

Current state of getting lost accidents and their mechanisms in Japan

-- The impact of getting lost, especially on back roads --

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1. Characteristics, history, and countermeasures for getting lost accidents in Japan

The number of mountain accidents in Japan increased sharply in 1994, following the "Mountain hiking boom" that began in response to the television broadcast of Japan's 100 most famous mountains, and tripled from 962 in 1994 to 3,043 in 2015. Since then, the number has continued to increase slightly, reaching 3,357 as of 2024.

The cause of this sudden increase in the number of accidents is "accidents due to getting lost ." As shown in Figure 1, the proportion of accidents due to getting lost among all causes of accidents has always exceeded 30%, reaching as high as 45% in some years. The number of accidents due to getting lost has consistently exceeded 1,000 since 2013, and remains at the present level.

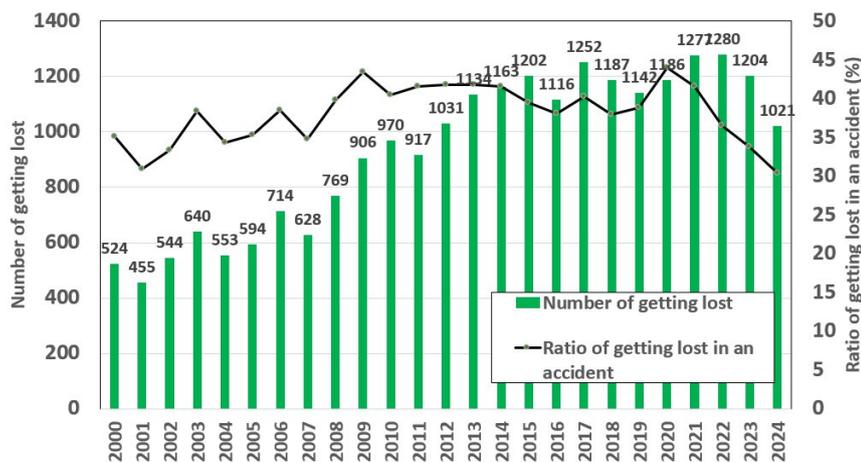


Figure 1: 25-year changes in get-loss accidents (2000-2024)

In Japan, all mountain accidents that occur in mountainous areas are handled by the police and fire departments. When they respond to a rescue request, the accident is treated as a mountain accident. In this case, a "lost accident" refers to the state of the area at the time the rescue team arrived on the scene. If there is no injury or death, it is recorded in the accident statistics as a safe rescue. Instead of "overdue " and "getting lost," as in the UK's Mountain Search and Rescue, all accidents have been treated as "getting lost."

A characteristic of "getting lost accidents" is that until 2010 they included "wild vegetable picking", accounting for over 20% of mountain activity, and many of these accidents involved getting lost. "Wild vegetable picking" is an extremely hazardous activity, as it involves straying from mountain trails for extended periods of time and venturing deep into the mountains,

making it easy to get lost. Since then, interest in "wild vegetable picking" has waned, with the rate declining from 20 % in 2013 to 8.8% as of 2024. The decline in the rate of lost trail accidents since 2020, as shown in Figure 1, is attributed to the effects of the "campaign to reduce getting lost " and a decrease in "wild vegetable picking" accidents.

Figure 2 shows typical causes of mountain accidents, plotted as a five-year average from 2020 to 2024. The figure shows that accidents due to getting lost are significantly more common than those caused by sliding down the hill, tumbling, illness, fatigue, and other factors. As a result, a "Mountain accident reduction activities" campaign was launched in 2021 with the slogan "Let's reduce the number of accidents due to getting lost by 1,000."

