

Understanding Translated Geographical Concepts: Focusing Köppen's Tree Climates in Korea and Japan

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번역된 지리 개념 이해하기: 한국과 일본에서 쾨펜의 수목 기후를 중심으로

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Abstract : Given the difficulties in reflecting the true meaning of translated concepts from a source language, translatability and linguistic diversity should be considered to understand them. In educational settings, translated geographical concepts need to be inquired from the perspective of geography education rather than foreign language education. Accordingly, this study examined the differences by comparing the meaning of the translated concepts in Köppen's climate classification in Korea and Japan with what was intended in the original concepts described in German. While only the concept of tree climates is described in Köppen's writings, the concepts of treeless and tree climates are both being used in Korea and Japan. Additionally, Japan also uses a novel classification method to distinguish between forested and unforested climates. The teaching strategies recommended in this study include replacing treeless climates with nontree climates and, particularly in Japan, employing a new classification method for high forest climates and non-high forest climates. The findings highlight the need to consider the meaning and use of translated words understood in each region to effectively learn geographical concepts.

Key Words : Köppen's climate classification, Tree climates, Treeless climates, Unforested climates, Translated concepts

요약 : 원어에서 참 의미를 번역된 개념에 반영하는 것이 어렵다는 사실을 전제할 때, 번역된 개념을 이해하기 위해서는 번역 가능성과 언어적 다양성을 고려해야 한다. 교육적 맥락에서 번역된 지리 개념은 외국어교육보다는 지리교육의 관점에서 탐구될 필요가 있다. 본 연구는 한국과 일본에서 쾨펜의 기후 구분 내 번역된 개념들의 의미와 독일어로 기술된 원 개념에서 의도된 의미를 비교하여 그 차이점을 살펴보았다. 쾨펜의 저술에서는 수목 기후의 개념만 기술하고 있지만, 한국과 일본에서는 수목 기후와 무수목 기후의 개념이 모두 사용되고 있다. 여기에 더해 일본은 새로운 분류 방법도 사용하는데, 수림 기후와 무수림 기후를 구분하고 있다. 본 연구에서 제안하는 교수 전략에는 무수목 기후를 비수목 기후로 대체하는 것과 특히, 일본에서 삼림 기후와 비삼림 기후를 구분하는 새로운 방법을 사용하는 것이 포함된다. 본 연구는 지리 개념을 효과적으로 학습하기 위해 각 지역에서 이해되어지는 번역된 단어들의 의미와 용도를 고려해야 할 필요성을 강조한다.

주요어 : 쾨펜의 기후 구분, 수목 기후, 무수목 기후, 무수림 기후, 번역된 개념

I. Misunderstanding Translated Geographical Concepts

In Korea, students are taught that trees do not or cannot

grow in dry climates (Lee, 2022). Seeing videos or photos showing trees growing in arid climates (e.g. ironwood trees in the Sonoran Desert, gum Arabic trees in Namibia, ghaf trees in the UAE, and juniper trees in Oman)

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therefore contradicts what they learn in school. This is because the meanings for tree as understood in Korea and Köppen's theory are different (Lee, 2022). In other words, the cause of the problem is in understanding translated geographical concepts.

In recognition of these issues, existing literature has tackled translatability and linguistic diversity (Burenhult and Levinson, 2008; Haspelmath, 2010; Burenhult *et al.*, 2017; Pavliuk, 2023). Translatability can be derived from the availability of translational equivalents in the target language. For example, it is said that 'regulation' within the EU context is similar but not identical to the closest translated language equivalent in Ukraine (Pavliuk, 2023). From an intercultural translatability standpoint, the meaning or linguistic categories of basic concepts may vary across languages. In the case of 'forest', it is possible to encode not only the meaning of a densely treed area, but also the abstract spatial meaning of the outdoors (Burenhult *et al.*, 2017).

