Final Presentation
GSGES Short-term Scholarship Program
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POLLUTANT REDUCING WITH FACTORS OF DISTANCE AND VEGETATION

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Self Introduction

Name	: Rina Dwica Desyana (Rina)
Country	: Indonesia
Current Affiliation	: Master Student, Department of Landscape Architecture Faculty of Agriculture Bogor Agricultural University (IPB)
Supervisor in IPB	: 1. Dr. Bambang Sulistyantara, M.Agr 2. Dr. Nizar Nasrullah, M.Agr
Research Topic in IPB	: Effectivity of tree canopy types in reducing vertical distribution of NO_2 and CO
Main Objective	: To analyze the effectivity of different tree canopies in absorbing vertical distribution of gaseous pollutant (NO_2 and CO) on roadside greeneries

Study in Kyoto University

Duration of Stay : 6 months (April 2 – September 29, 2015)

Affiliation : Special Audit Student, GSGES, Kyoto University

Supervisor in Kyoto Univ : Prof. Yoshizumi Kajii (Lab Atmospheric Chemistry)

Classes taken :

- Management of Global Resources and Ecosystems
- Environmental Ethics and Environmental Education
- Environmental Leadership A
- Integrated Watershed and Coastal Management

Compulsory subjects

- Landscape Ecology and Planning
- Atmospheric Chemistry

Additional subjects

Field and Laboratory works :

- Learned field-method to measure pollutant in ambience air
- Analyzed the measuring of pollutant from the instruments being used

Study Topic in Kyoto University

	Plan	Implemented
Title	Effectivity of roadside trees in reducing gaseous pollutant	Pollutant reducing with factors of distance and vegetation
Objectives	1. To learn measurement techniques for gaseous pollutant on roadside greeneries 2. To analyze the effectivity of roadside trees in reducing pollutant from transportation	1. To learn field measurement techniques for pollutant 2. To analyze the reducing of air pollutant based on distance from pollutant source, and vegetation
Method	Literature review, discussion, field study, lab analysis	Literature review, discussion, field study, lab analysis

Activities	Months					
	Apr	May	Jun	Jul	Aug	Sep
Study plan presentation						
Join classes, fieldworks, lab seminars						
Literature study						
Field research and lab analysis						
Final presentation						

Study Outcomes

Field Study and Analysis : August 17 – September 14

Parameters	Instrument	Method
O3 (ozone)	Thermo 49C O3	UV absorption
NO, NO2, NOx	Thermo Model 42i-TL	Chemiluminescence
CO	Thermo Model 48i	Non Dispersive Infra Red
Total Suspended Particle	Grimm Portable Aerosol Spectrometer Model 1,109	Optical Particle Counter

Process

DEFINING LOCATION

PREPARING INSTRUMENTS

MEASURING POLLUTANT LEVEL

ANALYZING DATA

RESULT

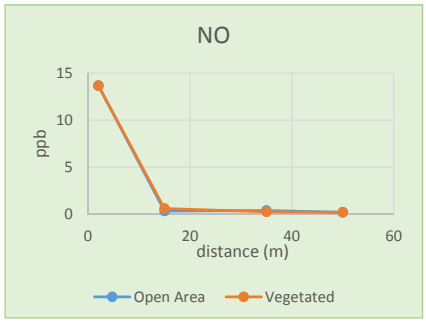


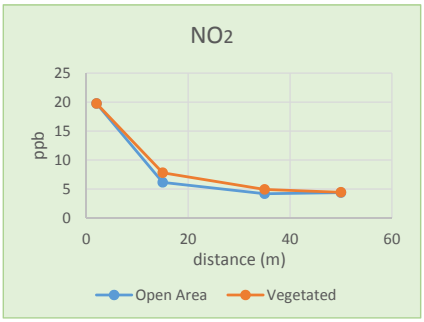

Study Outcomes

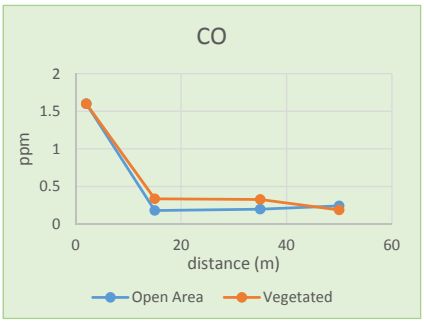
FIELD SURVEY (1)