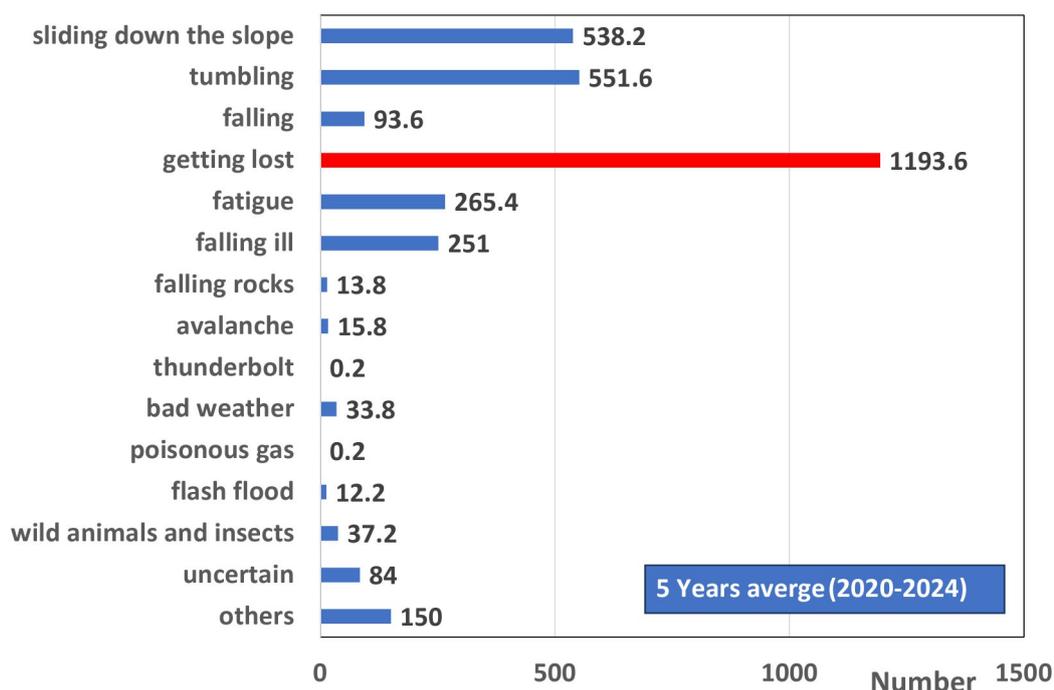


Figure 2: Five-year average causes of mountain accidents (2020-2024)

Meanwhile, seven prefectures with high mountain areas, such as the Japanese Alps, have enacted ordinances since around 2010 requiring climbers & hikers to submit a "mountain climbing & hiking registration," which includes contact information, a hiking plan, and the equipment they need. This is to enable a swift investigation in the unlikely event that a hiker gets lost or goes missing due to an accident. Even in other prefectures that have not enacted ordinances, there is a movement to make the submission mandatory. At the same time, various application software has been developed, and a movement is underway to share hiking information between hikers, the police, and fire departments.

The author conducted field experiments related to getting lost, spatial cognitive ability tests, and interviews with people who have become lost between 1997 and 2016, and has been involved in "Mountain accident reduction activities" with mountaineering organizations, police and fire departments, prefectural governments, and the Ministry of the Environment since 2013. I would like to introduce the main findings gained from these activities and the current problem of getting lost in Japan.

2. The three major causes of getting lost accidents and how they occur

Figure 3 shows that the causes of getting lost accidents are a combination of human factors, environmental factors, and information factors that interact with each other.

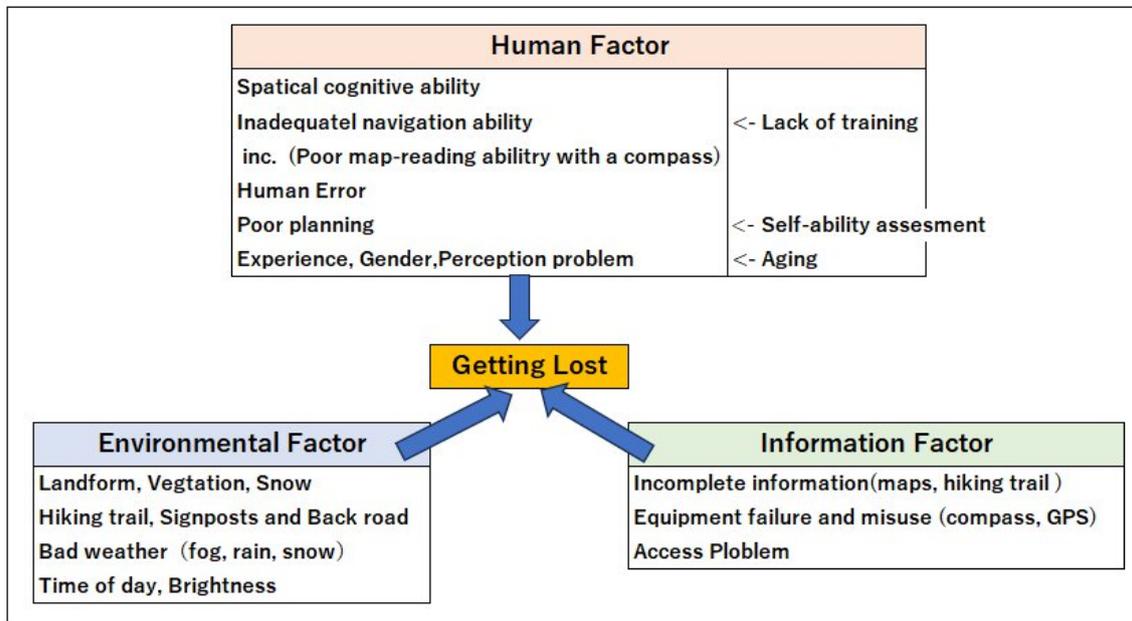


Figure 3: Correlation of the three major factors causing getting lost accidents

(1) Human Factors

Human factors that affect getting lost include the spatial awareness of hikers, depending on their age, low level of navigation ability, and human error. Spatial awareness varies greatly from person to person, including a good or bad sense of direction. Navigation ability is critical. A lack of ability to read a map and use a compass makes it easy to get lost, and even if people do get lost, they will not be able to find their way back to the right path, which is the main cause of most lost accidents.

