Session 3

“Sediment Transportation, and Its Control in the Brantas River Basin”

Management of Disaster Related To Water Resources

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Ministry of Public Works

Management of Disaster Related To Water Resources

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Department of Public Works

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BACKGROUND

- Disaster always occur a round the year and constitute threat forever
- Drought disaster in dry season, flood and slide in rainy season
- Tendency to increase in occurrence
- Causal of disaster by nature and human (action, activity, growth)
- Environmental degradation as either reason of keys factor

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BACKGROUND

- Disaster management complexity
- Disaster Management according to spread all over and intregate specially; flood, slide, and drought are the very important matter for all side
- Management disaster is a continue process, not periodic action (a moment)
- Management substance : human (human resources), nature (natural resources), infrastructure, institution, financial, policy, legalization and management capability
- Public guideline for disaster management
- The main term guideline are increase of pay attention for all side to reduction the effect of disaster
- The guideline must be applicable according to local characteristic and condition

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DISASTER TYPE

- **Disaster Types According to Regulation No. 7 Year 2004 about Water Resources:**

1. Flood 2. Erosion and Sedimentation 3. Landslide 4. Cold Lava Flood (debris flow) 5. Land Subsidence 6. Change of characteristic & substance of chemical, biology and physical water	7. Threatened extinction of flora and fauna 8. Epidemic 9. Intrusion 10. Infiltration

- **Disaster Types Based on Disaster Management Handbook (Carter, 1991):**

1. Earthquake 2. Volcanic Eruption 3. Tsunami 4. Tropical Cyclone (Hurricane) 5. Flood 6. Landslide	7. Bushfire 8. Drought 9. Epidemic 10. Major Accident 11. Civil unrest

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- **Coalition disaster types based on those from the Regulation No. 7 Year 2004 about Water Resources and those from Carter (1991) are as follows:**

1. Bushfire 2. Change of characteristic and substance of chemical, biology and physical water. 3. Civil unrest 4. Cold Lava Flood (debris flow) 5. Drought 6. Earthquake 7. Epidemic 8. Erosion and Sedimentation 9. Flood	10. Infiltration 11. Intrusion 12. Land Subsidence 13. Landslide 14. Major Accident 15. Threatened extinction of flora and fauna 16. Tropical Cyclone (Hurricane) 17. Tsunami 18. Volcanic Eruption

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FLOOD DISASTER

Natural Hazard Research and Applications Research Center-1992, stated four basic strategies for management of flood areas :

- Reducing risk about damage and flood disturbance (zone or to arrange a land use within flood areas).
- Reducing flood (use a flood control reservoir)
- Reducing effect of flood
- Return and defend of natural and resources from flood areas

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Causal of Flood

1. Land-Use change
2. Waste disposal
3. Erosion & sedimentation
4. Dirty areas on the round of river/drainage
5. Inappropriate flood control system plan
6. Intensive and high rainfall
7. River physiographic/geophysical effects
8. Inadequate capacity of river and drainage system
9. Water rise effect
10. land subsidense and *rob*
11. Land drainage
12. Dam and water building
13. Destruction

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DROUGHT

Characteristics:

- Major areas liable to drought are usually well known
- Periods of drought can be prolonged
- Areas affected may be very large
- Long Warning
- Effect on agriculture, livestock, rural industry production and human habitation may be severe.
- Long terms effect can be in the form of severe economics loss, erosion which affects habitation and production and sometime abandonment of large tracts of land
- Man-made activities may aggravate the possibility of drought problem
- The inability and/or unwillingness of the population to move from drought prone areas may exacerbate the problem.

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LANDSLIDE

Characteristics:

- Warning period may vary.
- Speed of onset is mostly rapid
- Damage to structures and system can be severe
- Rivers may be blocked, causing flooding
- Crops may be affected, sometime areas of crop producing land may be lost altogether.
- When landslide is combined with very heavy rain and flooding, the movement of debris may cause high level of damage and destruction.

Problem for Disaster management:

- Maintenance of adequate community awareness and preparedness
- The arsonist problem is difficult to counter
- Establishment and maintenance of adequate warning system, particularly the meaning of signal and their interpretation by threatened communities
- Timely dissemination of warning and, if applicable, decision to evacuate
- Long term recovery may be prolonged due to high levels of environmental damage and destruction
- Evacuation movement, either out of affected areas, or to safe havens within such areas.

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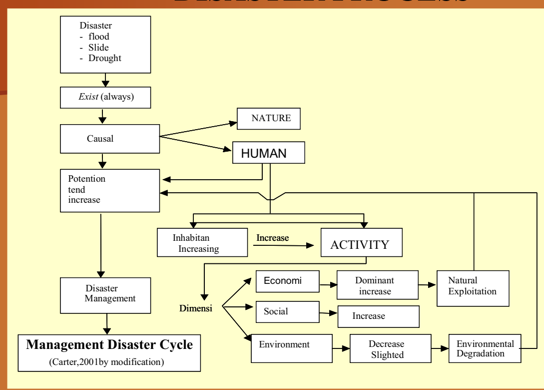
DISASTER PROCESS



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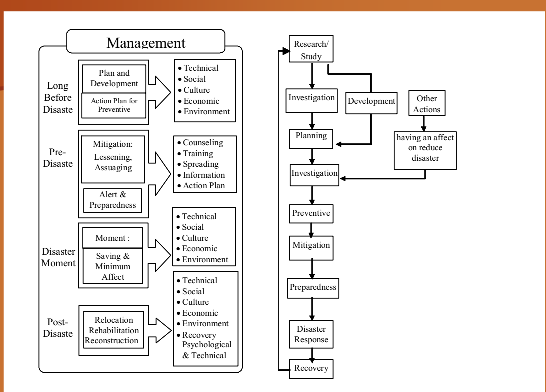
DISASTER MANAGEMENT CONCEPT