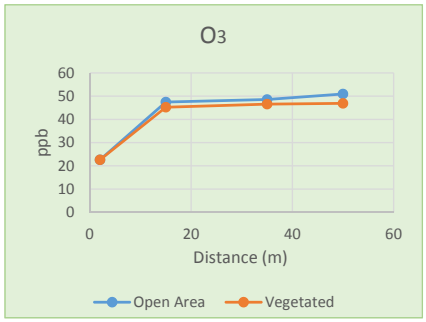
- **Objectives :** Comparing pollutant level between vegetated and open area at several distance from road (pollutant source : transportation)
- **Location** : South Campus, in front of Yoshida International House
  Line A : vegetated area
  Line B : open area

Study Outcomes









- NO, NO2 and CO levels decreased following distance
- Not much difference between vegetated and open area, probably because :
  - vegetation was not too dense
  - pollutant moved and reacted very quickly (natural process in the atmosphere)
- O3 level in vegetated area was lower than open area, but the vegetation effect was not too significant

Study Outcomes

Pollutant level at a distance can be predicted using formula*

$$C(x) = C(0) \times \frac{z + 2}{[\,(x^2 + z^2)^{1/2} + 2\,]}$$

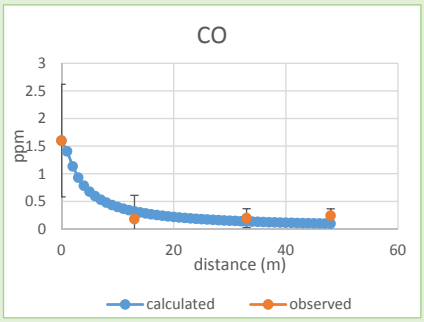
C(x) = pollutant concentration at x distance

C(0) = pollutant concentration at emission source

x = horizontal distance between emission source and measurement point

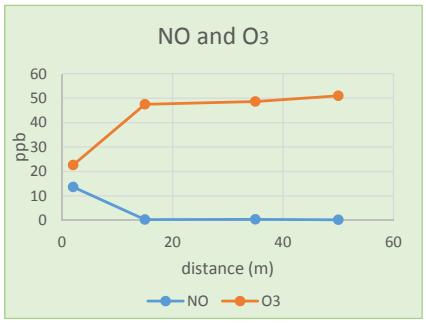
z = measurement height (constant at 1 m)

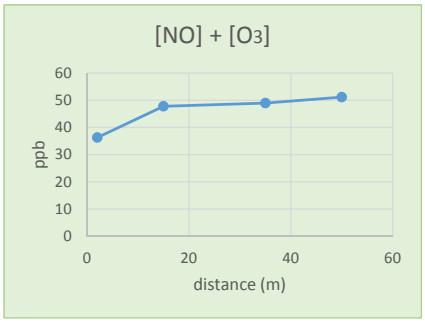
* *Nakashima et al., Aerosol and Air Quality Research*, 14: 1763–1768, 2014

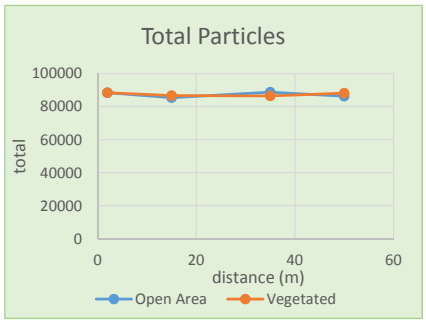


- CO is a stable pollutant (non reactive with other pollutant species)
- Using this formula to check the observed value, the result value is very close
- Data of this study is reliable, with discrepancy = 0.0045 for C(0) = 1.6
- Formula can be used to predict CO level at some distance