When planning a mountain hike, if people do not plan a route that matches their navigation abilities, they run a high risk of getting lost.

Human error, which can lead to getting lost, is likely to occur due to changes in the environment and the condition of the hiking trail. A typical example would be making a mistake in choosing the right path due to assumptions when walking along a fork in the road that is difficult to distinguish from the terrain. Once a human error due to assumptions occurs, people will continue on the wrong route unless it is proven that their choice was clearly wrong, and they will often remain lost for a long time. Hiking routes where human error is more likely to occur are more likely to be rough hiking trails with fewer hikers. They are also more likely to occur in low mountain areas where there is a confusing web of trails for various purposes, such as work trails.

It is generally believed that older people are more likely to get lost and have accidents due to the effects of presbyopia and wandering away due to cognitive impairment. Indeed, as can be seen in the age distribution of people who get lost, the highest number of accidents occurs in the 60s, as shown by the solid red line in Figure 4. However, when examining the proportion of people getting lost among all accident causes by generation (blue), it shows a

tendency for the proportion to decrease as people age. This tendency for younger generations to have more accidents due to getting lost is similar to the results of an analysis of the causes of hiking accidents by generation in Germany.

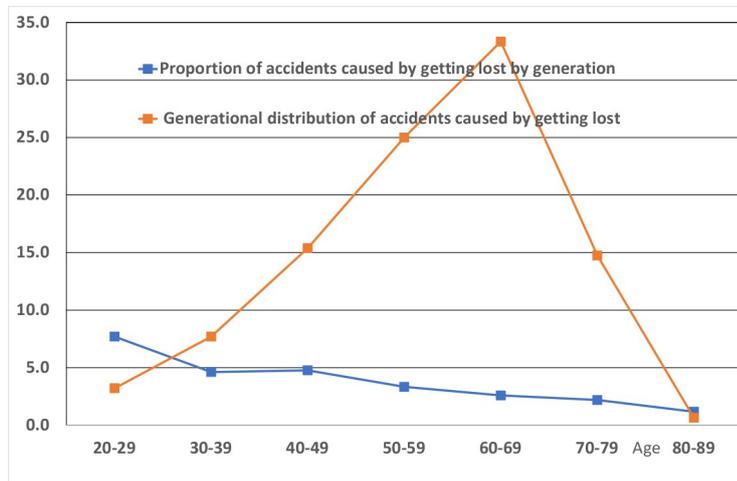


Figure 4: Number of getting lost accidents by generation and accident rate by generation

Next, regarding women's lack of map-reading ability, which became famous in Alan & Barbara's "Why men don't listen & women can't read maps," experiments on the navigation abilities of men and women have concluded that there is no difference. However, in experiments on getting lost on mountain trails, women perform worse.

(2) Environmental factors

The environmental factors that cause people to get lost, depending on the combination of the hiking trail, terrain, weather, and time of day, create a variety of places and situations that make it difficult to determine one's current location and direction. Since it's a problem of getting lost, the difficulty is naturally determined by the visibility level. It's impossible to move in the middle of the night without moonlight or a light. In bad weather conditions such as ground blizzards, whiteouts, or thick fog, navigation may be possible, but in most cases visibility is obstructed, making it difficult even for experienced hikers to move in the right direction. Experiments that replicate this blindfolded state on flat ground make it difficult to head straight for one's destination, leading to ring-wanderings that stray from the hiking trail and create radii of various sizes.

On the other hand, even if visibility is good, in gentle or low mountain ranges without any prominent features, the continuous, similar scenery makes it difficult to determine one's current location and direction. Furthermore, in areas overgrown with trees and weeds, one can easily stray from the trail and end up in a bushwhack, making repeated detours, which can quickly lead to losing one's current location and becoming lost. It is no surprise that people gathering wild vegetables who stray from the trails are prone to getting lost and having accidents. Furthermore, when snow accumulates deeply, the trails disappear and the terrain changes, making it difficult to judge the terrain and lose one's sense of direction.

As mentioned above, when considering the problem of getting lost on mountain trails, it can be seen that whether you are on or off the official hiking trail is the factor that determines the likelihood of escape from getting lost. Here, "official hiking trails" refers to trails marked on maps. This does not include trails that are actually maintained but not marked on maps.

Of course, getting lost can happen even when you are on the official hiking trail, but as long as you are on the trail, even if you are significantly behind schedule, you can somehow deal with the problem by turning back. It is also easier to find and rescue the lost person. However, if you stray from the trail, it becomes difficult to turn back and be found, so the risk of getting lost and wandering for long periods of time, which requires bivouacs, increases significantly.

The five reasons for straying from the hiking trail are:

Case 1: Darkness, bad weather; when visibility is limited,

Case 2: When the trail becomes invisible due to vegetation or snow cover,

Case 3: When the trail itself cannot be seen (rocky area, trail with mixed footprints),

Case 4: When a hiker leaves the trail of his own volition (to search for a toilet, pick mushrooms, for hobbies, etc.)