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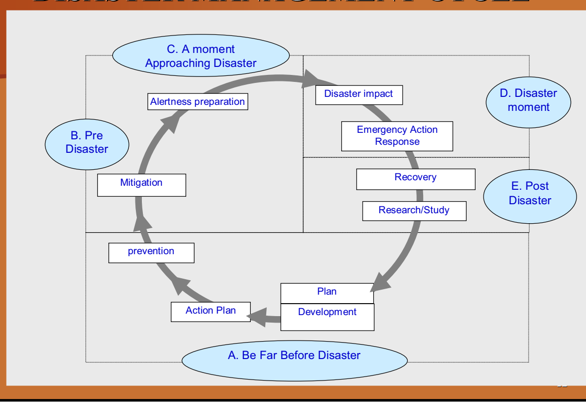
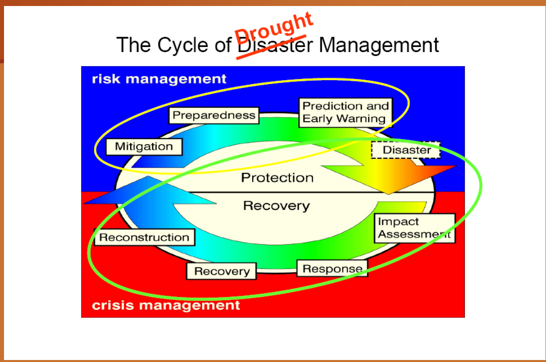
DISASTER MANAGEMENT CYCLE



DISASTER MANAGEMENT CYCLE



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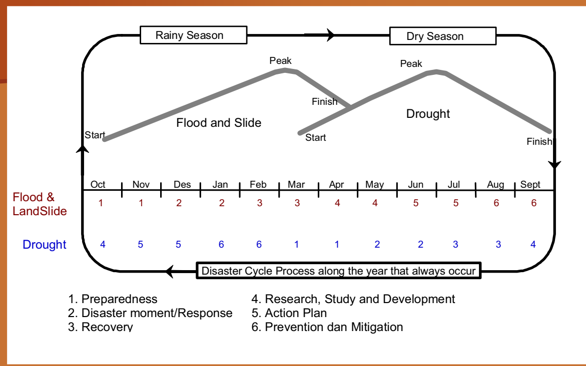
Flood, Landslide and Drought Disaster Cycle Diagram



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Pre-Disaster Until Before Disaster

A. Prevention

Actions or measures for preventing the occurrence of a disaster and or prevent danger/harmful affects for community and important infrastructures.

Example prevention action:

- Regulation in connection with within prevention efforts (i.e land use regulatory for community activity, land use regulatory appropriate for RUTRK/W).
- Countermeasure infrastructure
- Monitoring, hazzard maps, socialization, training and education.
- People awareness, preparadness, participations
- Anticipation activity : example identification, action plan, supply water reserve.

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B. Mitigation

Basic Mitigation

General:

- Disaster give a rarely opportunity to introduce mitigation action
- Mitigation may be introduced with : reconstruction, new investment and existing environment management.

Management:

- Mitigation action are complex and interdependent, and have a large responsibility. Accordingly an effectively leadership and coordination are important to create success.
- Mitigation will be more effective if actions about security to disaster are spread out through many varieties of activities. .
- Active a mitigation action that rely on motivation will be more effective than passive action according to limited of law and control.
- Mitigation must be integrated through preparedness, response, and reconstruction.

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C. Preparedness

An action that makes government, organization, society and stakeholders can anticipate and respond.

Examples for Preparedness measures are:

- The formulation and maintenance of valid, up-to-date counter disaster plans witch can be brought into effect whenever required.
- Special equipments for emergency action
- Early warning systems.
- Emergency communications.
- Public education and awareness.
- Training programs, including exercises and examinations.
- Community awareness and preparadness.

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Disaster Moment

A. DISASTER AFFECT

Influence or everything that happens caused by disaster for example:

- death
- bodily injury
- good and chattel ruination
- damage and ruination of source of living and agricultural produce
- production process trouble
- life style trouble
- lose the residence
- special service trouble
- infrastructure damage and trouble of governance system
- economic loss
- affect of sociology and psychology

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B. Response

All actions which are immediately conducted at the time of disaster. Its objective is for the minimization of the impact and looses. Actions have to as according to SOP (Standard of Operation Procedure).

Typical measures include :

- Implementation of plans
- Activities of counter disaster system
- Search and rescue
- Provision of emergency food, shelter, medical assistance etc
- Survey and assessment
- Evacuation measures

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Post Disaster

A. Recovery

Some important step of recovery action:

- Restoration
- Rehabilitation
- Reconstruction

B. Research / Study and Action Plan

- Assessment and Investigation
- Gathering primary and secondary data
- Analyze and study of disaster causes
- Conclusion
- Recommendation for action plan
- Time scale: Short, Medium, Long Range
- Space scale: Local, Regional.

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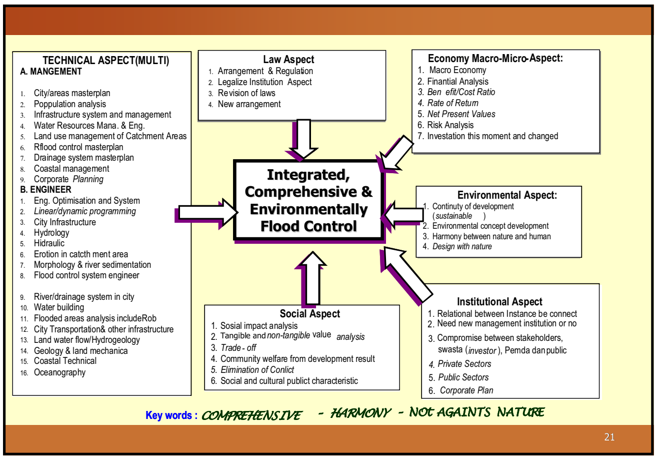

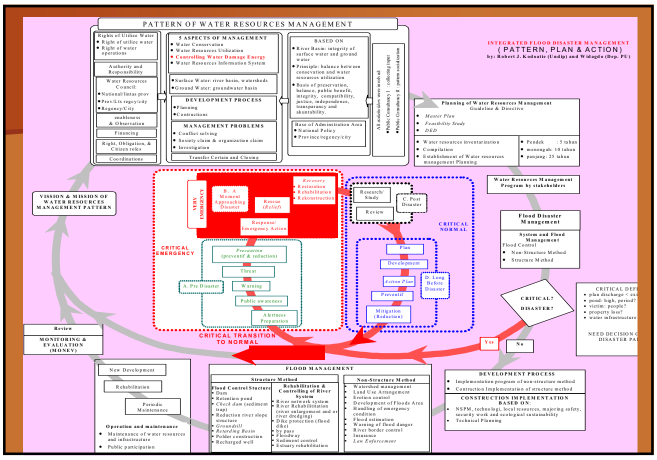

RELATED STAKEHOLDERS

There are many related stakeholders, including elements: government, university, non government organization, private/investor, contractor, consultant, communities and other.

