February 20 (Tue) 2024
APFSD11 Side Event
Promoting Synergistic Approaches in Asia and the Pacific: Addressing The Triple Planetary Crisis

Mitigating and Preventing Heat Stroke through the Use of Roadside Trees

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Introduction

●Growing number of heat strokes among urban residents in Japan due to rising temperatures.

● KERI conducted research this year on how Nature-Based Solutions (NBS) could help reduce heat strokes.

● Examined use of roadside tree shade to reduce heat stroke in urban areas

●Results suggest that roadside trees are effective in reducing temperatures and preventing heat strokes among pedestrians

Main takeaway⇒ *Urban vegetation is important both for climate mitigation and adaptation*

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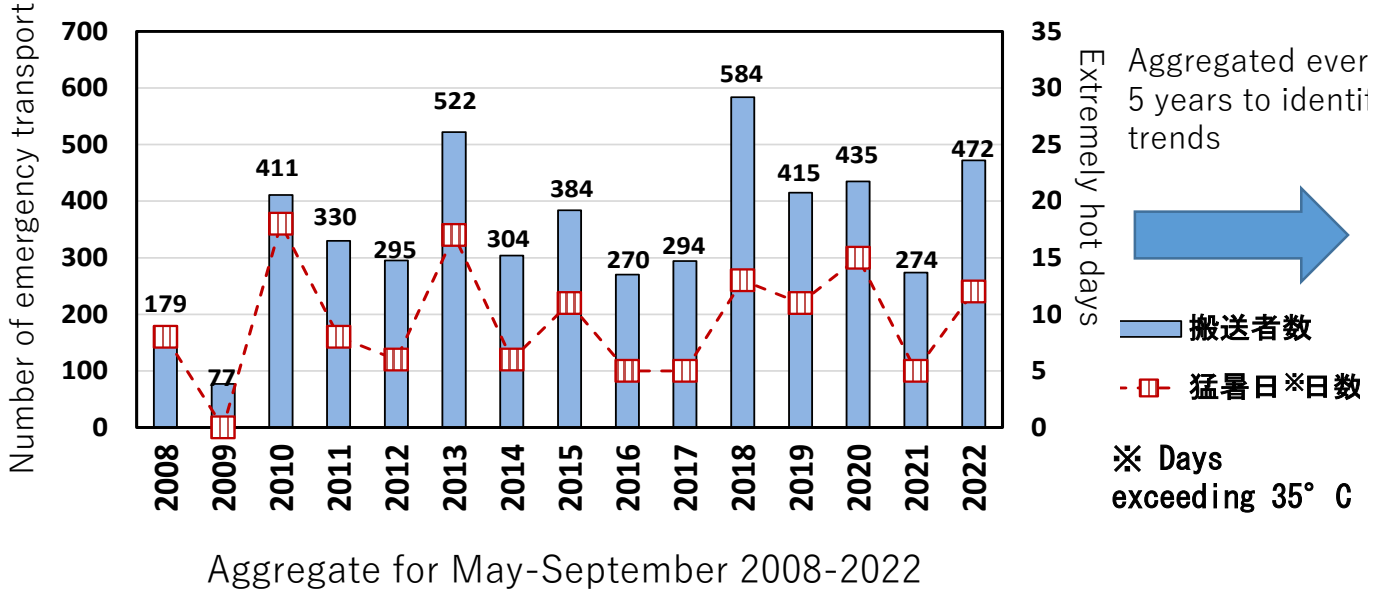
Research on heat stroke prevention ①