Case 5: When there is a path leading to an outside trail or place off the official hiking trail ("back trails"* , shortcuts)

* Here, back trails are defined as "a trail that is not shown on maps, even if there is a real trail."

(3) Information factors

Information factors include errors in mountain maps, delays in map revisions resulting in outdated information, irresponsible installation of simple guideposts, and deterioration of guideposts.

The basic maps used for mountain climbing and hiking are the 1/25,000 topographical maps issued by the government's Geospatial Information Authority of Japan, but the hiking trail information (e.g., course times, hiking trails) written on them varies from company to company. Furthermore, the digital information and paper-based map information for government master maps are different. In particular, paper-based maps are updated slowly, and in many cases, for example, when a new highway is built, it is only recorded on the digital map.

Secondly, because there is no standardization in signpost management or creation methods in Japan, signposts of various styles are created by organizations ranging from the Ministry of the Environment to prefectural governments and private individuals. Signposts made simply are prone to deterioration and can provide incorrect information to hikers and climbers. Furthermore, simple signposts such as tape, cloth, and painted marks placed along hiking trails are installed for various purposes, resulting in the problem of multiple pieces of tape or cloth being placed on a single tree. Even if people follow simple signposts, there are many cases where they end up at the wrong destination. While it is possible to assume that these factors contribute to accidents caused by people getting lost, it is difficult to grasp the actual extent of their impact.

Recently, many hikers and climbers have started using GPS, and even the GPS software for hiking trails can lose track of where they are if the map information used in the software is out of date. There are also issues with mountain areas where GPS is not compatible due to being outside of the radio wave reception range, and with excessive battery consumption in cold climates. Relying solely on GPS for navigation increases the risk of getting lost if the function stops working for some reason.

3. Interview survey of people who got lost and the results of the getting lost experiment

3.1 Interview survey with those who experienced getting lost

Interviews with 76 people who have gotten lost revealed that fearful experiences caused by anxiety can lead to auditory hallucinations in as little as one to two hours. Furthermore, they also reported that hallucinations appear if they wander the mountains for an extended period of time. Photo 1 shows a lost person who got lost and suffered from auditory and visual hallucinations, hunger, and thirst, who was found and rescued seven days later. While "getting lost" can be accompanied by hunger, thirst, and fear of death, many ordinary people think of it as being on the same level as getting lost in town. Those involved in mountain rescue efforts have even discussed changing the term "getting lost" in the context of mountaineering.



Photo 1: Scene in which the lost person was found after 7 days.

It is extremely difficult to interview people who have become lost. Because the majority of rescued people who have become lost are still lost, their answers are vague due to fragmented memories, and the accuracy and reliability of the content are lacking. The route they actually walked on the day of the accident is naturally different from the route they were imagining that they walked on a map. Therefore, in an interview lasting only a few hours, it was not possible to obtain a clear answer as to what route they walked. The problem was probably the vagueness of the people's memories and the vague questioning method of asking about their "experience of getting lost."

Therefore, I created a checklist with 79 questions divided into five categories (A. If you are on the hiking trail, B. If you leave the hiking trail, C. How to move, D. Terrain conditions, E. Visibility, F. Front view).

The task involves using maps, photos, etc., to identify the scene of getting lost accident and following the questionnaire. As time passed, we (the lost person and investigators) sought out memorable scenes at each location the lost person visited, drawing like stop motion footage, and then we came up with a comprehensive estimate of the route we thought the person might have actually taken.

For the interviews, we sought a person who had sufficient mountain hiking experience, understood our purpose of safe mountain hiking, and was willing to cooperate with the

interviews over an extended period of time. Figure 5 shows the analysis results of a person who got lost on Mt. Ishizuchi for three days. The interviews took a total of 15 hours over five days.