Type of stakeholders may be categorized into 5 groups, including:

- service provider
- regulator
- planner
- support organizations
- user

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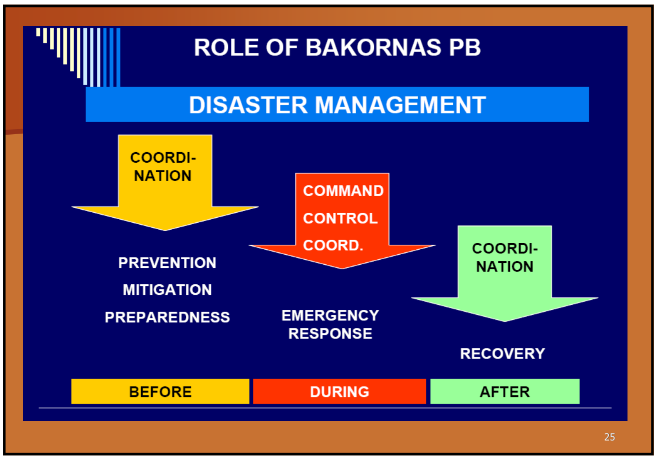

Problems in Disaster Management:

- Limited Budget
- National Priority for other activities
- Political Aspect
- Development Problem and Balance in Natural Disaster Management
- Traditional point of view (difficult to change)
- The view that the management is government responsibility, monopoly by government cause the community apathy
- Environmental degradation

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Policies

- Strengthen national capability in disaster management, especially in prevention, mitigation and preparedness.
- Manage and mobilize all potential resources (infrastructure and manpower) in disaster preparedness, responds and recovery
- Empower local authorities in anticipating and responding disaster in their regions.
- Coordinate all stakeholders and activities in disaster management.
- Incorporate disaster risk reduction in the framework of national development plan.

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Strategy

- Disseminate disaster risk reduction and strengthen capacity through training and education.
- Prepare disaster legislation, regulations and standard operating procedures
- Set up disaster management information systems
- Disseminate hazard mapping and risk assessment
- Set up disaster management plan in all levels
- Strengthen National/Provincial/District Emergency Operation Center and Rapid Response Team.
- Strengthen local capacity in disaster recovery

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Thank you very much !!!

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Assessing the sediment sources of deposited sediment in reservoirs using sediment tracer techniques

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University of Tsukuba

Estimating soil erosion rate and sediment sources using Pb-210ex in upper Brantas river basin in Indonesia

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Increase of sedimentation in Sengguruh reservoir has been a recent environmental concern, and elucidating the sediment sources is essential for suitable sediment management. However, a primary sediment sources has not been assessed quantitatively in this basin. This study estimated soil erosion rate on forest hillslope and hilly cultivated land using Pb-210 naturally occurring radionuclide. In addition to this, sediment contribution rates from two potential sediment sources (surface erosion on cultivated land and a sediment from gully erosion and shallow landslide scar) were estimated by analysis of Pb-210ex activities in the deposited sediment collected from upper Brantas river basin (UB basin), Lesti and Amprong river basin (LA basin) and in the lake sediment of Sengguruh reservoir. The estimates of soil erosion rate using DM model[1] on forest slope and cultivated land were 0.4 t/ha/y and 11.1 t/ha/y, respectively, suggesting that the erosion potential of hilly cultivated land was much higher than that of forest hillslope. The higher sediment contribution rate from surface erosion of cultivated land was detected in UB basin (approximately 70%) compared with LA basin (approximately 5%). Similarly, the sediment contribution rate over upper Brantas river basin was estimated at approximately 30%. The results of this study indicated that surface erosion on hilly cultivated land was one of the primary sediment sources in upper Brantas river basin. Also, the total of potential sediment discharges from forest area and cultivated land in upper Brantas river basin was estimated around 800,000t/y. This estimation explains almost 30% of average annual sedimentation rate in Sengguruh reservoir calculated by existing study, and matches well with the contribution ratio of cultivated land in upper Brantas river basin.

References

[1] Walling, D. E., Collins, A.L.,and Sichingabula, H.M., *Geomorphology*, **52**, 193–213 (2003).

Second International Workshop on Water and Sediment Management

Assessing the sediment sources of deposited sediment in reservoirs using sediment tracer techniques

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Potential problems in upper Brantas

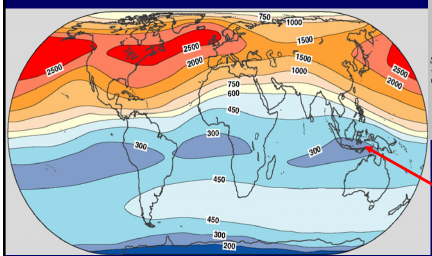
Problem of sediment in reservoirs

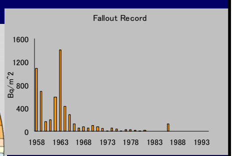
Quantifying source of sediment in Reservoirs

Quantifying net erosion rate in forest hillslope and agricultural land

Quantifying role of sand mining on sediment discharged

Sediment tracer (Cs-137)





Very low fallout rate!!

Perhaps Cs-137 can not use in Brantas River Basin

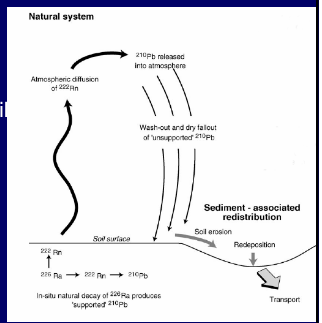
Fundamentals of Pb-210ex

Half life 22.3 years

Fallout in association with precipitation

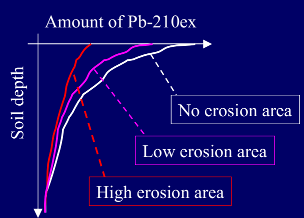
Strong and rapid adsorption by soil

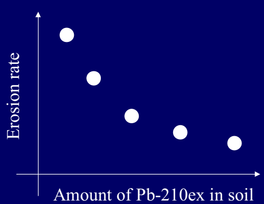
Naturally produced



After the initial adsorption of Pb-210, all subsequent vertical and lateral re-distribution occurs in association with erosion, transport and deposition of soil particles.