～ Heat stroke trends in relation to ambulance dispatchs on extremely hot days～

Trends over time

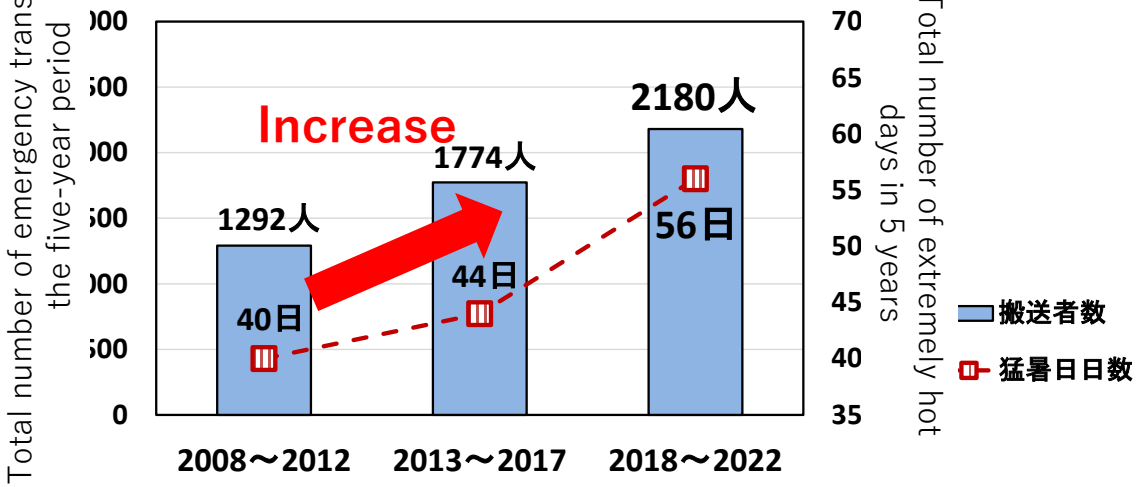


Aggregated ever
5 years to identi
trends

搬送者数
猛暑日※日数

※ Days exceeding 35° C

Trends over a five-year period



The frequency of ambulance use tends to increase on extremely hot days.⇒ Heat stroke prevention is crucial.

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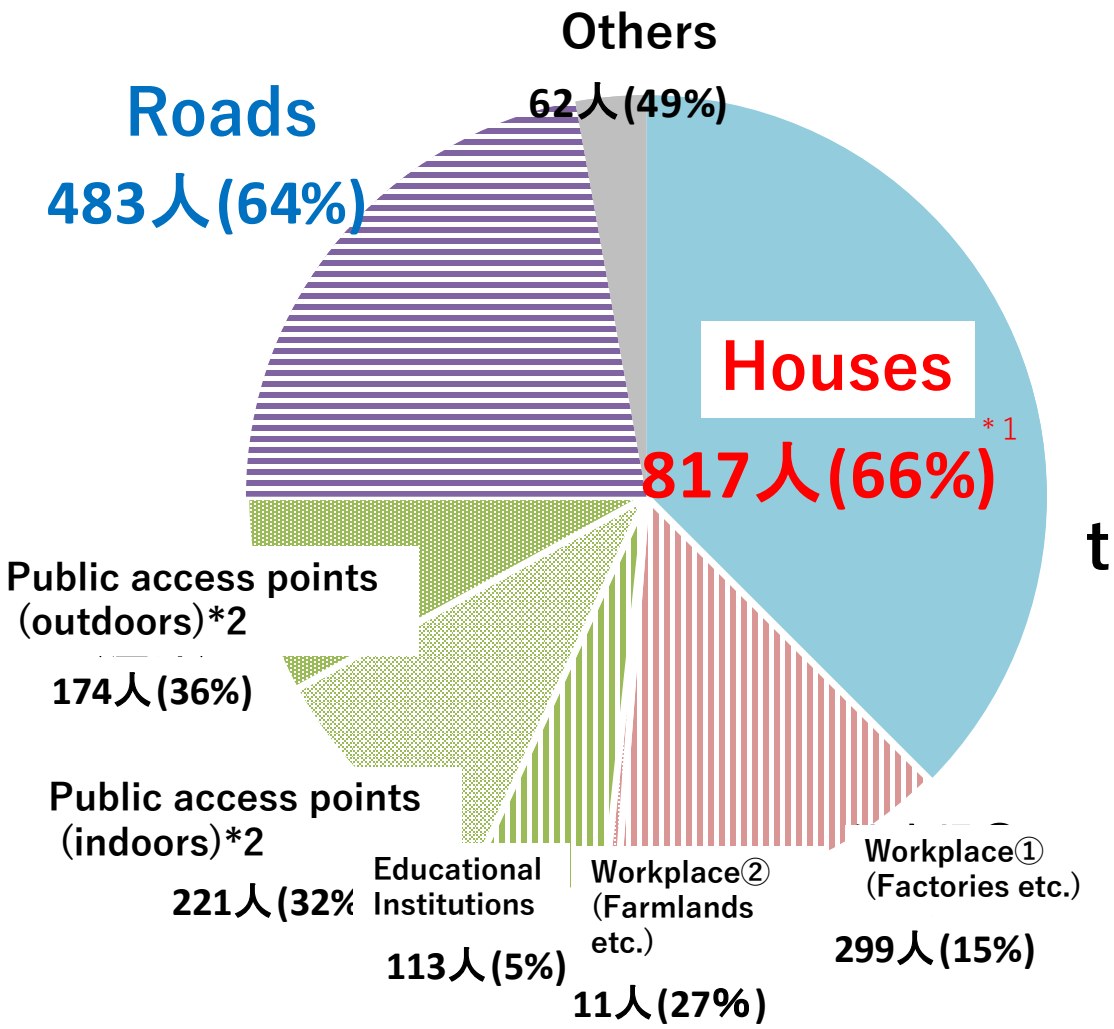
Research on heat stroke prevention ②

