



ISCO-ISS 2019

INTERNATIONAL SEMINAR & CONGRESS INDONESIAN SOIL SCIENCE SOCIETY

Towards Sustainable Environment and Food Security

Secretariat : Soil Science and Land Resources Department,
Faculty of Agriculture, Padjadjaran University

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Indonesian Soil Science Society

LETTER OF ACCEPTANCE

June, 21st, 2019

Mr Partoyo
Universitas Pembangunan Nasional Veteran Yogyakarta
Submission ID. 256

Dear, Mr Partoyo

Thank you for your interest in International Seminar and Congress of Indonesian Soil Science Society (ISCO-ISS 2019) which will be held on August, 5-7th, 2019 at Trans Luxury Hotel, Bandung, Indonesia. We are delighted to inform you that your paper entitled:

**ANALYSIS OF SOIL QUALITY INDEX OF VARIOUS LAND USE IN THE
DRYLAND SLOPING AREA OF GEDANGSARI SUBDISTRICT, GUNUNGKIDUL
REGENCY**

has been accepted for **Oral Presentation**.

We remind you that the author or co-author need to be present at the conference venue for presentation. Please submit your *fullpaper* in our submission system (<http://isco-iss.faperta.unpad.ac.id>) by July 15th, 2019.

Additional information regarding registration, full paper submission, presentation guidelines, accommodations and other programs are available at our website.

Should you have any queries, please do not hesitate to contact us. While we look forward to meeting you in Bandung, Indonesia, your participation is highly appreciated.

Sincerely,

ISCO-ISS 2019

Anne Nurbaity, PhD.
Chairperson of ISCO-ISS 2019

CERTIFICATE OF APPRECIATION



THIS IS TO CERTIFY THAT

PARTOYO

Participated as **PRESENTER**

at International Seminar and Congress of Indonesian Soil Science Society :
Land Resource Management and Agriculture Innovations, Towards
Sustainable Environment and Food Security (ISCO-ISS 2019) .

Bandung-Indonesia, 5-7 August 2019

Prof. Dr. Budi Mulyanto
President of Indonesian
Soil Science Society

Anne Nurbalaty, Ph.D.
Chair Person of ISCO-ISS 2019



Bandung
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ISCO-ISS 2019



Analysis of Soil Quality Index of Various Land Uses in Gedangsari Sub District, Gunungkidul Regency

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Yogyakarta
2019

ICSO-ISS Bandung, 5-7th August 2019

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1. Introduction

- ❑ **Soil quality** is a capacity of the soil to function in the ecosystem boundaries to sustain biological productivity, to maintain environmental quality, and to increase plant and animal health (Doran & Parkin, 1994).
- ❑ Many studies on soil quality have searched for a way to aggregate the information obtained for each soil quality indicator into a single **soil quality index**.
- ❑ This study developed a weighted scoring method to calculate soil quality index.



1.1. Background

- ❑ Farming activity in *Mertelu* village has extended to newly agricultural land at sloping area for dryland farming.
- ❑ Foodstuff production has increased and overcome the deficit of foodstock problem.
- ❑ *Mertelu* village has been declared as one of village model for food self sufficient village (*Desa Mandiri Pangan - MAPAN*) in Yogyakarta since 2016.



1.2 Objective

- The study aimed to assess soil quality of newly extended dry agricultural land in *Mertelu* village after several years of farming practice.



1.3. Hypothesis

- There is a deterioration of soil quality after several years of farming activity in the sloping area.



2. Materials and Methods

- ❑ The study was conducted in Mertelu village, Gedangsari sub-district, Gunungkidul regency, Yogyakarta Special Region.
- ❑ The area consists of hilly topographic landform of Baturagung zone, altitude ranged from 450 – 700 m asl.
- ❑ Climate type D (moderate) according to Schmidt&Fergusson, rainfall 1,907 mm/year.
- ❑ Site selection was purposively determined for 10 locations represented variation of land use and slope steepnes, i.e.:
 1. KAC: orchards, moderately steep slope (15– 25 %), covers 3.78 ha
 2. KC: orchards, steep slope (25– 45%), covers 18.13 ha
 3. SAC: bush, moderately steep slope (15–25 %), covers 6.82 ha
 4. SC: bush, steep slope (25–45 %), covers 12.86 ha
 5. TAC: dry land, moderately steep slope (15–25 %), covers 319.6 ha
 6. TC: dry land, steep (25-45%), covers 473.03 ha
- ❑ Data was collected from the field observation and laboratory analysis of soil samples.