As previously demonstrated, it is difficult to straightforwardly translate the source language into the target. Therefore, people who use the translated concepts may misunderstand its original meaning. That is, the meaning of the source language of translated concepts may be interpreted differently depending on the cultural background of the target country. Although research was required to discuss how to deal with translated concepts in educational settings, many related discussions have been conducted primarily from the perspective of foreign language education (Riley, 1984; Pérez, 2005; Bahremand, 2015). However, it is believed that the meaning and limitation of translated geographical concepts can be understood more professionally and profoundly when discussed from the perspective of geography education (Day *et al.*, 2010; Lane *et al.*, 2019; Lee, 2022).

Lee (2022) analysed world geography textbooks in Korea, raising the issue that the expression "treeless climate" leads to conceptual misunderstandings for the first time. Moreover, it suggested the possibility that this problem may have originated from its relevance to

Japan. Building on this possibility, this study confirms the reciprocal relationship between Korea and Japan by comparing the cases of use in both of them.

In this process, Lee (2022) served as a significant reference point and formed the basis for the discussion of this study. However, since the prior study was written in Korean, it posed challenges for international readers in comprehending the findings, so it was necessary to introduce the core parts of the previous research in English. Nevertheless, this study critically accepts the contents of Lee (2022) and strives to describe them more clearly and accurately than the preceding research.

This study aimed to examine the differences by comparing the meaning of the translated concepts in Köppen's climate classification in Korea and Japan with what was intended in the original concepts described in German. To this end, we analysed several cases of use in geography textbooks and online searches in Korea and Japan, which both utilise the same Chinese character for tree. Through this, we identified the differences in understanding of translated geographical concepts related to Köppen's tree climates. Based on discussions of these linguistic attributes, we sought strategies that are appropriate for teaching these concepts more effectively in Korea and Japan.

II. Köppen's Theory¹⁾

1. Understanding of Köppen's climate classification

Köppen's climate classification is a widely used and well-known method around the world. It empirically classifies world climates using temperature and precipitation indicators based on vegetation growth environments (Beck *et al.*, 2006; Kotteck *et al.*, 2006). The climate types in Köppen's classification provide a convenient framework for explaining the relationship between climate and physical world factors or human activities (Bennetts, 2005:127).

First published in 1884, Köppen continued to develop his theory before publishing it in his final study, 'The Geographical System of Climates (*Das geographische System der Klimate*)', in 1936 (Rubel and Kottek, 2011: 361-362). His student Geiger continued to revise it before presenting the Köppen-Geiger climate classification in 1961. As most modified theories used in many cases merely reflect minor modifications, Köppen's method continues to remain valid (Geiger, 1961, as cited in Rohli *et al.*, 2015; Beck *et al.*, 2018).

Köppen's climate classification continues to be used in recent studies, primarily to assess the predicting ability of climate models (Falquina *et al.*, 2022) and to investigate the environmental impacts of climate change on climate regions or biomes (Diaz and Eischeid, 2007; Wong *et al.*, 2012; Beck *et al.*, 2018). It is excellent for synthesising complex climate gradients into a simple yet ecologically meaningful classification system (Beck *et al.*, 2018:2). However, students may still encounter challenges in categorising specific climate types based on temperature and precipitation data (Larson and Lohrengel II, 2011). Thus, further research on climate classification will be

necessary to understand the principles behind climate types.

2. Tree climates in Köppen's writings

In 'The Geographical System of Climates (*Das geographische System der Klimate*)' (Köppen, 1936), Köppen classified A, C and D climates as tree climates (*Baumklimate*) (Fig. 1) where the annual precipitation is adequate for tree growth, and the average temperature in the warmest month is over 10°C (Hess, 2011). Köppen did not classify the remaining B and E climates separately but distinguished them from the tree climates (Köppen, 1936:14). In addition, he mentioned the concept of tree climates several times in other pages of the main text (Köppen, 1936:19, 28). While Köppen's writings described tree climates, they did not describe concepts opposite to them (e.g. treeless, forested and unforested climates).

