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Effects of Native Tree Cover Resiliency on the Thermal Comfort of Typhoon Affected Green Open Space

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Abstract

The Philippines is a tropical country with ambient temperatures reaching to as high as 45 degrees Celsius in certain urban areas. But unfortunately it is also hit by several strong typhoons yearly. A previous research by the author learned that the value of tree cover was deemed necessary by experts, especially in quickly developing urban areas. But when valuable tree cover is threatened by loss or damage by the seasonal typhoons, the effects on the use of the space, especially its thermal comfort, are greatly altered and affected.

The study will aim to measure the temperature of open spaces, when it has tree cover and when it is directly exposed to the sun's heat especially on a sunny day, at midday when there is maximum sun exposure. It will compare the differences in temperature and check how many degrees Celsius tree cover will bring down temperature for shaded areas. It will also study the crown density effects on the temperature. Results will be cross referenced with acceptable temperature levels for human use of outdoor space.

The research will also look into a few popular trees in urban areas that were typhoon stricken. It will check on whether native or introduced species fared better against the typhoon's strong winds. Lastly the research will zoom into selected sites that were affected by typhoon Odette and qualify the damage their tree crown, canopy sustained. It will attempt to relate thermal comfort (through temperature) to the perceived conditions of the space's canopy cover.

Keyword: Green Open Space, Native Trees, Typhoon Resiliency

Goal

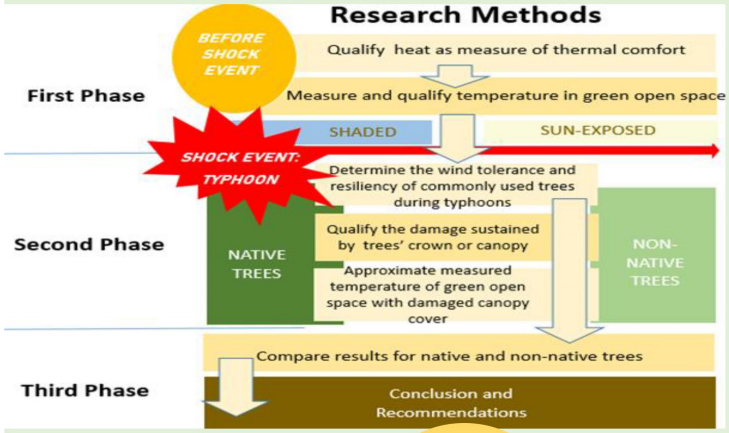
The research aims to evaluate the typhoon resiliency of a native tree's arbor in establishing heat protection and acceptable thermal comfort for urban green spaces under direct sun exposure.

Objectives

1. The study will check on how heat affects user preference for outdoor space.
2. The study will determine the acceptable levels of heat exposure/temperature for humans in using outdoor spaces
3. It will qualify and measure the temperature of green open space at midday sun exposure at various levels of tree canopy cover
4. It will attempt to establish that using native tree species in urban green space are more typhoon resilient compared to popular landscape trees.
5. It will qualify the damage sustained by trees planted in urban areas in several typhoon events
6. The research will ultimately qualify and analyze how the canopy damage affect the temperature/thermal comfort of the open space after the typhoon.

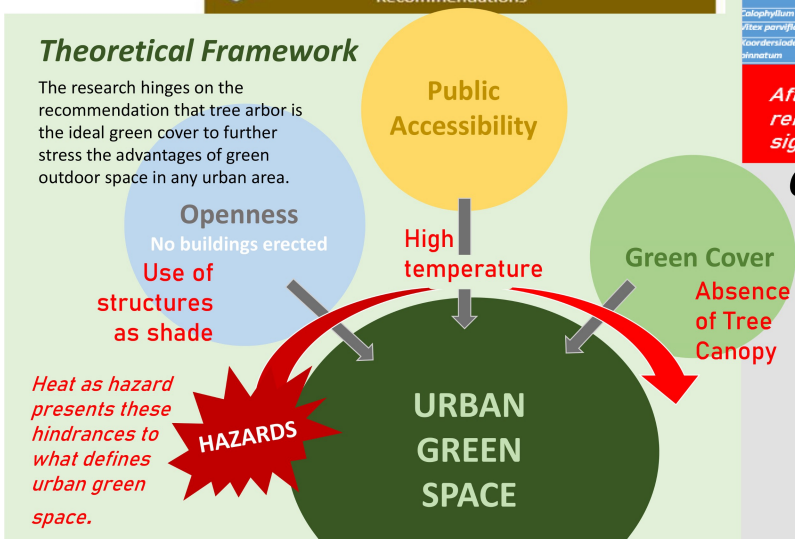
Research Methodology

The research design was carried out in three phases. The first phase tackled thermal comfort conditions before the disruptor event, which in this case is a typhoon. The second phase and third phase recorded and measured observations and data after the disruptor event.