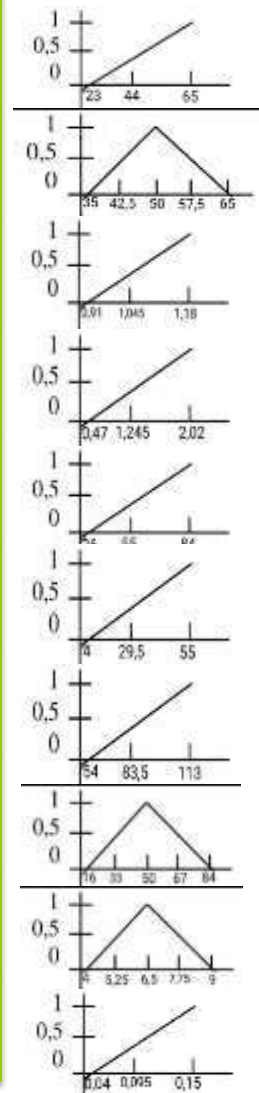
2. Materials and Methods -cont'd

- Soil quality index was calculated following these steps:
 1. Determining of soil functions, soil indicators, and score weight for each indicator involved in the analysis.
 2. Developing scoring function for each indicator.
 3. Transforming the data of each indicator into converted score using scoring function.
 4. Calculating quality index for each indicator by multiplying weighted indicator and its converted score.
 5. Summarize all indicator's quality index into a single soil quality index.

Scoring functions



Indicator	Soil function	Range of Soil Data	Scoring function
Effective depth	Biological activity	23 – 65 cm	$y = 0.0238 x - 0.5476$
Porosity	Regulating and retention of water	35 – 50%	$y = 0.6667 x - 2.333$ $y = -0.6667 x + 4.333$
Bulk Density	Regulating and retention of water and nutrient	0.91 – 1.18 gr/cm ³	$y = 3.7037 x - 3.3703$
C Organic	Biological activity; nutrient availability; buffering	0.47 – 2.02 %	$y = 0.6541 x - 0.3032$
N available	Biological activity; nutrient availability	26 – 84 mg/kg	$y = 0.0172 x - 0.4482$
P available	Biological activity; nutrient availability	4 – 55 mg/kg	$y = 0.0196 x - 0.0784$
K available	Biological activity; nutrient availability	54 – 113 mg/kg	$y = 0.0169 x - 0.9152$
Texture (sand, silt, clay fraction)	Regulating and retention of water	16 – 50 %	$y = 0.0294 x - 0.4705$ $y = -0.0294 x + 2.4705$
pH	Biological activity; nutrient availability	4 – 6.5	$y = 0.4 x - 1.6$ $y = -0.4 x + 3.6$
N Total	Biological activity; nutrient availability	0.04 – 0.15 %	$y = 0.090 x - 0.3636$