Although Köppen did not clearly explain the concept contrary to tree climates, he described E climates as having no trees (*baumlos*): '[front part omitted] the C climates directly border the E climates "without trees" (...

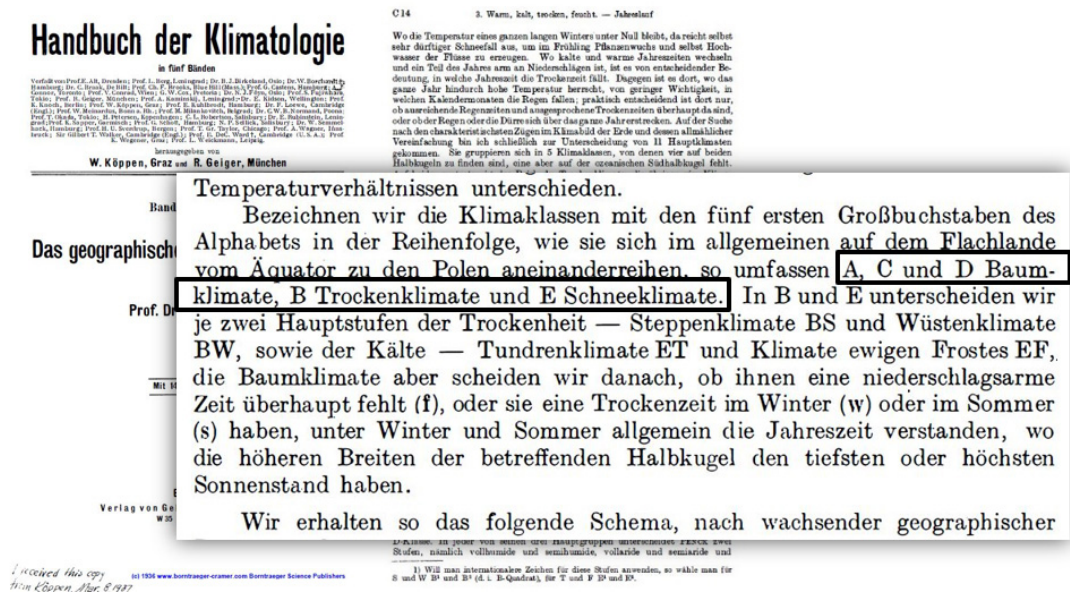


Fig. 1. Excerpt from the text in 'The Geographical System of Climates'

Source : Köppen (1936:14).

die C-Klimate unmittelbar an die "baumlosen" E-Klimate grenzen)' (Köppen, 1936:27). On the contrary, B climates were described as not being as 'hostile to trees (*baumfeindlich*)' as E climates: 'Because of the supply of water to the soil through groundwater or artificial irrigation, B is "not" nearly as "hostile to life or trees" as E [last part omitted] (*Wegen der Zufuhr von Wasser im Boden durch Grundwasser oder Künstliche Bewässerung ist eben B lange "nicht" so "lebens- oder baumfeindlich" wie E ...*)' (Köppen, 1936:28). In other words, Köppen acknowledged that trees could grow even in B climates because they could be supplied with water through groundwater or artificial irrigation.

III. Tree Climates as Understood in Korea and Japan

1. Meaning of translated words for tree

Although some translated words retain their original meaning, translated concepts may vary in meaning as linguistic context differs by region. Therefore, the translated words for tree can have dissimilar meanings in each country. The German word for tree is *Baum*. *Baum* is generally used as the generic term for woody plants and is also used in plant taxonomy to distinguish it from other woody plants such as shrubs and woody vines (Steinfort *et al.*, 2020). *Baum* represents the extrinsic and intrinsic characteristics of a tree: one stem growing tall and straight (extrinsic) with the presence of cambiums capable of secondary growth that increases the volume of the stem (intrinsic) (Matyssek *et al.*, 2010; Bartsch and Röhrig, 2016). *Baum* therefore has a similar meaning to 'high tree'.