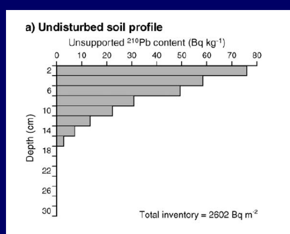
Profile in soil layer

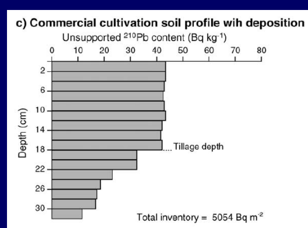




Pb-210ex have used for estimating net (ca. 40 years) soil flux

Undisturbed soil / Cultivated Soil

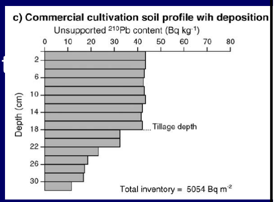




Walling et al. *Geomorpholgy* 52 (2003) 193–213

Improved mass balance model (Walling &He, 1999)

- Reference Inventory (Relaxation Depth, Proportional Factor)
- Sampling Year
- Tillage Depth
- Year of Tillage Commencement



DIFUSION AND MIGRATION MODEL FOR UNCULTIVATED SITES Walling et al. (2003)

- Constant Fallout Input: Reference Inventory sampling
- Estimate diffusion and migration coefficients from reference site: Relaxation depth (initial distribution)
- Estimate erosion rate from inventory measurement on bulk cores: Soil sampling

Walling et al. *Geomorphølgy* 52 (2003) 193–213

MASS BALANCE MODEL

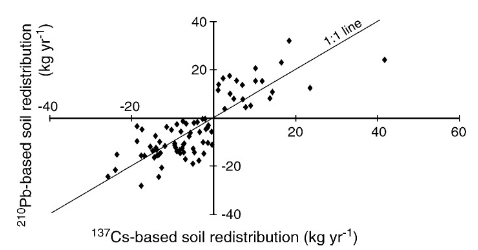


Fig. 5. The relationship between ^{210}Pb- and ^{137}Cs-derived estimates of soil redistribution rates for individual slope segments obtained for the soil cores collected from the transects located in areas of commercial cultivation.

Cs-137 : total erosion for 40 yrs, Pb-210ex average erosion =>100yrs
Walling et al. *Geomorphølgy* 52 (2003) 193–213

Diffusion and Migration MODEL

Cs-137 based erosion rate | Pb-210ex based erosion rate

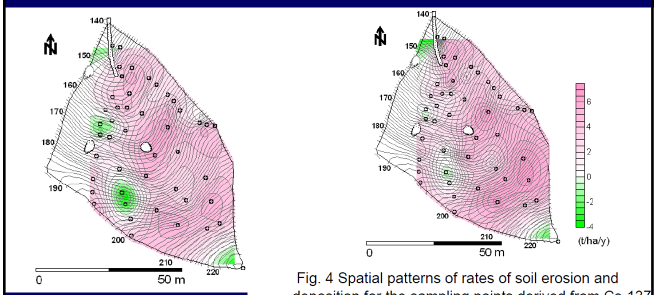
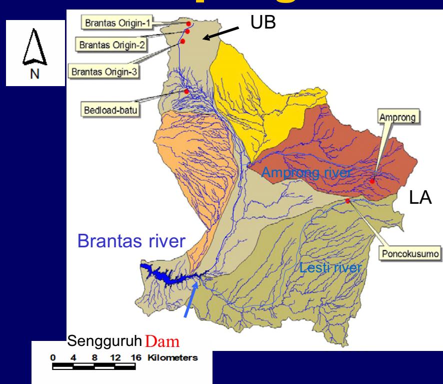


Fig. 4 Spatial patterns of rates of soil erosion and deposition for the sampling points derived from Cs-137 and Pb-210$_{ex}$ inventories

Fukuyama,T. Onda, Y., Takenaka, C. and Walling DE. (in press) *JGR Earth Surface*

Results in Brantas River Basin

Sampling site



Soil Sampling (reference site)

- Scraper plate

Soil core sampling (LA site)

Forest soil (LA site)

Soil core sampler

Soil core sampling (upper Brantas)

Portable time integrated sampler

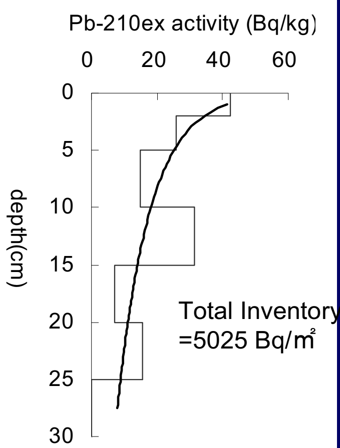
Takahashi, F., Onda, Y., Kato, H. and Uchida, T. (2006) *J. Japan Soc. Erosion Control Eng.*, 60(1), 48-51