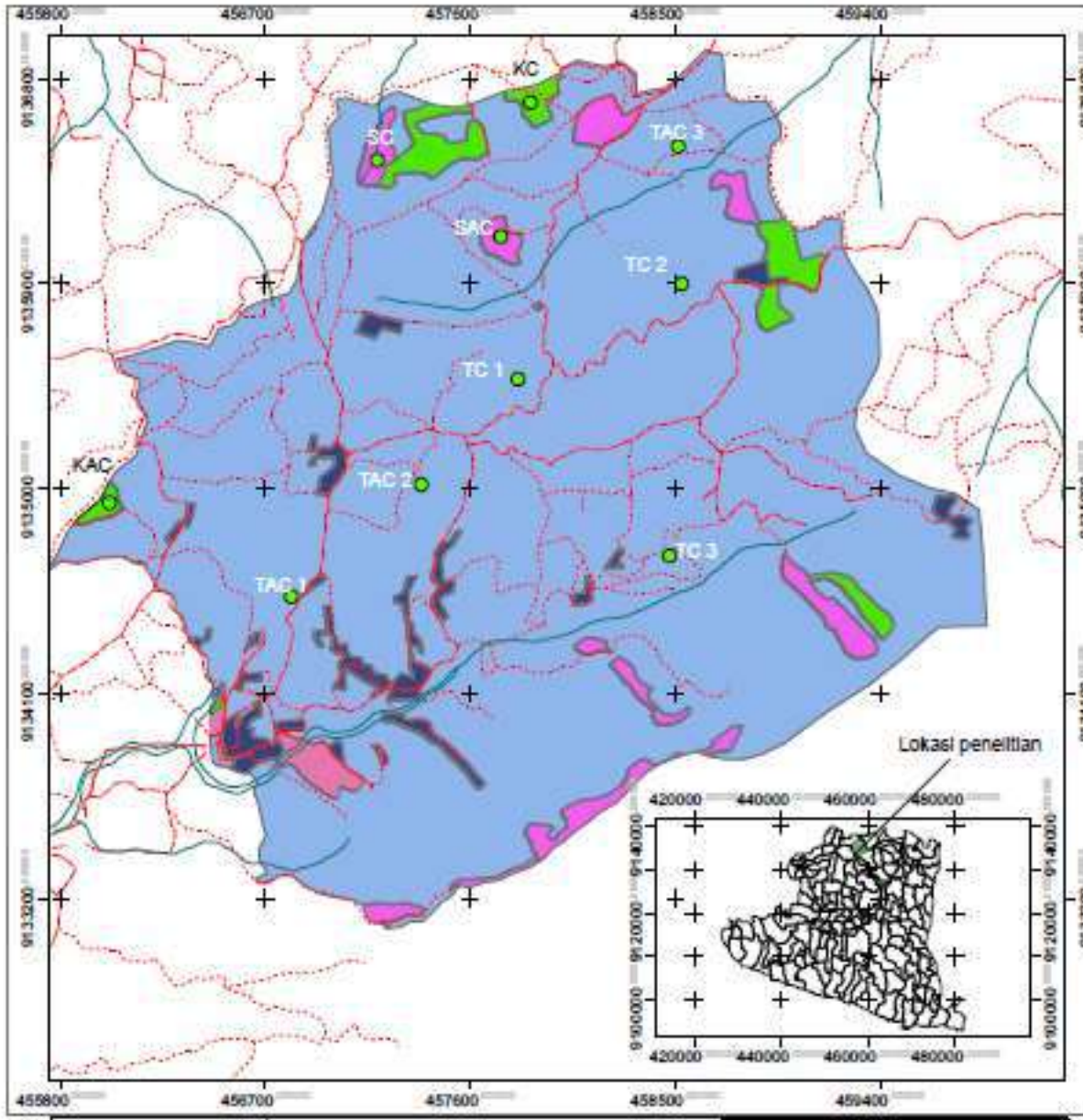
Soil function		Soil indicators			Weighted indicator (2)*4)*(5)	Value of soil indicator KAC	Converted score (6)*(7)	
(1)	Weight (2)	(3)	Weight (4)	Weight (5)				(6)
Sustaining biological activity	0,4	Rooting media	0,3					
		• Effective depth (cm)		0,6	0,072	0,93	0,69	
		• Bulk density (g/cm ³)		0,4	0,048	0,48	1,00	
		Soil moisture	0,3					
		• Porositas (%)		0,6	0,072	0,00	0,00	
		• C Organic (%)		0,4	0,048	0,05	0,00	
		Nutrient availability	0,4					
		• pH H ₂ O		0,3	0,048	0,49	0,00	
		• P- available (ppm)		0,1	0,016	0,00	0,33	
		• K- available (ppm)		0,1	0,016	0,31	0,00	
		• C Organic (%)		0,4	0,064	0,05	0,00	
• N - available (ppm)	0,1	0,016	0,28	0,03				
Regulating water flow and storage	0,3	Texture	0,6					
		• Sand		0,4	0,072	0,91	1,00	
		• Silt		0,3	0,054	0,59	0,53	
		• Clay		0,3	0,054	0,03	0,00	
		Porosity (%)	0,2	0,06	0,00	0,00		
		Bulk density (g/cm ³)	0,2	0,06	0,48	1,00		
Filtering and buffering	0,3	Texture	0,6					
		• Sand		0,4	0,072	0,91	1,00	
		• Silt		0,3	0,054	0,59	0,53	
		• Clay		0,3	0,054	0,03	0,00	
		Porosity (%)	0,1	0,03	0,00	0,00		
		Microbiological process	0,3					
		• C Organic (%)		0,5	0,045	0,05	0,00	
• - N Total (%)	0,5	0,045		0,09	0,00			
TOTAL Soil Quality Index					1			