In Korea and Japan, the Chinese character 樹木 is used to represent the meaning of a tree. 樹木 has a more generic meaning than *Baum*; in plant taxonomy, trees are classified into shrubs, high trees, and woody vines while the Encyclopedia of Korean Culture (2017) and the Japan National Dictionary (2003) both define 樹木 as the general

term for most woody plants in Korea and Japan. Further differences are observed between the Korean and Japanese terms as the Japanese 樹木 (じゅもく, たちき) may sometimes narrowly refer only to a high tree, while the Korean version (수목, 나무) is mainly used as a broad descriptor for all types of woody vegetation (Lee, 2011).

2. Cases of use in Korea²⁾

The geographical concepts of 'tree climates' and 'treeless climates' are introduced in geography textbooks in Korean high schools. Trees grow or can grow in tree climates (Kang *et al.*, 1982; Physical Geography Dictionary Committee, 1996:300), whereas they do not or are unable to grow in treeless climates (Kang *et al.*, 1982; Physical Geography Dictionary Committee, 1996:189).

The 'Kumsung Textbook' presents A, C and D climates as tree climates that indicate the presence of trees, and B and E climates as treeless climates that indicate the absence of trees (Hwang, 2019:35). The 'Visang Education' textbook distinguishes between tree and treeless climates (Choi, 2019:38-39). The 'Chunjae Textbook' also presents a climate classification method, which divides climates mainly into tree and treeless climates (Shin, 2019:35) (Fig. 2).

While Korean textbooks explain that trees do not grow in B climates, they also explain that date palms, olive trees and pomegranate trees, among others, grow in arid climate environments (Choi, 2019:39, 129-130; Hwang, 2019:125; Shin, 2019:126-127, 130). These descriptions can be considered slightly contradictory because they state that trees do not grow, but also imply that they do, in fact, grow even in dry climates.

Many examples of climate classification for tree and treeless climates can easily be found in Korean online search results. According to renowned Korean portal sites (e.g. Naver and Daum), most search results obtained usually describe tree climates as the ones where trees are present, while treeless climates are the ones without trees. Generally, A, C and D climates are classified as tree climates, and B and E climates are

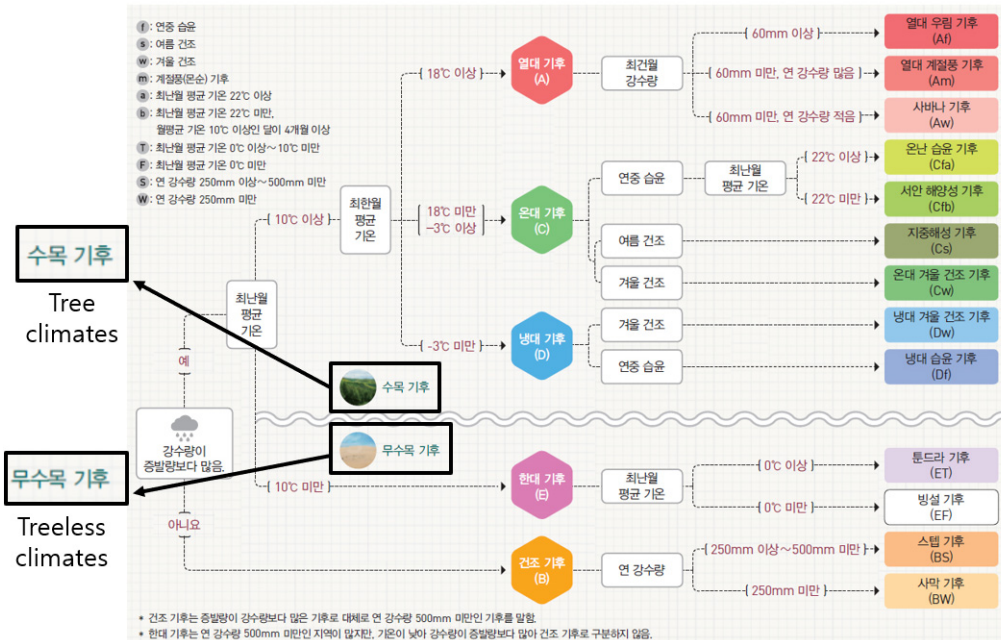


Fig. 2. Excerpt from the Chunjae Textbook

Source : Shin (2019:35).

classified as treeless climates as mentioned in the Doopedia dictionary (n.d.).