Theoretical Framework

The research hinges on the recommendation that tree arbor is the ideal green cover to further stress the advantages of green outdoor space in any urban area.

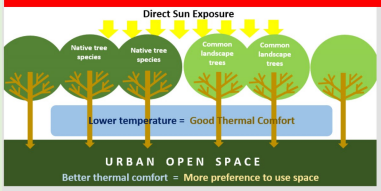


RESEARCH PROPER AND RESULTS

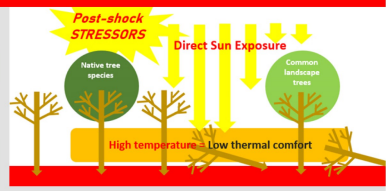
Crown canopy/arbor protection was tested by comparing thermal comfort of outdoor space with zero and varying tree shade protection levels. Thermal comfort was determined by measuring the outdoor space temperature using a dry bulb thermometer.

To approximate the damage brought about by a typhoon, temperature under reduced crown cover (total defoliated and 50% reduction) was also measured.

Before Shock



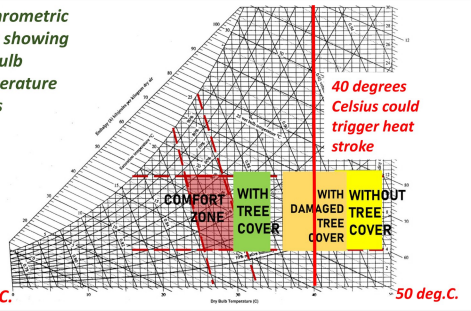
After Shock



Tree arbor protection could bring down air temperature 10 to 20 deg. C., closer the acceptable indoor comfort zone levels.

Damaged tree crown temperature levels are significantly raised placing premium on the resilience of a tree to regenerate its crown.

Psychrometric chart showing dry bulb temperature levels



Sample case study site data:

Site 2: UP Diliman Academic Oval

Shock Event: Typhoon Glenda, July, 2014

10-minute sustained: 165 km/h (105 mph), 1-minute sustained: 260 km/h (160 mph)

Tree species	Local name	Nature	Number of trees in research	Damage sustained			
				Defoliated	Damage branches	Leaned	Fell down
Albizia Saman	acacia	introduced	Approximately 100	Partly defoliated	Some are partly debranched	2	5
Plumeria obtusifolia	kalachuchi	introduced	10	Heavily defoliated	Heavily damaged branches	1	2
Sterculia foetida	kalumpang	native	2	Partially defoliated	None	None	None
Dracontomelon dao	dao	native	50	Partially defoliated	Partially damaged branches	None	None
Peltophorum pterocarpum	siar	native	1	Partially defoliated	Heavily damaged branches	None	None
Terminalia microcarpa	kalumpit	native	1	Partially defoliated	Partially damaged branches	None	None
Parkia timoriana	kupang	native	3	Partially defoliated	Moderately damaged branches	None	None
Calophyllum inophyllum	bitaog	native	30	None	None	None	None
Vitex parviflora	molave	native	4	Partially defoliated	None	None	None
Koordersiodendron pinnatum	amugis	native	1	None	None	None	None

After the typhoon shock it was learned that NATIVE TREE SPECIES remained standing with varying levels of damage compared to a significant number of fallen EXOTIC TREE SPECIES.

CONCLUSION:

Days after shock, fell down trees will render the space with zero protection from sun exposure and high temperatures

A heavily damaged arbor will bring down heat temperature from 0 to 5 degrees. But partially damaged arbor could still significantly bring down temperature from 5 to 10 degrees. But the damaged trees would still have chance to regenerate and restore green cover.

Native trees observed were more resilient to toppling down compared to their introduced counterparts. The crown damage may be at varying levels of damage which leaves the green space with varying levels of heat protection after the typhoon shock.

The tree resilience translates to varying levels of heat temperature with crown level protections varying from 1 to 20 degrees Celsius. The crown cover, however damaged, is still a precious commodity for open space thermal comfort.