3. Result & Discussion



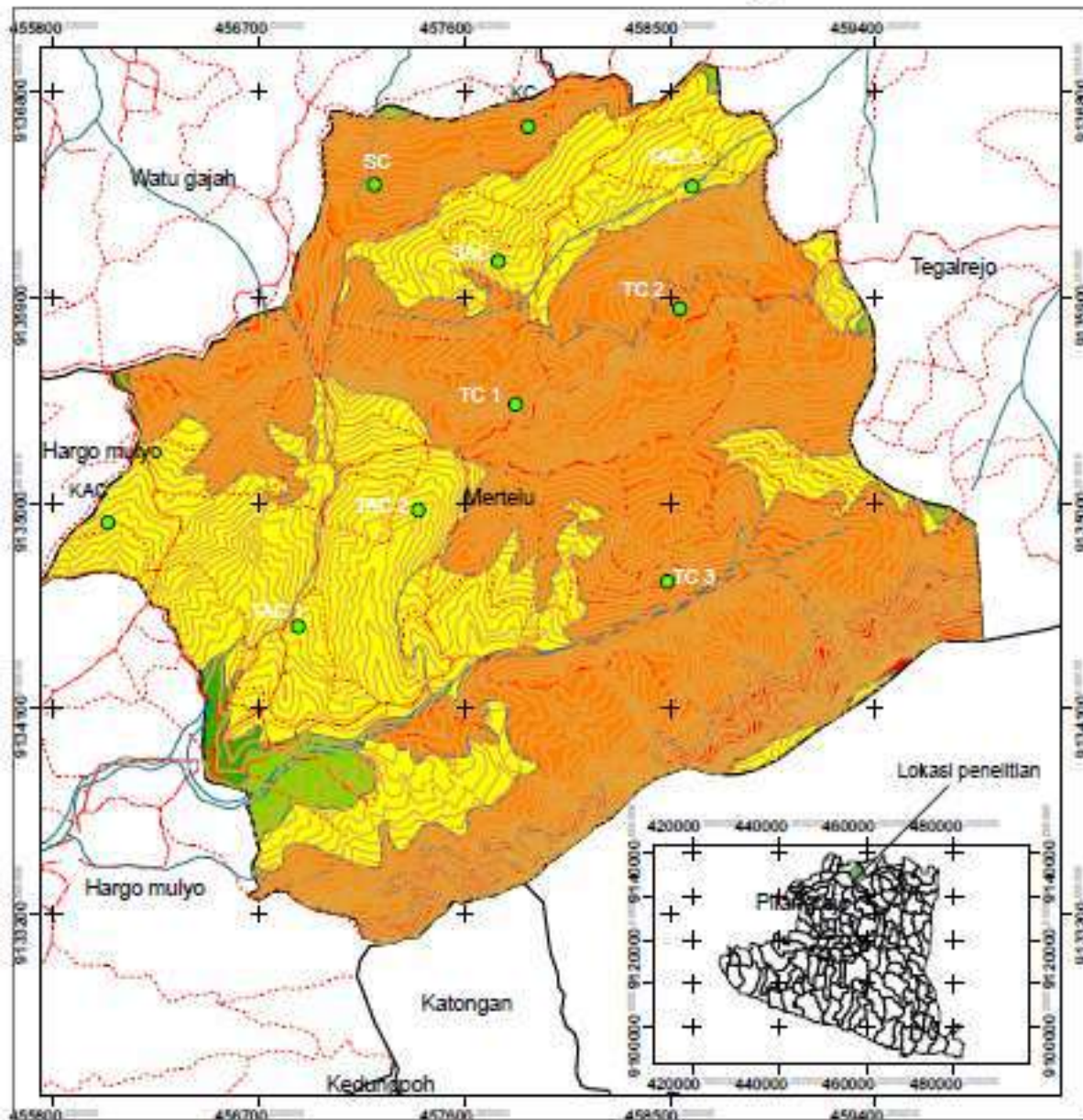
Land use map



- Dry land
- Bush
- Orchard



Slope map



- Flat
- Gently sloping
- Moderately steep
- Steep



SQ of Orchards

Fungsi Tanah	Bobot 1	Indikator Tanah			Indeks Bobot	Nilai Indikator Tanah				Indeks Kualitas Tanah	
			Bobot 2	Bobot 3		Agak Curam		Curam		Agak Curam	Curam
						Nilai	Skor	Nilai	Skor		
Melestarikan Aktivitas Biologi	0,4	Media perakaran	0,3								
		- Jeluk perakaran (cm)		0,6	0,072	62	0,93	52	0,71	0,067	0,051
		- Berat volume (gr/cm ³)		0,4	0,048	1,04	0,48	1,18	1,00	0,023	0,048
		Kelengasan	0,3								
		- Porositas (%)		0,6	0,072	56,12	0,59	56,13	0,59	0,043	0,043
		- C Organik (%)		0,4	0,048	0,54	0,05	0,47	0,00	0,002	0,000
		Ketersediaan Nutrisi	0,4								
		pH H ₂ O		0,3	0,048	6,38	0,87	6,53	0,99	0,042	0,047
		- P- tersedia (ppm)		0,1	0,016	4	0,00	21	0,33	0,000	0,005
		- K- tersedia (ppm)		0,1	0,016	72	0,31	54	0,00	0,005	0,000