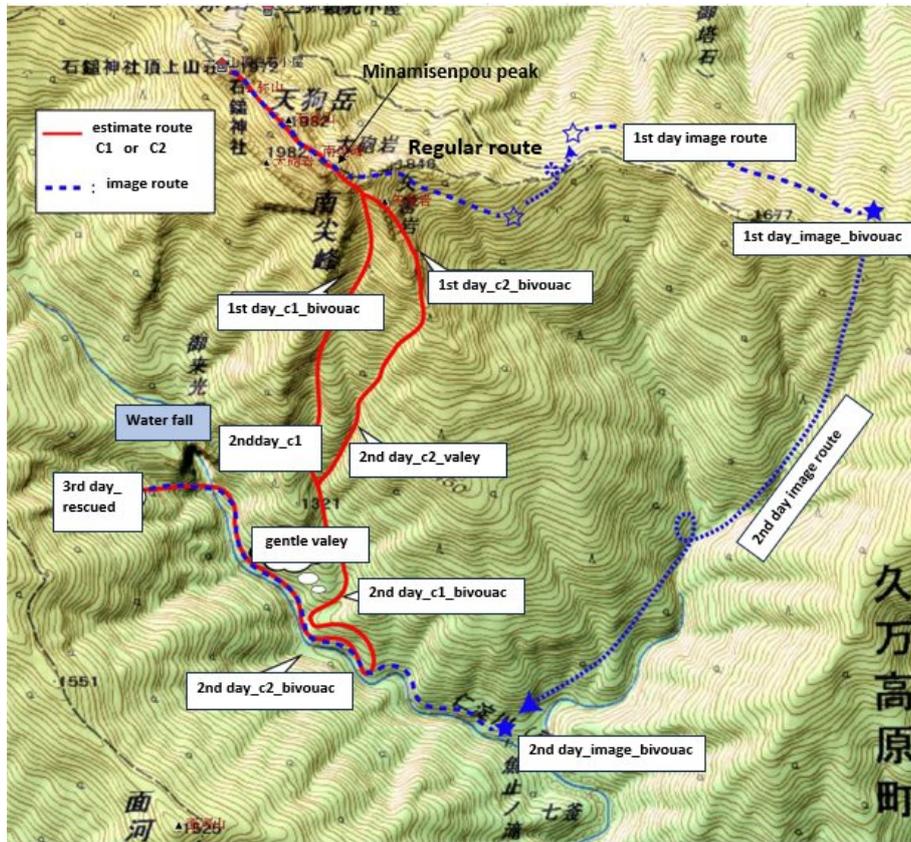


Figure 5: Actual routes taken by the lost person and his imagined routes

On the first day, the victim aimed to descend the ridge extending east from the summit, indicated by the blue dashed line. However, it is estimated that he actually went around the rocky area of the Minamisenpou-peak, a little east of the summit, and descended the southern slope, indicated by the red line. At this time, the two routes C1 and C2 were estimated on the map because the route could not be narrowed down. Along the way, he bivouacked on the ridge for the first day. At this point, he had lost track of the approximate location and thought he had bivouacked near the blue star.

On the second day, he continued down the slope (C1 or C2) to the south, meeting at around 1,321 m, and the estimated route became one, with bivouacs (two locations) on gentle slopes close to the valley bottom. But his imaginary route would allow him to head south in one go, and he bivouacs near the confluence of the two rivers.

On the third day, the path he actually walked overlapped with the path his imagined, and when he had hiked halfway up the slope just before the waterfall, he received a call and was rescued.

The reasons for getting lost and straying from the trail are Case 2 (the trail is not visible due to vegetation) and Case 3 (rocky terrain makes it difficult to see the trail). However, the

lost hiker had a compass and a map with him. If he had mastered navigation techniques beforehand, he would have realized the inconsistency at an early stage, even if he had imagined heading towards the east ridge but actually descended to the south. One of the characteristics of lost trail accidents is that even experienced hikers who have not mastered navigation techniques sometimes walk in this reckless manner for long periods of time.

When lost people are rescued, they are often told that they "ended up in an unexpected place." This is because the "route they were actually walking" and the "route they imagined on the map" are different. The navigation ability of hikers can be confirmed through a getting lost experiment.

3.2 Getting lost experiment in the mountains

There are two methods for conducting a getting lost experiment: (I) the subject walks a route marked on a 1:25,000 map, and an examiner follows behind, measuring the subject's walking trajectory and observing their navigation ability, and (II) the subject is given a 1:25,000 map, and the examiner guides the subject, telling them their current location at observation points, and the subject writes that location on the map.

Test method (I) is closest to the reality of getting lost, but it can only handle one person at a time, and most people, once they get lost, continue going until they are stopped. Therefore, although it is possible to track the path of a person getting lost, it is difficult to measure and analyze detailed map-reading ability, so the experimental method (II) was mainly used.

The experimental place was at an altitude of 100m to 400m. There were many work roads for power line maintenance, making it a hiking trail. There were no landmarks at all except for power lines, and the terrain was gently undulating, making it a highly challenging course for a getting lost experiment. The experiment was conducted between 1997 and 2016, with 612 participants. The subjects ranged from university students in their 20s to hikers in their 30s to 70s who belonged to mountaineering clubs. There was a slightly higher proportion of male hikers.

The results of the experiment (II) were roughly divided into three types. (Type 1: Cases where the location can be accurately identified using all measurement points on the route. Type 2: Cases where the person gets partially lost but can regain the correct route by making corrections along the way. Type 3: Cases where the person gets significantly lost.) Furthermore, within Type 3, beginners who were looking at a 1:25,000 map for the first time were classified as Type 30 and excluded from the analysis; the rest were classified as Type 31.

Type 31 is common among ordinary hikers, and although they bring maps and compasses with them when hiking, they use them based on their own interpretation and have never received training in how to use them. A typical example of Type 31, which is the problem here, is shown in Figure 6.