～ Total number of people / proportion of elderly / location of heat stroke～



Breakdown of the number of emergency transport for heat stroke by location of occurrence [Total for May-September 2018-2022.]

Total number of people 2180 (Elderly: 1060 people transported(49%))

* 1 % of elderly people transported where heat stroke has occurred

*2 Public access points (indoors)
Indoor areas where there is access by unspecified personnel (theatres, restaurants, department stores, etc.)

Public access points (outdoors)
Outdoor areas where there is access by unspecified personnel (stadiums, outdoor parking lots, outdoor concert venues, etc.)

(Fire and Disaster Management Agency)

- **Heat stroke occurs more frequently inside houses and on roads**
- **More than 60% are elderly people**

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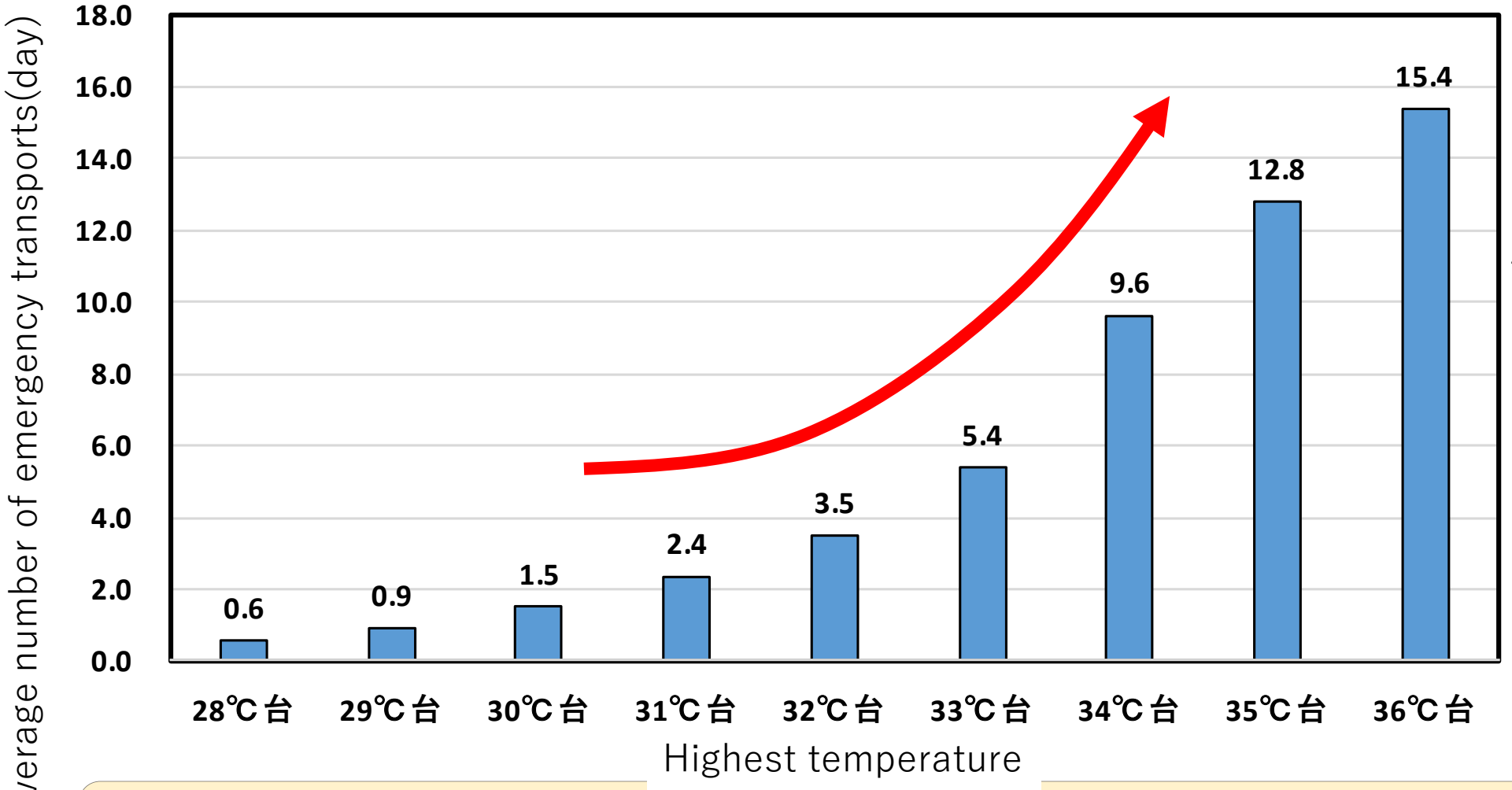
Research on heat stroke prevention ③