- C Organik (%)		0,4	0,064	0,54	0,05	0,47	0,00	0,003	0,000		
-N- tersedia (ppm)		0,1	0,016	42	0,28	28	0,03	0,004	0,001		
Pengaturan dan Penyaluran Air	0,3	Tekstur	0,6								
		Pasir		0,34	0,0612	47	0,91	50	1,00	0,056	0,061
		Debu		0,33	0,0594	36	0,59	34	0,53	0,035	0,031
		Lempung		0,33	0,0594	17	0,03	16	0,00	0,002	0,000
		Porositas (%)	0,2		0,06	56,12	0,59	56,13	0,59	0,036	0,035
		Berat volume (g/cm ³)	0,2		0,06	1,04	0,48	1,18	1,00	0,029	0,060
Penyaringan dan Penyangga	0,3	Tekstur	0,6								
		Pasir		0,34	0,0612	47	0,91	50	1,00	0,056	0,061
		Debu		0,33	0,0594	36	0,59	34	0,53	0,035	0,031
		Lempung		0,33	0,0594	17	0,03	16	0,00	0,002	0,000
		Porositas (%)	0,1		0,03	56,12	0,59	56,13	0,59	0,018	0,018
		Proses mikrobiologis	0,3								
		- C Organik (%)		0,5	0,045	0,54	0,05	0,47	0,00	0,002	0,000
- N Total (%)		0,5	0,045	0,05	0,09	0,04	0,00	0,004	0,000		
TOTAL					1				0,462	0,494	



