. Retrieved from <http://www.kiter.org/EVENTS/Conference00/html/Zhao%20Shidong.htm>

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Ecological Survey on Vegetation:

What do we measure?

By investigating the characters of vegetation in Changbaishan, it provides the fundamental ideas on the process of succession and reveals the relationship with the environment.

What data we collected?

The following items reflect the characters of vegetation including: Species richness (numbers of each species), density within quadrat, basal coverage, height of tree, relative height of tree, breast-height diameter.

How we measured?

By using quadrat sampling, we draw a 20m x 20m quadrat and conduct data of tree, shrub and herb inside.

1. Tree survey within the 20m x 20m quadrat, by counting: Tree species, visually estimate the approximate height, trunk diameter, the width and length of the crown spread
2. Shrub survey within 5m x 5m quadrat, by counting: Shrub species, height, species richness, relative abundance, basal coverage, density and frequency
3. Herb survey within 1m x 1m quadrat, by counting: Herb species, height, species richness, relative abundance, basal coverage, density and frequency

Tools required

Transect 100 m, Quadrat(5m x 5m), Quadrat(1m x 1m), Altimeter, Fixing rod, Measuring tape, Identification sheet, Data record sheet.



Result and discussion:

As mentioned before, Changbaishan experience a great destruction by volcano eruption, however, according to the result from this survey, it was found a well-developed forest with various species of trees.

Including those precious trees with high values, like *Pinus koraiensis* (紅松), *Tilia amurensis* (紫椴). Based on the result, it hardly observed any evidence of the impact of volcano eruption because of limited scale size and data in this survey. However, one conclusion can be made, the nature is able to restore the damage through succession.

Conclusion:

While doing an ecological studies in a place, different angles can be investigated. In this poster, two issues were discussed. Firstly, by doing research review, we try to bring out the relationship between the history of volcano eruption and the present characteristic of vegetation distribution in Changbaishan. Secondly, we try to summaries the experience of ecological survey practice in Changbaishan in the field trip and provide a briefly analysis on the data we have collected.

Result: Species diversity of trees in Changbaishan forest

Species name	Breast-height diameter (cm)	Height(m)	Minimum axis(m)	Maximum axis(m)
1. <i>Betula dahurica</i> (黑樺)	33.1	22	9.78	9.26
	20.55	20	3.42	1.94
2. <i>Syringa reticulata</i> (暴馬丁香)	8.9	6.76	5.63	2.62
	6	3	3.31	1.28
	5.85	6.24	4.22	2.03
3. <i>Tilia amurensis</i> (紫椴)	38.2	18	16.18	6.05
	33.15	20	9.54	6.82
	33.1	20	8.98	6.63
4. <i>Pinus koraiensis</i> (紅松)	39.3	23	5.34	3.52
	9.7	10	5.37	3.75
5. <i>Acer pseudosieboldianum</i> (假色槭)	12.45	9.5	3.67	3.11
	10.6	13	1.93	0.88
6. <i>Acer mono Maxim</i> (色木槭)	8.1	12	4.26	1.28
	16.1	11	5.54	5.85
7. <i>Cerasus tomentosa</i> (山櫻桃)	16.5	11.2	6.48	1.34
8. <i>Mongolian Oak</i> (蒙古櫟)	75.9	25	16.16	10.25
9. <i>Ulmus pumila</i> (榆樹)	10.7	12	3.78	1.52

Result: Species diversity of shrub in Changbaishan forest

Species name	Average height (cm)	Amount	Relative basal coverage
1. <i>Scabrous Deutzia</i> (溲疏)	87.9	22	40%
2. <i>Philadelphus schrenkii</i> (東北山梅花)	88.6	9	30%
3. <i>Actinidia chinensis Planch</i> (猕猴桃)	83.0	18	35%
4. <i>Ribesiaceae</i> (針葉茶藨)	80.4	1	1%
5. <i>Eleutherococcus senticosus</i> (刺五加)	59.1	11	40%

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