3. Cases of use in Japan

The geographical concepts of ‘forested climates’ and ‘unforested climates’ are introduced in geography textbooks in Japanese high schools. Unlike in Korea, the terms ‘tree climates’ and ‘treeless climates’ are not found in Japanese textbooks. Forests can exist or are formed in forested climates (Geographic Education Society of Japan, 2006; Tsutomu, 2015:38) but not in unforested climates (Geographic Education Society of Japan, 2006; Tsutomu, 2015:38).

The ‘Ninomiya Shoten’ textbook divides climates into forested and unforested climates based on the presence or absence of a forest (Akira, 2023:42). Similarly, the ‘Tokyo Shoseki’ and ‘Teikoku-Shoin’ textbooks classify A, C and D climates into forested climates, and B and E climates into unforested climates (Hiroshi, 2023:42; Noritaka, 2023:42, 45) (Fig. 3).

Japanese textbooks conceptually distinguish between ‘tree’ and ‘forest’ (Akira, 2023:39), clearly conveying that, although trees may exist in unforested climates, a forest does not exist under those same conditions. For example, trees may grow in an oasis, even in extremely dry desert climates (BW) where a forest is not typically found. Therefore, unforested climates are generally described as areas where it may be difficult for a forest to thrive, rather than those where trees do not survive (Noritaka, 2023:45, 48).

Japanese online search results display not only the classification method of forested and unforested climates, but also that of tree and treeless climates. According to renowned Japanese portal sites (e.g. Yahoo Japan and Google), these two classification methods have nearly the same meanings and appear to often be interchanged in Japanese daily life. For example, the Japanese Wikipedia (2024) defines forested climates as the ones where trees can grow and unforested climates as the ones where trees cannot grow.

	気候帯 平均気温	最暖月 平均気温	気候区	湿润・乾燥	分類基準	
					気温	降水量
Forested climates (climates with a forest)	A (熱帯)	18℃	Af 熱帯雨林気候	乾季なし	最寒月の平均気温が18℃以上	最少雨月降水量60mm以上
			Am 熱帯モンスーン気候	短い乾季あり		最少雨月降水量60mm未満 最少雨月降水量 $\geq -0.04 \times$ 年降水量+100
			Aw サバナ気候	乾季あり		最少雨月降水量60mm未満 最少雨月降水量 $< -0.04 \times$ 年降水量+100
	C (温帯)	3℃	Cs 地中海性気候 (温帯冬雨気候)	夏乾季・冬雨季	最寒月の平均気温が18℃〜3℃ 平均気温10℃以上が4か月以上 (北半球では5月と9月の各平均気温が10℃以上) c…平均気温10℃以上が1〜3か月 d…最寒月の平均気温が-3℃未満	S…夏に雨が少ない(冬雨型) W…冬に雨が少ない(夏雨型) f…年間を通じてほぼ均等に雨が降る
			Cw 温帯冬雨気候 (温帯夏雨気候)	夏雨季・冬乾季		
			Cfa 温暖・湿潤気候	年中湿潤		
			Cfb, Cfc 西岸海洋性気候	年中湿潤		
	D (亜寒帯)	10℃	Dfa, Dfb 亜寒帯(冷帯)湿潤気候 (大陸性混合林気候)	年中湿潤		
			Dfc 亜寒帯(冷帯)湿潤気候 (タイガ気候)	年中湿潤		
			Dwa, Dwb 亜寒帯(冷帯)冬季少雨気候 (大陸性混合林気候)	夏雨季・冬乾季		
			Dwc, Dwd 亜寒帯(冷帯)冬季少雨気候 (タイガ気候)	夏雨季・冬乾季		
Unforested climates (climates without a forest)	E (寒帯)	0℃	ET ツンドラ気候		最寒月の平均気温が0℃以上10℃未満	
			EF 氷雪気候		最暖月の平均気温が0℃未満	
	B (乾燥帯)		BS ステップ気候	年降水量が乾燥限界 r (mm) 未満 年平均気温を t℃とした場合 ● 冬に乾季がある地方: $r = 20(t+14)$ ● 乾季がない地方: $r = 20(t+7)$ ● 夏に乾季がある地方: $r = 20t$		年降水量が $\frac{1}{2}r$ 以上
			BW 砂漠気候			年降水量が $\frac{1}{2}r$ 未満
	H		H 高山気候	標高が高い土地(高度は気候帯による)		