SQ of bush

Fungsi Tanah	Bobot 1	Indikator Tanah			Indeks Bobot	Nilai Indikator Tanah				Indeks Kualitas Tanah		
			Bobot 2	Bobot 3		Agak Curam		Curam		Agak Curam	Curam	
						Nilai	Skor	Nilai	Skor			
Melestarikan Aktivitas Biologi	0,4	Media perakaran	0,3									
		- Jeluk perakaran (cm)		0,6	0,072	27	0,16	23	0,07	0,011	0,005	
		- Berat volume (gr/cm ³)		0,4	0,048	1,04	0,48	0,91	0,00	0,023	0,000	
		Kelengasan	0,3									
		- Porositas (%)		0,6	0,072	59,22	0,39	57,87	0,48	0,028	0,034	
		- C Organik (%)		0,4	0,048	0,75	0,18	2,02	1,00	0,009	0,048	
		Ketersediaan Nutrisi	0,4									
		pH H ₂ O		0,3	0,048	7,14	0,74	6,75	0,90	0,036	0,043	
		- P- tersedia (ppm)		0,1	0,016	11	0,14	55	1,00	0,002	0,016	
		- K- tersedia (ppm)		0,1	0,016	96	0,71	105	0,86	0,011	0,014	
		- C Organik (%)		0,4	0,064	0,75	0,18	2,02	1,00	0,012	0,064	
-N- tersedia (ppm)		0,1	0,016	49	0,40	84	1,00	0,006	0,016			
Pengaturan dan Penyaluran Air	0,3	Tekstur	0,6									
		Pasir		0,34	0,0612	36	0,59	47	0,91	0,036	0,056	
		Debu		0,33	0,0594	39	0,68	37	0,62	0,040	0,037	
		Lempung		0,33	0,0594	25	0,26	16	0,00	0,016	0,000	
		Porositas (%)	0,2		0,06	59,22	0,39	57,87	0,48	0,023	0,029	
		Berat volume (g/cm ³)	0,2		0,06	1,04	0,48	0,91	0,00	0,029	0,000	
Penyaringan dan Penyangga	0,3	Tekstur	0,6									
		Pasir		0,34	0,0612	36	0,59	47	0,91	0,036	0,056	
		Debu		0,33	0,0594	39	0,68	37	0,62	0,040	0,037	
		Lempung		0,33	0,0594	25	0,26	16	0,00	0,016	0,000	
		Porositas (%)	0,1		0,03	59,22	0,39	57,87	0,48	0,012	0,014	
		Proses mikrobiologis	0,3									
		- C Organik (%)		0,5	0,045	0,75	0,18	2,02	1,00	0,008	0,045	
- N Total (%)		0,5	0,045	0,07	0,27	0,15	1,00	0,012	0,045			
TOTAL					1					0,406	0,558	