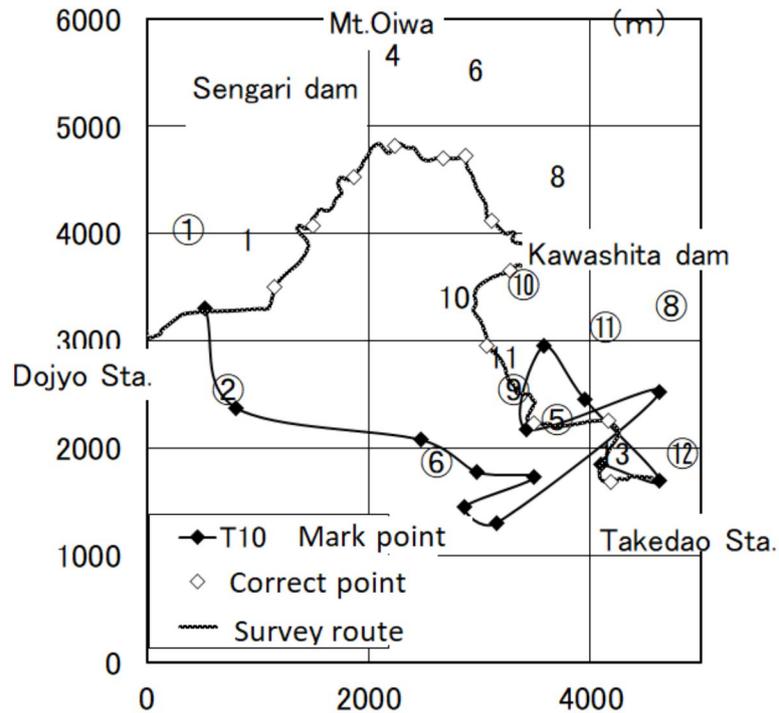


Figure 6: Getting lost experiment: Cases in which the actual location and the imagined location differ

In the getting lost experiment, subjects traveled along the regular course from measurement points 1 to 12 in the diagram, so the image points 1 to 12 that the subjects plotted based on their current location should overlap with the measurement points. However, as is clear from the diagram, he imagined his current location to be in a completely different place.

As the characteristics of the scenery he sees begin to match those on the map from point 10 at Kawashitagawa Dam, he gains a certain degree of confidence, drawing a complex curve. This type of situation, where he imagines his current location to be far from the correct location is common among Type 31 subjects.

I believe this case is very similar to the example of the real getting lost accident introduced in Section 3.1.

For each measurement point, the subject was asked to rate their confidence in determining their location on a four-point scale (4: Very much, 3: Some, 2: Almost none, 1: None at all). This subject showed the highest confidence level of 4 at measurement points 1 to 3, where the actual location and the imagined location began to differ. It appears that he received a topographical clue near measurement point 2. However, it is speculated that the reference point of the subject's coordinate system shifted significantly. Eventually, he were unable to explain the situation using his own coordinates, and his confidence dropped to level 1, indicating he had no idea, at measurement points 6 to 7. Later, by chance, the imagined location came close to the actual location, and his confidence recovered.

The important thing here is that even when Type31s are completely lost, they have a strong sense of confidence. This is a kind of human error. At this stage, there were many cases where people showed no interest even when given correct information (for example, passing a signpost).

A characteristic of lost people's navigation is that when they lose track of their current location on a map, they tend to jump to information such as outcrops of rock or streams they can see in the vicinity. Even if the location they considered is suddenly several kilometers away on the map, they make the human error of determining their current location regardless of the distance.

In a public getting lost experiment broadcast on television, a subject who had completely lost his current location saw a 1-meter-wide stream, interpreted it as a 40-meter-wide river in the northwest, and determined that his current location was a hiking trail near the river. Afterwards, when the TV director asked about his current location, the subject explained the relationship between the surrounding terrain and the map while walking, and there were no contradictions, and it was reasonably convincing.

In places without distinctive topographical features, the scenery remains similar no matter how far you go, and there is no information to correct your mistakes. It is natural that people get lost and accidents occur, so it is important to acquire solid navigation skills.

4. The problem of back trails that cause people to get lost in the mountains and difficulty solutions

4.1 Current status and problems of back trails in the mountains

Why do over 1,000 people get lost every year? Even when comparing data on people getting lost in other countries, no country has been found with more than 1,000 people getting lost. Those involved have long debated the cause (e.g., causes of straying from hiking trails; Cases 1-5), but it is difficult to imagine that the navigation skills of ordinary hikers in Japan are significantly inferior to those in other countries. And no other possible causes have been identified other than the high number of accidents resulting from "the abundance of overgrown mountains" and "picking wild vegetables."

However, around 2005, an application software company that handles large amounts of mountaineering-related data developed a system that records all of a hiker and climber's GPS-based walking tracks once they register. As a result, a huge number of hiking tracks by many hikers have been compiled into a database that can be viewed by the public. This is Yamareco's "Mountain Hiking Trace Records." Because the vast number of GPS footprints of people who spend their time in the mountains hiking and climbing, for leisure, or for work, are recorded on a map, it has become possible to understand the movements of hikers and climbers.