Gamma-ray spectrometry for suspended sediment

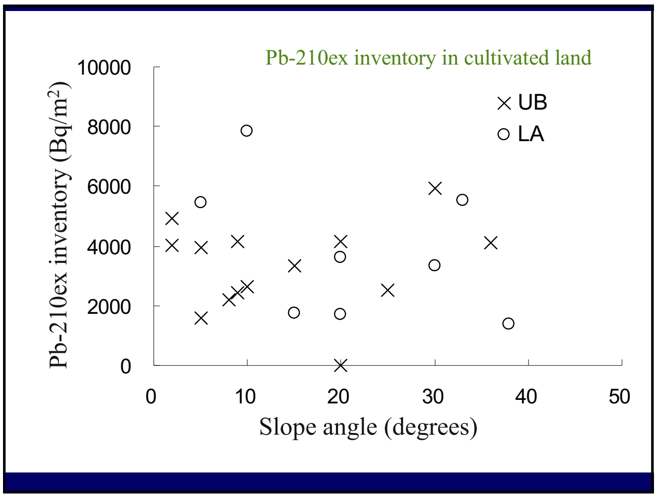
Enough sample

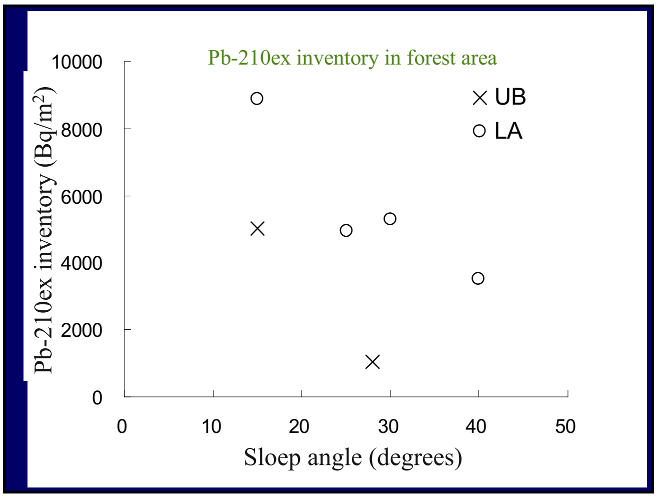
University of Tsukuba

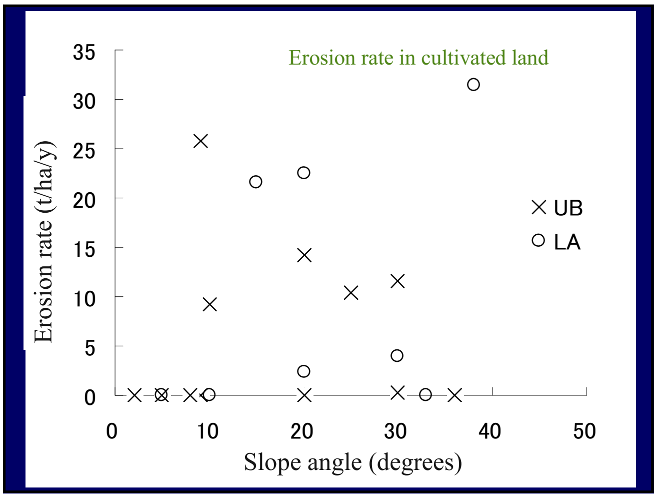
- N-type coaxial germanium detector
- Eurysis
- Relative efficiency 25%, 30%
- Energy and efficiency are calibrated for Pb-210, Pb-214 and Cs-137

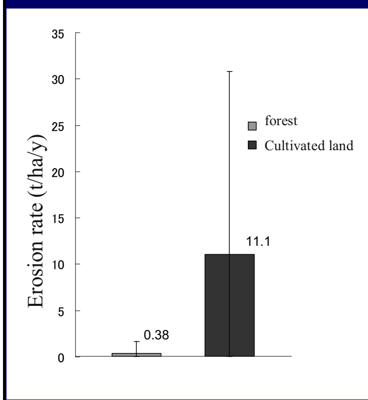


Distribution of Pb-210$_{ex}$ at reference site









Estimated erosion rate in upper Brantas

Cultivated land 70%

Forest 16,000 t/y,
Cultivated land 678,000 t/y
Total ca. 800,000 t/y

		Pb-210ex (Bq/kg)	σ (Bq/kg)	No. of samples
Forest	UB	22.0	±2.9	2
	LA	27.2	±3.9	4
Cultivated area	UB	21.7	±4.1	14
	LA	16.9	±2.9	8
Channel sediment	UB-ⅰ	11.8	±2.1	1
	UB-ⅱ	6.4	±8.4	1
	LA	0.5	±8.0	1
uspended sediment	UB	8.5	±6.5	1
Reservoir sediment		3.8	±0.8	1