Study Outcomes





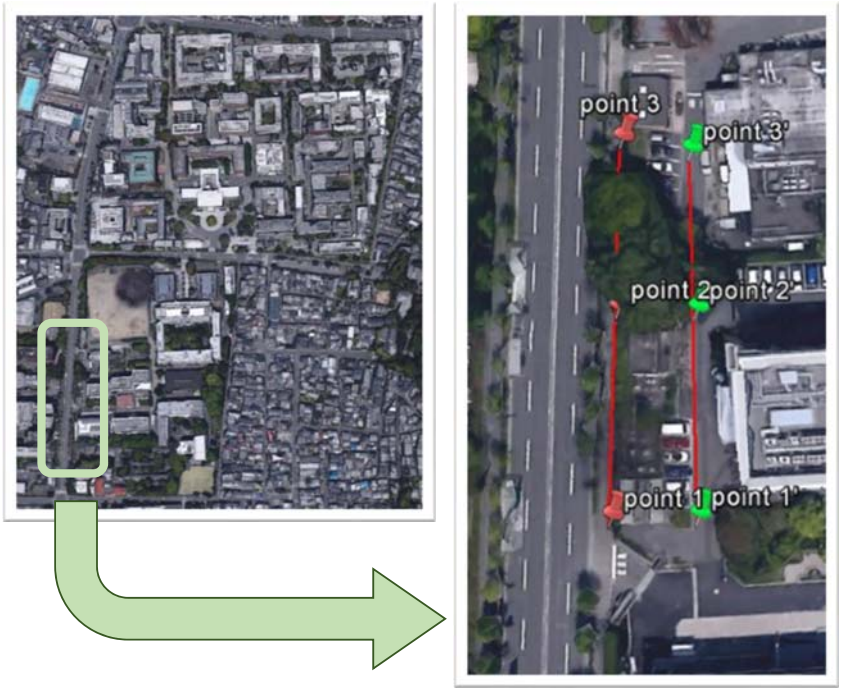


- NO is main pollutant from emission (90%) so the level at source was very high and decreased following distance
- O3 behavior is reversed with NO, low at source and increased following distance because generated from reaction of other species
- NO is very reactive with O3, [$NO + O_3 \rightarrow NO_2 + O_2$]
- In this study, total of [NO] + [O3] (conserved value) can be said stable

Total particle was almost similar, no significant effect from distance or vegetation, probably because :

- plant type was not effective to adsorp particles
- there are other sources of particle pollutant

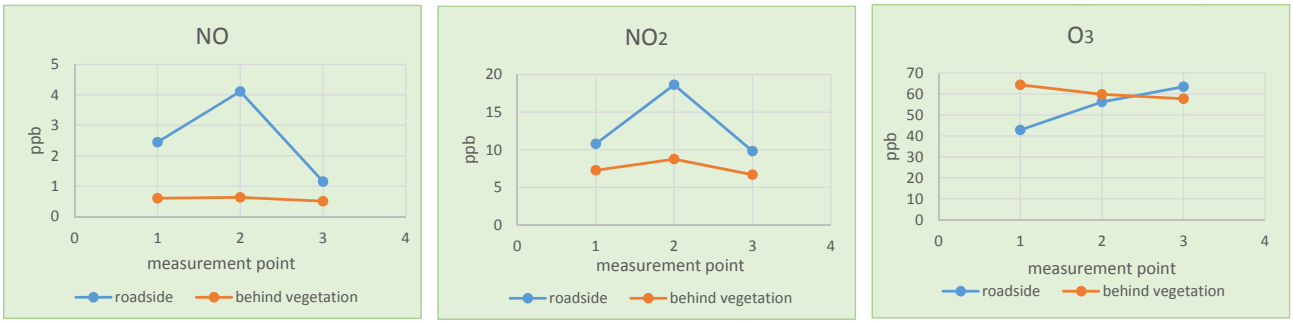
Study Outcomes



FIELD SURVEY (2)