Fig. 3. Excerpt from the Tokyo Shoseki textbook

Source : Hiroshi (2023:42).

IV. Strategies for Teaching Tree Climates in Korea and Japan

1. Current teaching strategies

The original content of Köppen's theory may have been modified in the process of adapting Köppen's tree climates in Korea and Japan. First, the concept of treeless climates (Korean 무수목기후, Japanese 無樹木気候, *むじゅもくきこう*) has been newly created in correspondence with tree climates (Korean 수목기후, Japanese 樹木気候, *じゅもくきこう*). This may be examined by older (20th century) textbooks in Japan and Korea, which 'treeless climates' first appeared. In fact, Köppen neither defined nor identified the term 'treeless climates'. Likewise, the usage of 'treeless climates' is not found in English references (e.g. English Wikipedia, Britannica, Oxford Reference and National Geographic Society) nor English online search results (e.g. Google and Microsoft Bing).

Second, Japan has introduced a novel classification method to distinguish between forested and unforest

climates (Japanese 樹林気候, *じゅりんきこう* and 無樹林気候, *むじゅりんきこう*, respectively), which can be substituted for the relationship between tree and treeless climates. This classification has the advantage of resolving misunderstandings that may arise from the concept of treeless climates. However, Köppen's tree climates are originally classified according to trees—or more precisely high trees—and not according to forests.

Korea and Japan naturally have distinct attributes surrounding their language compared to those in the German regions where Köppen lived (Jordan-Bychkov and Domosh, 1999). In essence, it is challenging to accurately convey the meaning of the source language to the target language in the translation process (Pavliuk, 2023). Therefore, translating a language must be done within the context of the target rather than the source country (Boas, 1911, as cited in Haspelmath, 2010; Lee, 2022).

The guiding principle for solving such misunderstandings is not to merely accept Köppen's theory as it is, but to adapt it according to the meaning and use of translated words utilised in each country, while preserving

the meaning intended in the original content as much as possible. In other words, differences in linguistic context must be considered when teaching students in Korea and Japan to prevent conceptual confusion about relevant terminology.

2. Recommended teaching strategies

If only the concept of 'tree climates' that Köppen himself mentioned is used, there would be no problem in understanding the translated concept. This is because tree climates are climate types in which trees, including both high trees and general woody plants, grow. However, it seems that Korea and Japan have faced several issues due to the use of 'treeless climates' or 'unforested climates', which are concepts contrary to tree climates.

One potential solution to this issue is to replace the term 'treeless climates' with 'nontree climates'. Generally, in plant taxonomy, the word 'nontree' is mainly used to refer to other plants that are not high trees (e.g. shrubs and woody vines). Nontree climates can be defined as climate types where diverse plants other than high trees predominantly grow. In nontree climates (Korean 비수목기후, Japanese 非樹木氣候, ひじゅもくぎこう), various plants, including woody plants, can grow even if they are not necessarily high trees. This solution allows for the conceptual presentation of the possibility of tree growth in dry areas without completely excluding it.

Another solution is to retain the current classification method for treeless climates and to add a prerequisite that limited tree growth may be possible given the existing descriptions of treeless climates. This solution considers some tree species that are adaptable to arid or cold environments and helps widely recognise cases where trees can inhabit areas even in treeless climates, provided specific topographical or micro-climatic conditions are met.