Fingerprinting

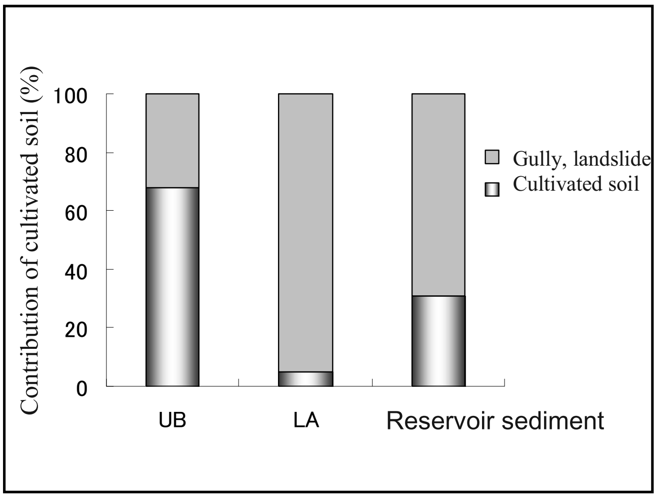
$$XP_c + YP_g = P_r$$

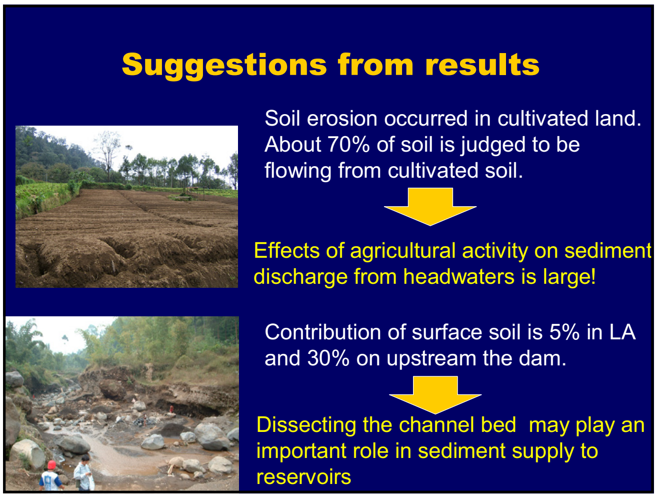
$$X + Y = 1$$

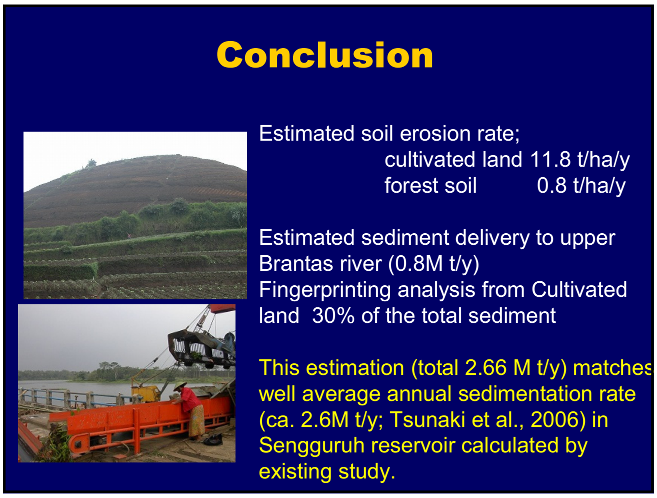
P_r;Pb-210ex concentration of fluvial sediment,
P_c;Pb-210ex concentration from cultivated soil,
P_g; Pb-210ex concentration from gully erosion (=0)
X, Y ; contribution ratio of each source

$$P_c = \frac{aA + bB + cC + ...nN}{a + b + c + ...n}$$

$A,B,C,..N$ Pb-210ex concentration of each site
$a,b,c,\cdots n$ Erosion rate of each sampling points


Contribution of cultivated soil (%)
100
80
60
40
20
0
UB
LA
Reservoir sediment
Gully, landslide
Cultivated soil


Suggestions from results
Soil erosion occurred in cultivated land. About 70% of soil is judged to be flowing from cultivated soil.
Effects of agricultural activity on sediment discharge from headwaters is large!
Contribution of surface soil is 5% in LA and 30% on upstream the dam.
Dissecting the channel bed may play an important role in sediment supply to reservoirs


Conclusion
Estimated soil erosion rate;
cultivated land 11.8 t/ha/y
forest soil 0.8 t/ha/y
Estimated sediment delivery to upper Brantas river (0.8M t/y)
Fingerprinting analysis from Cultivated land 30% of the total sediment
This estimation (total 2.66 M t/y) matches well average annual sedimentation rate (ca. 2.6M t/y; Tsunaki et al., 2006) in Sengguruh reservoir calculated by existing study.

The assessment of sediment sources at Sengguruh reservoir by X-ray diffraction(XRD) technique

Dr. Dian Sisinggih

University of Yamanashi

The Assessment of Sediment Sources at Sengguruh Reservoir by X-ray Diffraction (XRD) Technique

Dian Sisinggih[1] , Kengo SUNADA[1] and Satoru OISHI[1]
[1]*University of Yamanashi, 4-3-11, Takeda, Kofu, Yamanashi 400-8511, JAPAN*

In this study X-ray powder diffraction technique was used for qualitative analysis of the mineral composition of sediment samples. The sources of sedimentation at reservoir were assessed by mean of Hierarchical Cluster Analysis of minerals composition in the samples of sediment sources and deposited.

The sediment has been composed of many minerals and non minerals. The mineral is normally crystalline and that has been formed as result of geologic processes. Since each crystalline material has a unique characteristic atomic structure then it will diffract X-ray in unique pattern. The possible minerals in the sample were obtained by the qualitative analysis of diffraction pattern using the Hanawalt's search and match method. The results were arranged as a binary matrix representative of mineral composition each sampling site. Applying the hierarchical cluster analysis, the sites were grouped based on mineral similarity. Utilizing the condition of the sample's environment, the physical meaning of dendrogram could be derived as sediment fingerprinting.

The proposed method was applied to the Sengguruh basin. Results indicated that in the Lesti sub-basin, sediment sources were mostly coming from the area of 25-30^{o} slope. Meanwhile, in the Brantas origin sub-basin, the cultivated area in the downstream of Brantas spring was detected as main sources of sedimentation. Recently it has been altered by the upstream area of Brantas spring. Compared with the observation data, good correlation was achieved.

Finally, the results of sediment fingerprinting could be considered to propose the appropriate countermeasures for erosion and sedimentation in this basin.

Keywords: Sediment sources; X-ray Diffraction; Cluster Analysis; Sediment fingerprint.

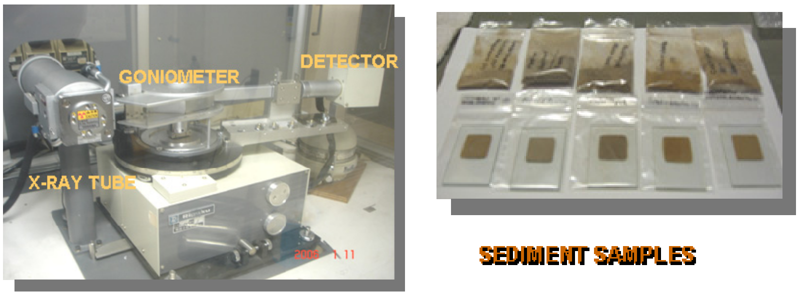


Figure 1. X-Ray Diffractometer and powdered sediment samples

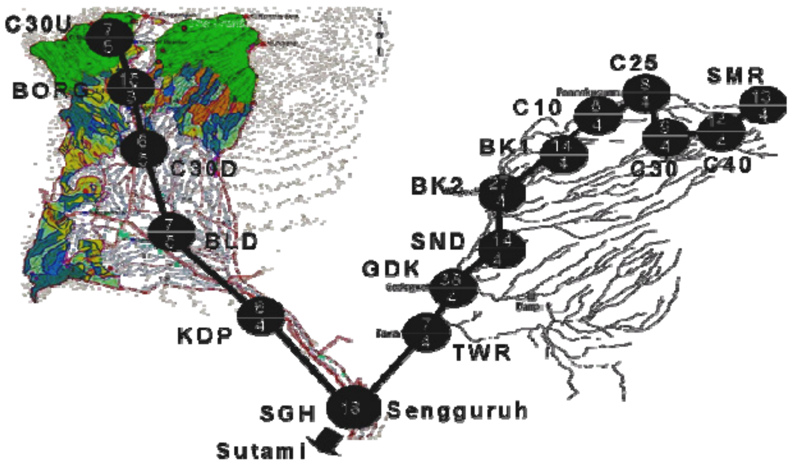


Figure 2. Number of major minerals detected in sampling sites

References

[1] Osanai, N., Noro, T. , Uchida, T, Assessing The Sediment Sources of Deposited Sediment In Reservoirs Using Sediment Tracer Techniques, *1st International Workshop on Water and Sediment Management in Brantas River Basin*, (2005).