～ Ratio between highest daytime temperatures / average daily number of ambulance calls ～



Data on heat stroke emergency transport from May to September 2013-2022

The risk of heat stroke increases dramatically at daytime highest temperatures of 30° C or higher.

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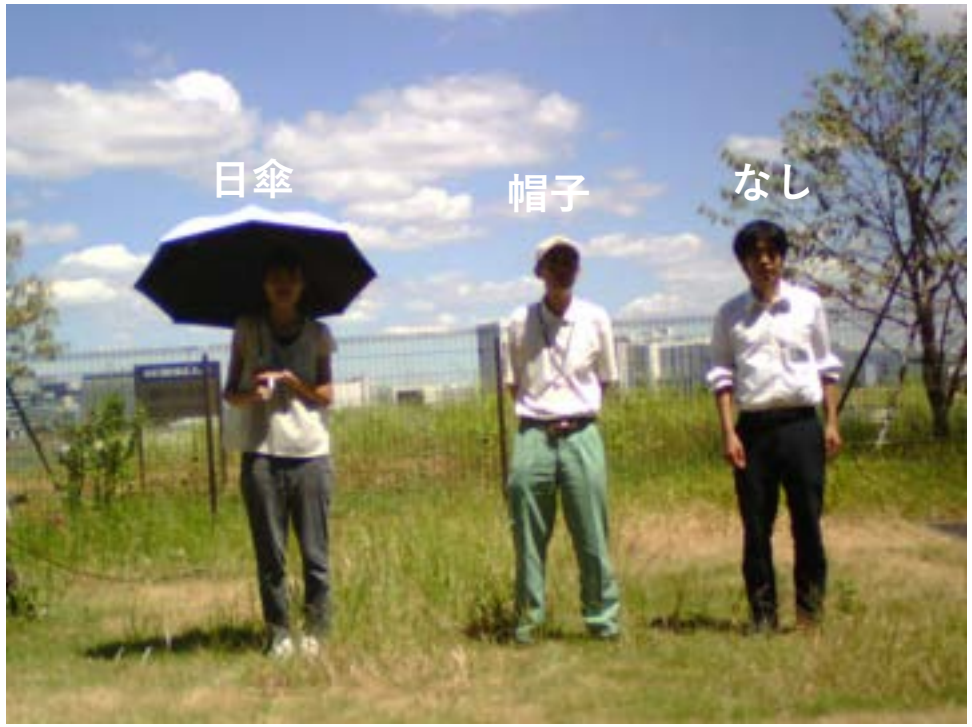
Research on heat stroke prevention ④