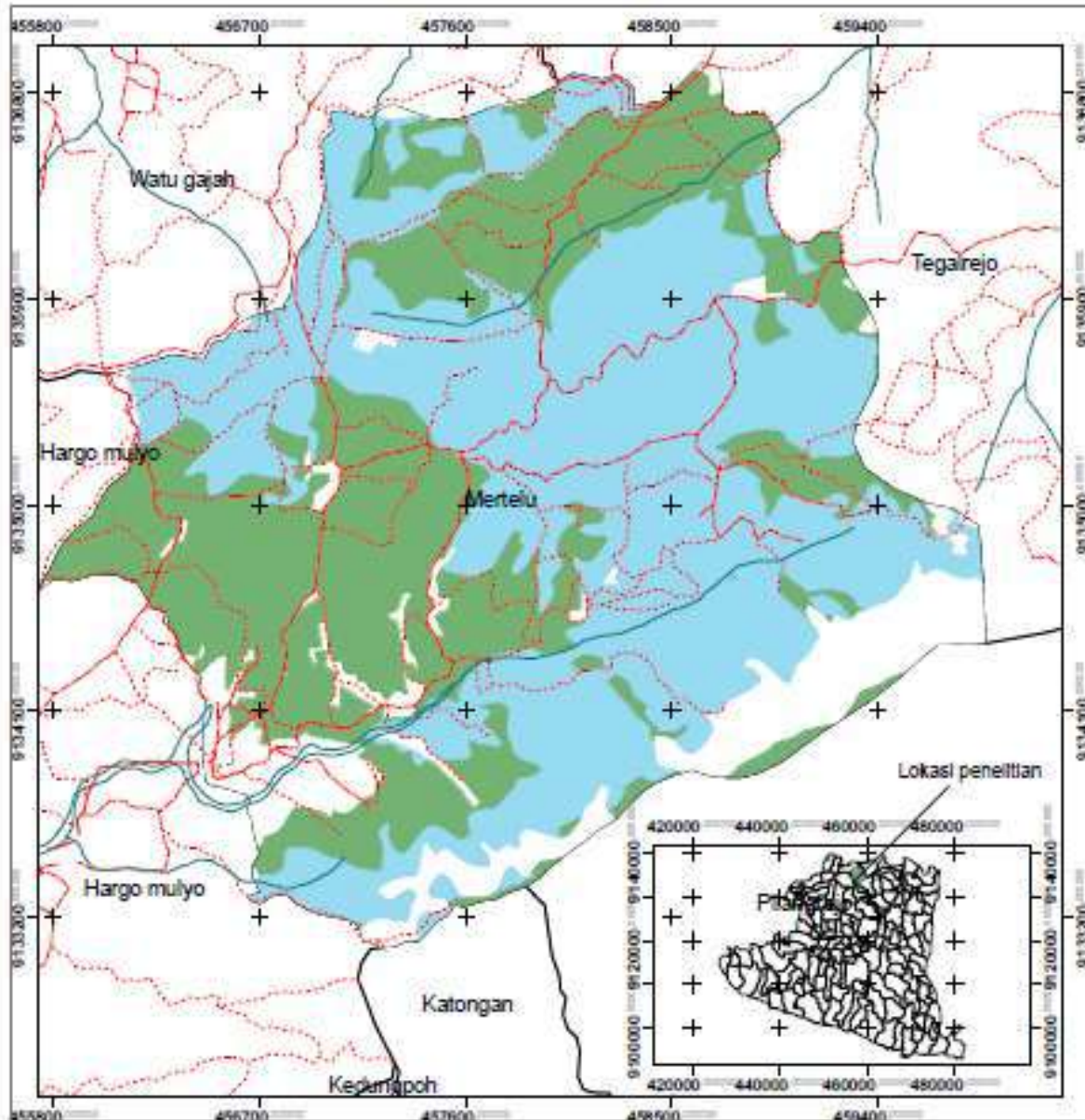


SQ of the dry land

Fungsi Tanah	Bobot 1	Indikator Tanah			Indeks Bobot	Nilai Indikator Tanah				Indeks Kualitas Tanah	
			Bobot 2	Bobot 3		Agak Curam		Curam		Agak Curam	Curam
						Nilai	Skor	Nilai	Skor		
Melestarikan Aktivitas Biologi	0,4	Media perakaran	0,3								
		- Jeluk perakaran (cm)		0,6	0,072	65	1,00	54	0,76	0,072	0,054
		- Berat volume (gr/cm ³)		0,4	0,048	1,02	0,41	0,98	0,26	0,020	0,012
		Kelengasan	0,3								
		- Porositas (%)		0,6	0,072	57,32	0,75	60,96	0,27	0,037	0,019
		- C Organik (%)		0,4	0,048	0,52	0,03	0,54	0,05	0,002	0,002
		Ketersediaan Nutrisi	0,4								
		pH H ₂ O		0,3	0,048	6,97	0,72	6,97	0,81	0,039	0,039
		- P- tersedia (ppm)		0,1	0,016	23	0,37	29,00	0,49	0,006	0,008
		- K- tersedia (ppm)		0,1	0,016	86	0,54	113,00	1,00	0,009	0,016
- C Organik (%)		0,4	0,064	0,52	0,03	0,54	0,05	0,002	0,003		
-N- tersedia (ppm)		0,1	0,016	49	0,40	26,00	0,00	0,006	0,000		
Pengaturan dan Penyaluran Air	0,3	Tekstur	0,6								
		Pasir		0,34	0,0612	49	0,97	30,00	0,41	0,059	0,025
		Debu		0,33	0,0594	34	0,52	48,00	0,94	0,031	0,056
		Lempung		0,33	0,0594	17	0,03	22,00	0,18	0,002	0,010
		Porositas (%)	0,2		0,06	57,32	0,75	60,96	0,27	0,031	0,016
		Berat volume (g/cm ³)	0,2		0,06	1,02	0,41	0,98	0,26	0,024	0,016
Penyaringan dan Penyangga	0,3	Tekstur	0,6								
		Pasir		0,34	0,0612	49	0,97	30,00	0,41	0,059	0,025
		Debu		0,33	0,0594	34	0,53	48,00	0,94	0,031	0,056
		Lempung		0,33	0,0594	17	0,03	22,00	0,18	0,002	0,010
		Porositas (%)	0,1		0,03	57,32	0,51	60,96	0,27	0,015	0,008
		Proses mikrobiologis	0,3								
		- C Organik (%)		0,5	0,045	0,52	0,03	0,54	0,05	0,001	0,002
- N Total (%)		0,5	0,045	0,05	0,09	0,04	0,00	0,004	0,000		
TOTAL					1					0,453	0,379