[2] Nakagawa, H. , Satofuka, Y. , Muto, Y., Oishi, S. Sayama, T. , Takara, K, On Sediment Yield and Transport in The Lesti River Basin, Experiences From Field Observations and Remotely Sensed Data, *1st International Workshop on Water and Sediment Management in Brantas River Basin,* (2005).

[3] Oishi S., Sayama T., Nakagawa H., Satofuka Y., Muto Y., Sisinggih D., Sunada K., Study on the estimation of sediment yield of fine particle by using raindrop size distribution, *Journal of Hydraulic Engineering, JSCE*, vol. 49, February (2005).

[4] BPP-FTUB, Final Report of Sediment Survey and Laboratory Test for Sediment of Dam Reservoirs and Sabo Facilities, Brawijaya University, (2004).

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THE ASSESSMENT OF SEDIMENT SOURCES AT SENGGURUH RESERVOIR BY X-RAY DIFRACTION (XRD) TECHNIQUE

Dian Sisinggih, Kengo SUNADA, Satoru OISHI

University of Yamanashi
4-3-11, Takeda, Kofu, Yamanashi 400-8511, JAPAN

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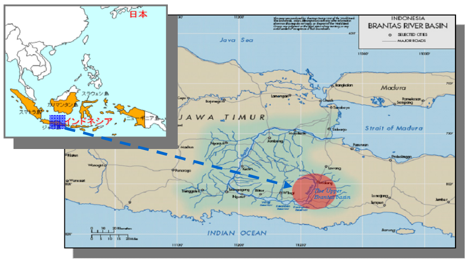

Sengguruh reservoir is the most upstream reservoir in the Brantas river system, Indonesia

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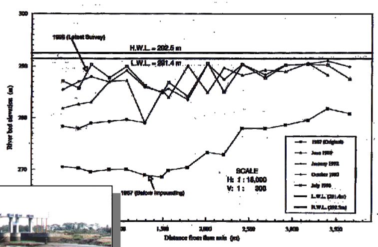

Sengguruh reservoir is facing severe sedimentation problem.

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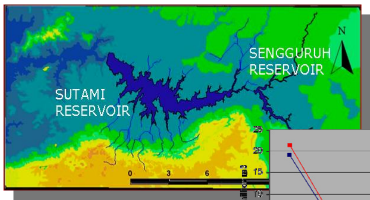

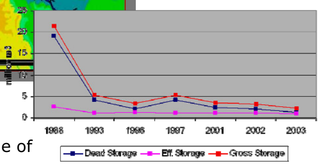

Sedimentation in Sengguruh reservoir is threatening lifetime of Sutami reservoir, the most important reservoir in Brantas river, Indonesia.

LWL = +291.4 HWL = +292.5

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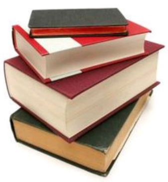
- There is an urgent need to improve the erosion control and management strategies.
- Many researchers have been studying the strategies for the best management practices of the Sengguruh basin.



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However ...

?

- those strategies are hampered by lack of understanding of the linkages between erosion sources and deposited sediment in the outlet.

?

- Detail of sedimentary sequences at the Sengguruh reservoir have not been reported yet,

Fingerprinting of sedimentation becomes the key step to design the appropriate countermeasures

- The objective of this study is to fingerprint the sediment in the Sengguruh reservoir.

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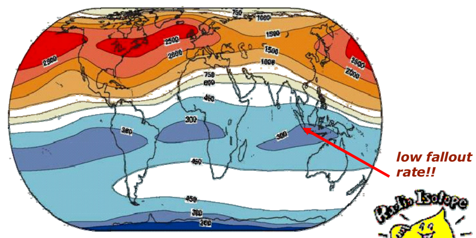
Common used of fingerprinting method



Is ^{137}Cs available as tracer ?

Background Problem Objective Method Results Conclusion

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^{137}Cs activities of all samples were smaller than the detection limit

^{137}Cs seems not available to be used for the fingerprints of sediment in Brantas river basin *OSANAI et al, 2005*

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What is in the sediment sample?

Sediments have been composed of many minerals and non minerals (amorphous) discharged by natural origin.

A mineral is an element or chemical compound that is normally crystalline and that has been formed as a result of geological processes.

Mitchel, James K., Fundamentals of Soil behavior, John-Willey & Sons, 1995

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What is Mineral?

Naturally Occurring: These words distinguish between materials formed by natural processes and those artificially created by man.

Inorganic: Almost all minerals are formed through inorganic processes - that is, not through the activities of living organisms.

http://www.utexas.edu/tmm/npl/mineralogy/mineral_what.htm

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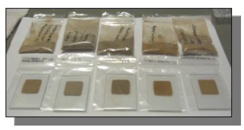
Sample of natural soils

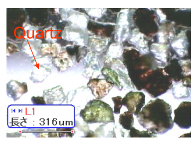
↓

Grain size analysis ** (> 74mm)

< 0.02 mm *Silt & Clay sizes* → *X-ray diffraction* **

Sand & Gravel sizes → *Optical Microscope* **





Mitchel, James K., Fundamentals of Soil behavior, John-Willey & Sons, 1995

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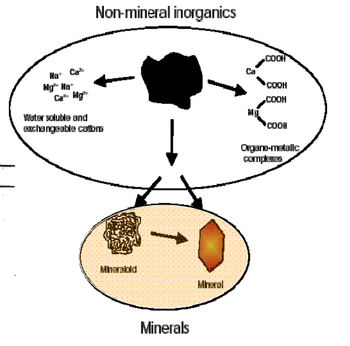
What is Mineral?

Mean Lifetime of a 1 mm Crystal at 25°C and pH 5 (From Lasaga et al., 1994, Table 1 and References Therein).