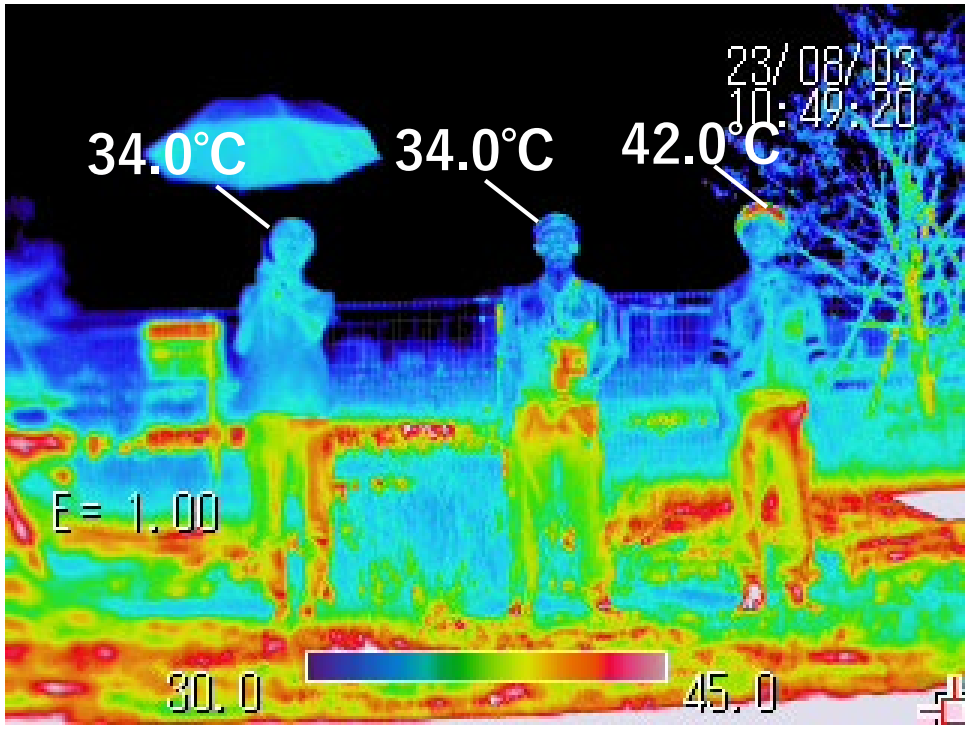
～ Comparison of body surface temperatures using infrared thermography cameras (use of parasols and hats)

Date of survey: 3 August 2023, 10:39-10:49.　Temperature: 34° C　　Weather: sunny

Beginning of the experiment



Temperature distribution at 10 min elapsed (hat removed)



- The temperature at the top of the head was 8.0° C lower when parasols and hats were used
- The use of parasols and hats is recommended to prevent heat stroke outdoors!

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Summary of research on heat reduction from roadside trees

Survey objectives	Analyze the heat reduction effect of shade versus sunlit sidewalks
Date of survey	24th and 29th August 2024 Weather: Sunny
Location	The sidewalks around the Kawasaki City Greening Centre (Tama Ward, Kawasaki City)
Survey method (overview)	Monitors walked for approximately 20 minutes in each of the following three cases **①Heat environmental data（WBGT etc.）②Amount of perspiration** **Case 1 :Walking in the shade** 24 August, 11:00 31.4°C※1 **Case 2 : Walking in the sunlight** 24 August , 14:00 31.9°C※1 **Case 3 : Walking in the sunlight with a Parasol** 29 August, 11:00 33.5°C※1 ⇒The weather conditions in cases 1-3 were equivalent

※1 Temperature data from the Tama measuring station of the city's Air Quality Monitoring System

Heat index （WBGT※2）

※2 Wet Bulb Globe Temperature

- Index incorporating all three : **Temperature, Humidity, Radiant heat** ※3
- This index is highly associated with heat stroke and is used in Japan

※3 Heat from solar radiation and heat radiated from the ground, buildings, etc.

(Ministry of the Environment's Heat Stroke Prevention website)

Heat index (WBGT) = 1 : 7 : 2

Temperature	Humidity	Radiant heat
Dry bulb Temperature	Wet bulb Temperature	Globe Temperature

Measurement methods for heat and perspiration data

① Heat environmental data
⇒Heat index (WBGT) per minute of walking,
Temperature, Humidity and Globe Temperature
(approx. 1.5 m above ground)

②Perspiration data
⇒ Perspiration amountevery 0.1 second while walking

WBGT instrument (Kyoto Electronics Manufacturing Co., Ltd.)