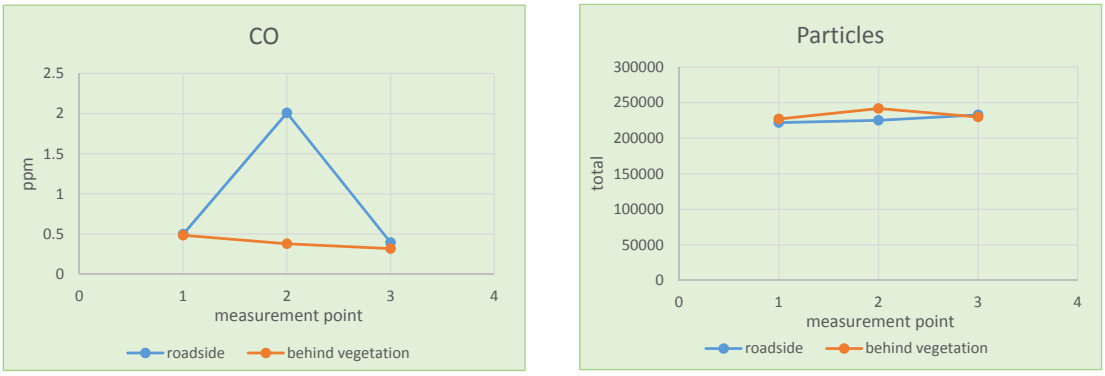
- **Objectives** : comparing pollutant level between roadside area and behind vegetation
- **Location** : South Campus, along Higashioji Dori
  Line A : 2 m from road (roadside), near emission source
  Line B : behind vegetation (combination of trees, shrubs, small buildings)

Study Outcomes



- Note : at point 2 roadside, there was a bus parking near the instruments
- NO and NO2 both are main emission from transportation, proved by the high level at the point 2 roadside
- Pollutant level at an area (roadside area, or vegetation area) can be assumed constant
- For NO and NO2, pollutant level on vegetated area were lower than those on roadside, means vegetation might had role in reducing pollutant
- O3 level at roadside and behind vegetation was reversed, no significant affect from vegetation

Study Outcomes



- Note : at point 2 roadside, CO level was much higher than other points (source : bus)
- Ignoring emission from bus, there was almost no effect from vegetation to CO
- CO level in this area can be assumed constant
- For particles, there was not much difference between roadside area and behind vegetation. Vegetation did not have significant effect in reducing pollutant particles, or there were other sources of particles beside transportation emission

Study Outcomes

Conclusion

- NO, NO2 and CO level decreased following distance, so proper distance from road is required in planning/making settlement or other places for activity
- As stable pollutant, CO level at a distance can be predicted using formula
- NO level and O3 level were inversed because they both involved in natural process in the atmosphere
- Vegetation barrier might had role in reducing NO and NO2 pollutant
- Vegetation on study area was not significant in reducing particle pollutant

Obstacles

- Different types of vegetation and road between Japan and Indonesia that the previously planned research could not be done
- At the time of measurement, some areas inside the campus was in construction process so it was hard to find suitable spot for field study
- Climate factor (strong wind, rain, typhoon) which affected the measuring time
- We had to move the instruments during measurement ~ can affect result
- Chemical interferes in the instrument

Activities

- GSGES welcome party (April 6)
- Field work at Yoshida-yama for class Landscape Ecology and Planning (May 17)
- Recent research presentation in lab seminar (June 11)
- International student welcome party (June 17)
- Wakayama field trip (June 27-28)
  - Visit to fisherman's village, Tanabe City
  - Visit to Kyoto University Seto Marine Biological Laboratory, Shirahama Town
  - Experienced ume harvesting at Fuyuki family's ume farm, Kamihaya village




- Joined lab summer campaign in Tokyo (July 23)

Lessons Learned

Academic

- Learned how to measure pollutant on-field and how to analyze data
- Gained broader and deeper understanding about pollutant, generation and effect to human and environment
- Learned problems related with pollutant, especially in global scale
- Experienced real condition in Japan and how they manage transportation for minimum emission and pollutant

Other Benefits

- Learned Japanese work ethics, how they appreciate time very much
- Gained more knowledge and experience
- Made new friends and links

I would like to express my deep gratitude to :

- Prof. Shigeo FUJII
- Dr. Gaku MASUDA
- All lecturers
- Staff of GSGES office
- Prof. Yoshizumi KAJII
- Assoc. Prof. Yosuke SAKAMOTO
- Members of Atmospheric Chemistry Laboratory

Thank you and see you again!