Map of soil quality index



- moderate
- low



Soil quality index in Mertelu village

KAC: Orchards, moderately steep

KC : Orchards, steep

SAC : Bush, moderately steep

SC : Bush, steep

TAC : Dryland, moderately steep

TC : Dryland, steep

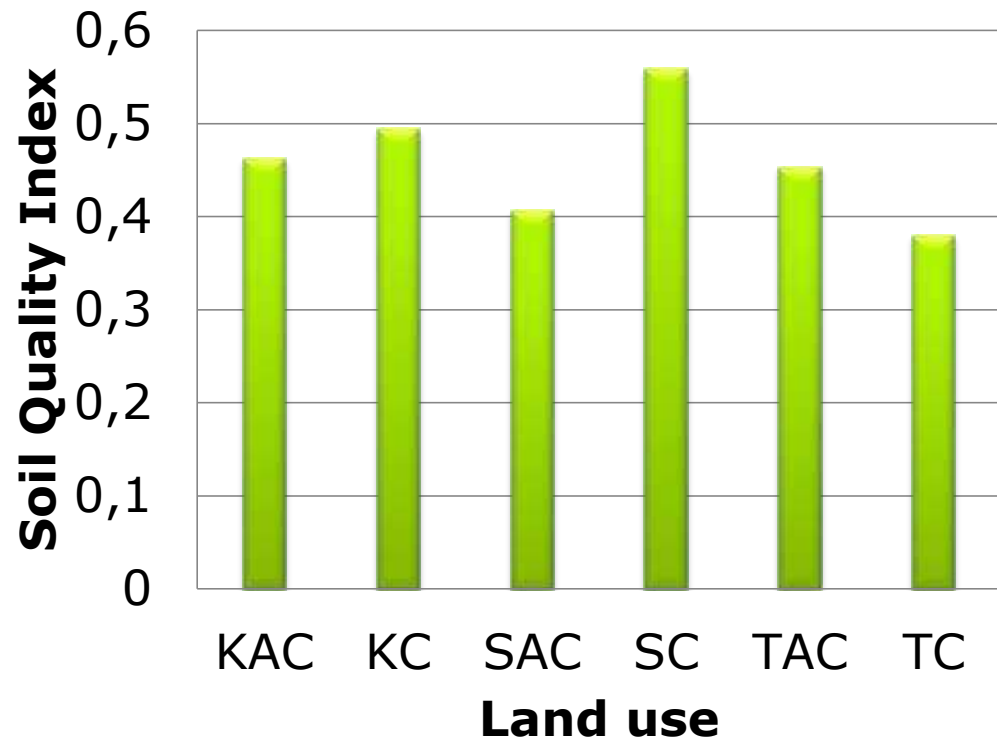




Table 1. Soil Quality Index and Soil Quality Classes in the study area

No.	Location	Soil quality index	SQ classes
1	Orchard; moderately steep	0.462	Moderate
2	Orchard; steep	0.494	Moderate
3	Bush; moderately steep	0.406	Moderate
4	Bush; steep	0.558	Moderate
5	Dry agriculture land; moderately steep	0.453	Moderate
6	Dry agriculture land; steep	0.379	Low



4. Conclusion

- Soil quality index shows the **highest** value of **bush with the steep slope**, followed by orchard from steep slope, orchard from moderately steep slope, dry agriculture land form moderately steep slope, bush from moderately steep slope, and the **lowest** one is **dry agriculture land from steep slope**.
- Soil quality in the study area **mostly** are included in **moderate** classes, **except** for area of **dry agricultural land with steep slope** is included in low soil quality class.



Thank you



ICSO-ISS Bandung, 5-7th August 2019

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