What caught my attention was that the walking tracks drawn as dots and lines on the map were not only on the official hiking trails, but also on slopes without trails. The latter is what is known as a back trail (causes of straying from hiking trails; Case 5) in the mountain.

The walking tracks revealed that the types of back trails differ from the official hiking trails, ranging from short routes like shortcuts on zigzag trails, to trails made in valleys by mountain climbers or canyoning people, fishermen, and civil engineers, detours, adventure trails off the beaten path into the mountains, small forest roads, and maintenance trails for power cables. People with various purposes for their activities in the mountains have created paths that differ from the official hiking trails. It was found that the distance of the back trails ranges from short paths of around 10m to ones that extend over several kilometers. When actually checking the back trails, some were wider than the official hiking trails, and many of them were where it was natural for hikers to get lost. Figure 7 shows an example of a junction

where the official hiking trail and the back trail diverge. From the photo, it appears that both paths are the same width and are comparable, but as can be seen from the GPS track on the map, the back trail does not have any dotted line symbols indicating a hiking trail, and you end up walking on a slope with nothing but contour lines. In other words, even if you are on a hiking trail, the map on your GPS screen will not show the trail, so you will not know where you are.



Figure 7: Junctions between official hiking trails and back trails (GPS-plotted map and photo)

To illustrate the relationship between typical, getting lost accidents and back trails, Figure 8 shows "getting lost accident locations" in the northern mountain range of Mt. Rokko, indicated by red circles. Despite its small area, this route is close to downtown Kobe and leads from the summit to the hot spring area in the north, attracting many hikers. As a result, many getting lost accidents (No. 1-11) have occurred.

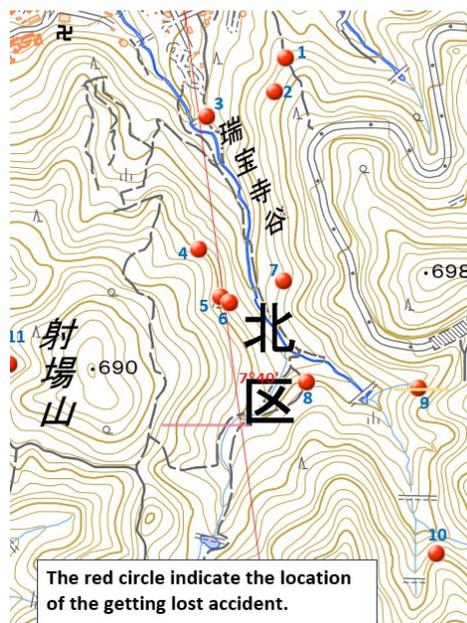


Figure 8: Locations where the getting lost accidents occur

After analyzing the causes of these accidents with the police and local officials, we found that the majority of getting lost accidents occurred on back trails (green routes) not shown on maps, as shown in Figure 9.

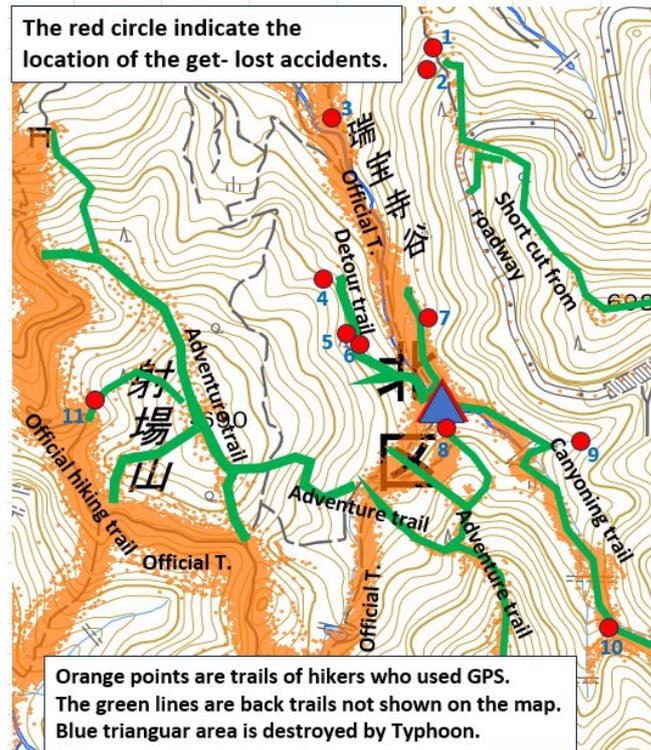


Figure 9: The influence of back trails on accidents

In particular, getting lost accidents No. 4-7 occurred on a detour route that spontaneously developed along a valley after the official hiking trail was destroyed by a typhoon at the blue triangle.

Figure 10 shows a wider view of the northern part of Mt. Rokko. We can see that nearly 30% of the hiking trails in the displayed area are back trails. It is not surprising that many hikers use these trails. Even when the displayed area is expanded further to look at the entire Mt. Rokko area, the number is still very high. When checking the mountain hiking records on Yamareco application software, this trend was also seen in other mountain areas. This is likely a characteristic of hiking trails in Japan.