A special solution may be necessary for Japan, which employs a unique additional classification method for 'forested climates' and 'unforested climates'. Köppen

appears to have designed his classification of climate types based on high trees rather than on general woody plants or forests. Considering this aspect, Japan must further clarify the meaning of a forest comprised of high trees when developing criteria for Köppen's climate classification.

The word 'forest' normally encompasses the meaning of both 'high forest' and 'shrub forest'; thus, making a strict distinction between the two is more helpful for better conceptual understanding. Therefore, using the new term 'high forest climates', defined as the climate types where high forests appear, to replace the term 'forested climates' should be considered. In addition, instead of the current term 'unforested climates', the new term 'non-high forest climates' can also be introduced as the concept opposite to 'high forest climates'. This concept is explained as climate types where plant communities are not necessarily centred around a high forest.

From the perspective of words used in Japan, the Chinese characters for forest and high forest are 樹林 (Japanese じゅりん) and 森林 (Japanese しんりん), respectively. Just as trees come together to form a forest, 樹林 is defined as a community where trees grow densely, while 森林 is defined as a high forest comprising a cluster of high trees growing in humid areas (Encyclopedia Nipponica, 2001). If new climate types previously suggested are expressed using Chinese characters in Japan, 'high forest climates' can be written as 森林氣候 (Japanese しんりんきこう), while 'non-high forest climates' can be written as 非森林氣候 (Japanese ひしんりんきこう).

V. Conclusion

Köppen classified A, C and D climates as 'tree climates', but did not classify the remaining climates separately. While Köppen may have used the word 'tree' to refer to a high tree with a single, tall stem that grows straight and produces secondary growth through cambiums, the

meaning of ‘tree’ in Korea and Japan is mainly understood as a general term that encompasses all woody plants.

The concept of ‘treeless climates’, which was not described in Köppen’s writings, is also used as the concept opposite to tree climates in Korea and Japan. B and E climates are categorised as treeless climates, indicating the absence of trees. Although Köppen did not deny that trees can grow in B climates, the misunderstanding that trees cannot grow in such climates arose in Korea and Japan.

Besides, in Japan, the classification methods for forested and unforested climates, as well as tree and treeless climates, are being used. ‘Forested climates’ and ‘unforested climates’ are classified based on the presence or absence of a forest. Nevertheless, this novel classification method has limitations since the concept of Köppen’s tree climates is originally classified according to high trees.

Based on the discussions so far, we explored more appropriate teaching strategies for Köppen’s tree climates in Korea and Japan. We proposed to replace the term ‘treeless climates’ with ‘nontree climates’, or alternatively modify the existing descriptions of treeless climates to acknowledge the potential of limited tree growth. In addition, we also proposed to introduce in Japan the new terms ‘high forest climates’ and ‘non-high forest climates’, instead of retaining the currently used terms of forested and unforested climates.

This study demonstrates that it is essential to consider linguistic contexts to understand a geographical concept without any misunderstanding in countries where the concept has been translated. The translated geographical concept must be carefully examined to determine whether it accurately reflects the meaning of the original theory or presents content not present therein. Among the learning concepts we deal with in geography classes, there may be geographical concepts that originate from foreign countries and have been translated, such as Köppen’s theory. Thus, it is important to check for conceptual misunderstandings and to prepare alternative

methods for learning such concepts.

Further research is necessary in the following aspects. First, how Köppen’s theory was initially accepted in Korea and Japan, and how it has been discussed thereafter require closer examination. This will help in elucidating the reasons and processes behind the development of unique geographical concepts such as treeless and unforested climates. Second, other translated geographical concepts that reflect similar meanings but have nuanced differences in interpretation depending on the region should be explored.

Notes

- 1) This part mainly referred to Lee (2022:66–69).
- 2) This part mainly referred to Lee (2022:69–72).

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