Wearable perspiration sensor

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Case Examples 1-3

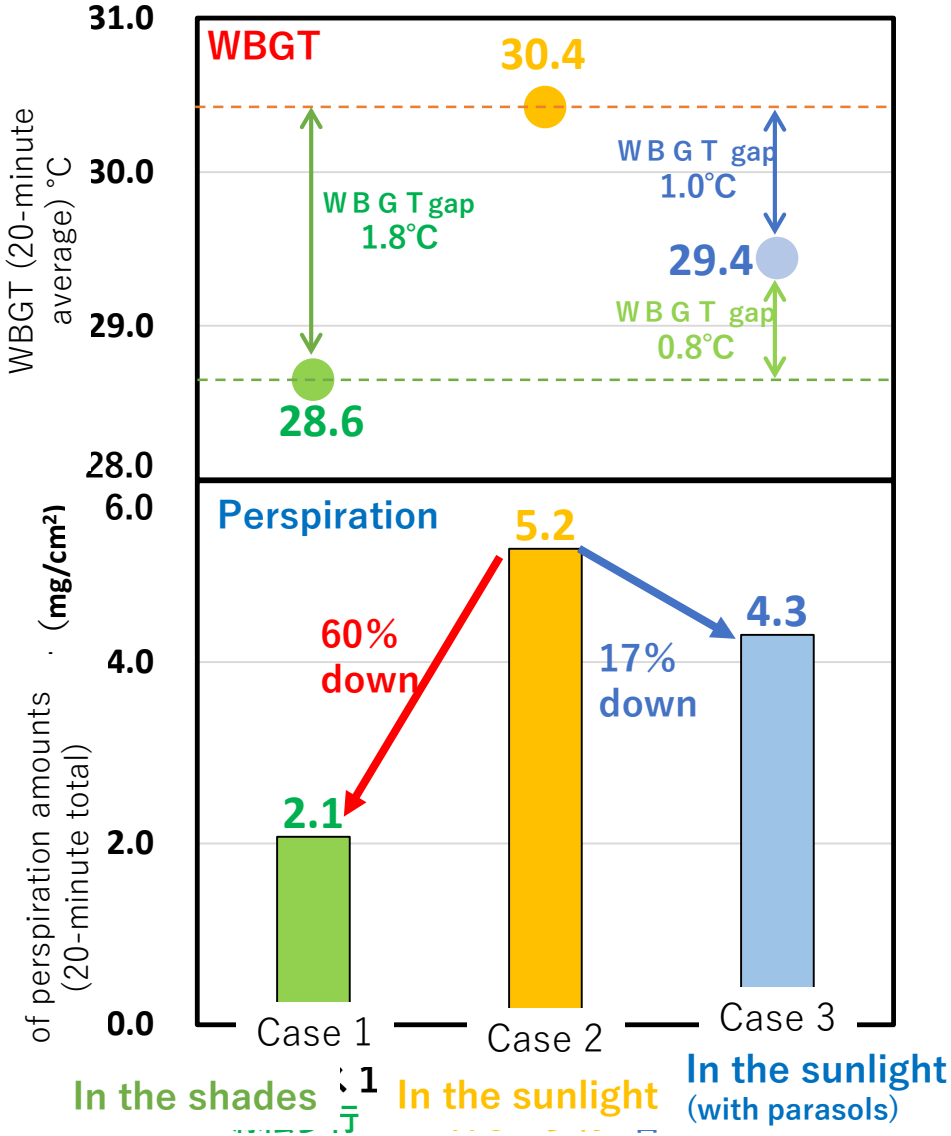
Case 1：In the shade

Case 2：In the sunlight

Case 3：In the sunlight (with parasols)

Comparison of WBGT and perspiration data in Cases 1-3

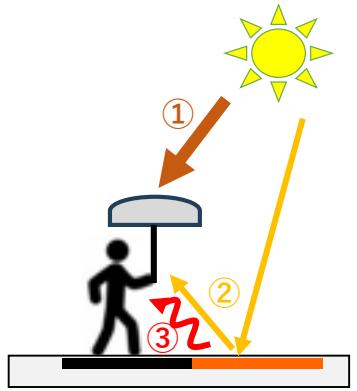
WBGT (20-minute average) and comparison of perspiration amounts (20-minute total)



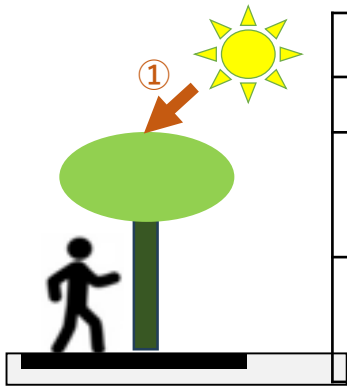
※ Notes that the perspiration amount data is the result of one monitor

Comparing Case 1 : in the shade to Case 2 : in the sunlight, Case 3 : in the sunlight (with parasols), WBGT and perspiration levels were the lowest
-> Green shade is considered to have a greater heat reduction effect* than parasols.