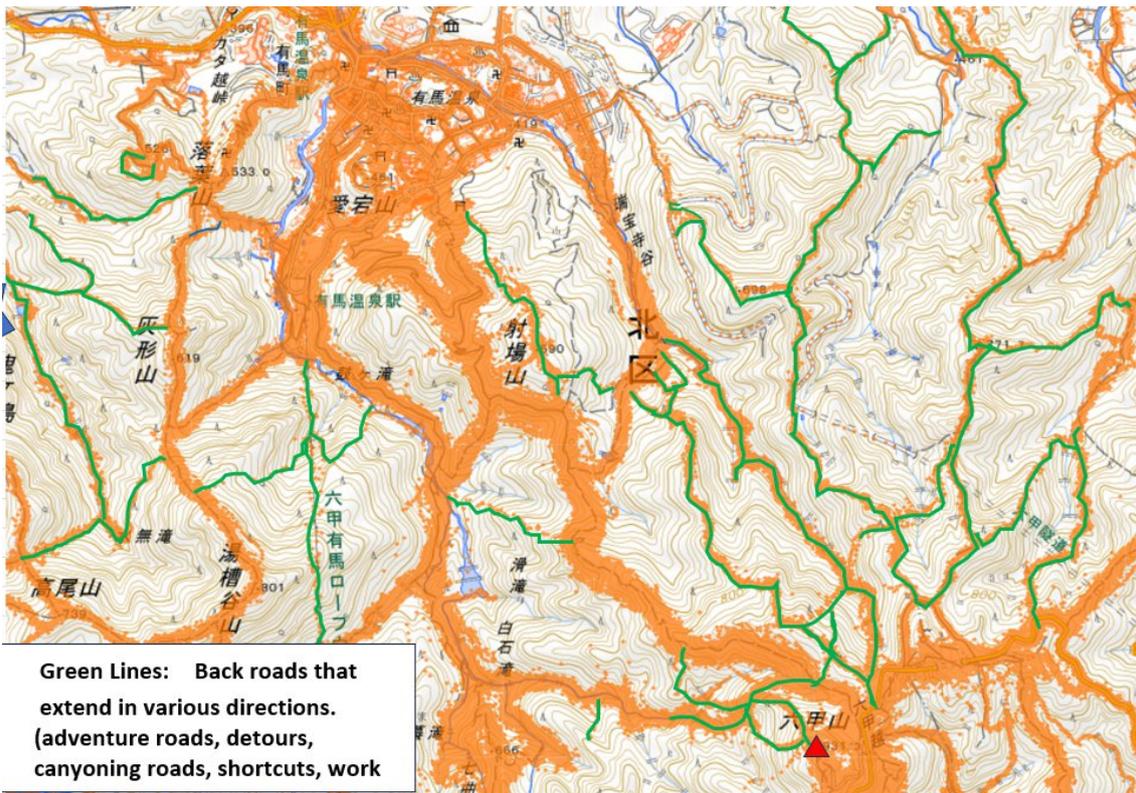


Figure 10: Back trails developing in various locations in the Mt. Rokko mountains

4.2 Consideration of measures to reduce getting lost accidents

To reduce the number of getting lost accidents, a safety council was formed, consisting of the police, fire department, local stakeholders, and government agencies. They considered installing signs to warn of dangers and prevent hikers from trespassing on back trails. However, it was pointed out that the locations where back trails exist all have complicated landownership issues, and that proper signposts, fences, and other structures would require permission from the landowners.

However, accidents involving people getting lost are certainly occurring. Although it is difficult to install signs due to the official position, in the name of prioritizing the safety of hikers, it was decided to install simple, easily removable guide signs enclosed in a laminated case and rope.

First, we created a database of hiking trails, including the locations of getting lost accidents in the mountain area where we are active, the location of back trails, and landowners, if known. Based on this database, we set up guide signs and created a system that can respond appropriately if any issues are pointed out by landowners, etc.

Furthermore, in cases where the landowner was clear on the back trails where a getting lost accident had occurred, simple fences were erected with permission. These activities significantly reduced getting lost accidents, confirming the effectiveness of these activities.

5. Conclusion

Getting lost is caused by a combination of three major factors: human factors, environmental factors, and information factors. We believe that if people have sufficient on-the-job training in navigation skills (training in map reading and compass usage), even if they get lost, they

will be able to calmly return to their original position and avoid an accident.

When hikers with low levels of navigation skills plan to go to mountains with poorly maintained trails, the risk of getting lost is extremely high. Furthermore, if factors such as worsening weather and poorly maintained trails are combined, there is a high probability of serious accidents resulting from getting lost. Unfortunately, the reality is that the majority of average hikers rely on their own navigation skills.

In the future, we will be keeping a close eye on the number of accidents involving people getting lost, to see to what extent the spread of smartphone GPS application software will be able to support hikers with poor navigation skills.