Case 3 : In the sunlight (with parasols) vs. Case 1 : Under the shades



Case 3	Impact
①Direct light	Small
②Reflected light	Big
③Radiant heat(road surface)	Big



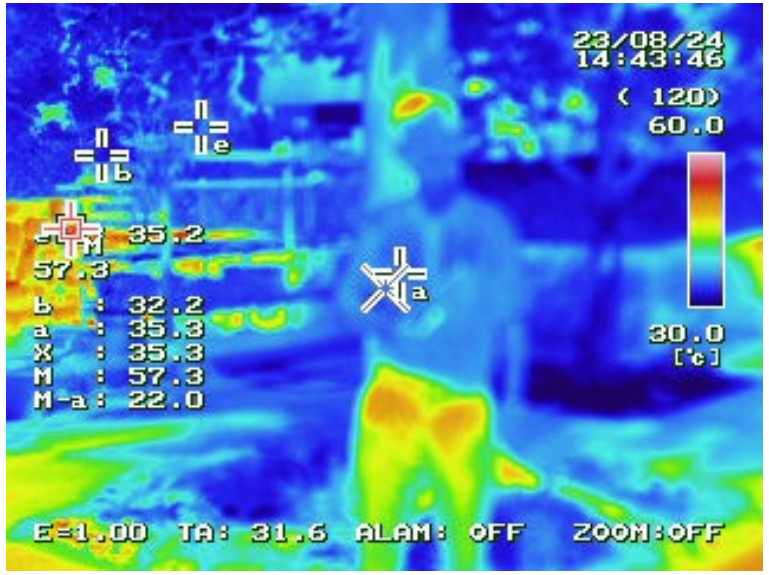
Case 1	Impact
①Direct light	Small
② Reflected light	Small
③Radiant heat (road surface)	Small

Comparison of body surface temperatures

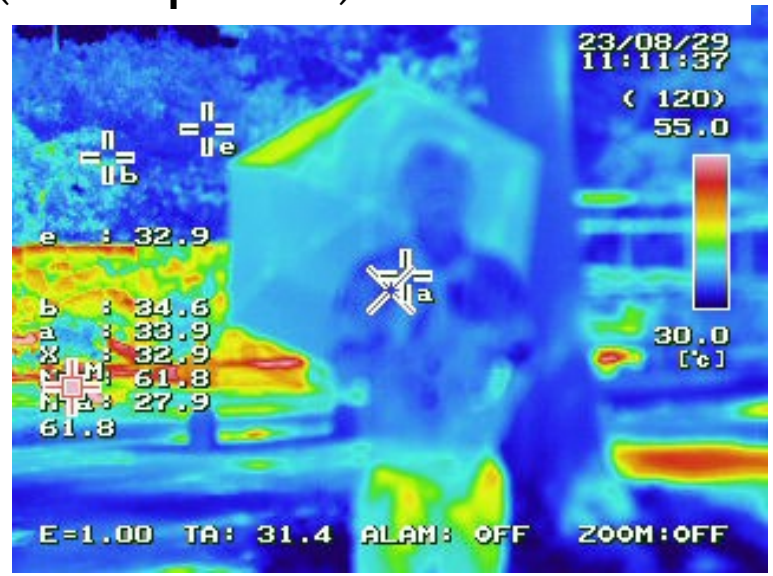
Image before walking

Case 1 ：In the shade

Case 2 : In the sunlight



Case 3 : In the sunlight (with a parasol)



Lessons Learned and Next Steps

【Key research finding】 Roadside tree shade has a greater heat reduction effect than parasols (note that the city has been promoting parasols and hats), making it an important adaptation measure

【Future actions】 Awareness raising on walking in tree shade to prevent heat stroke.

【Challenges】Narrow roads in Japan pose obstacles for planting roadside trees