Mineral	Lifetime (years)
Quartz	34,000,000
Kaolinite	6,000,000
Muscovite	2,600,000
Epidote	923,000
Microcline	921,000
Prehnite	579,000
Albite	575,000
Sanidine	291,000
Gibbsite	276,000
Enstatite	10,100
Diopside	6,800
Forsterite	2,300
Nepheline	211
Anorthite	112
Wollastonite	79



http://www.utexas.edu/tmm/npl/mineralogy/mineral_what.htm

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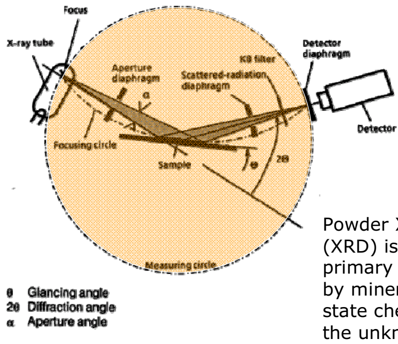

Powder X-ray Diffraction (XRD) is one of the primary techniques used by mineralogists and solid state chemists to examine the unknown solids.

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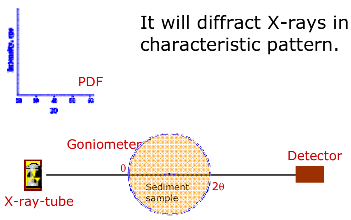
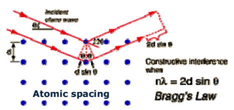
It will diffract X-rays in a unique characteristic pattern.





Each crystalline material has a characteristic atomic structure.

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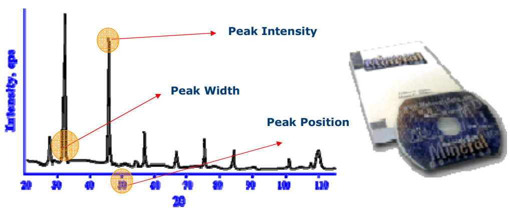

The possibility minerals composition was obtained by comparison of Powder Diffraction Patterns (PDFs) with database of known minerals.

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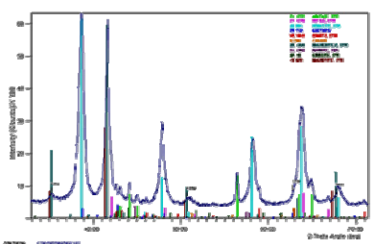

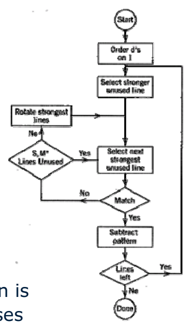

the identification of mineral composition is obtained by qualitative analysis of phases (comparison with standard patterns trough search & match procedures).

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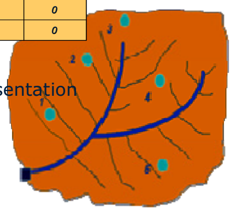
Mineral Name	Site -1	Site -2	Site -3	Site -4	Site -5
Mineral A	*0*	*0*	*0*	*0*	*1*
Mineral B	*0*	*1*	*0*	*0*	*1*
Mineral C	*0*	*0*	*0*	*1*	*1*
Mineral D	*1*	*0*	*1*	*0*	*0*
Mineral E	*1*	*0*	*0*	*0*	*1*
Mineral F	*1*	*1*	*0*	*1*	*0*
Mineral G	*1*	*0*	*0*	*0*	*0*

dichotomous matrix of mineral representation
0 = absent, 1 = present



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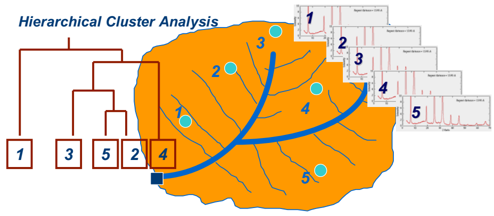

Cluster analysis is applied to the matrix of minerals to objectively identify samples that having similar mineral composition.

Considering the nature of sample environments and field survey, the fingerprint was derived.

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RESULTS AND DISCUSSION

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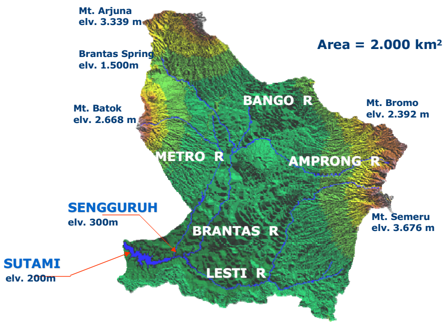

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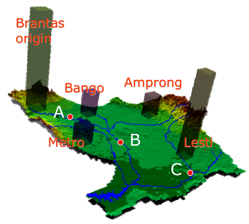
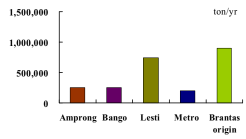
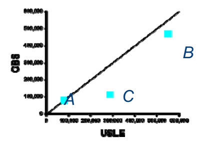
Potential erosion







Universal Soil Loss Equation

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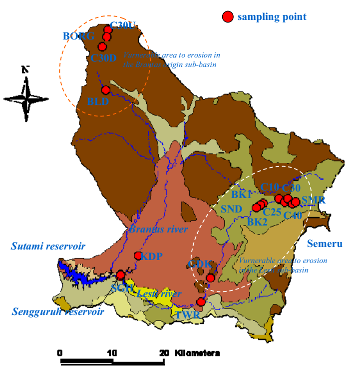

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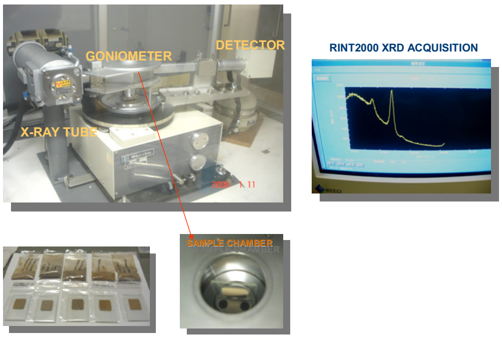
Analyze sediment samples



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	Mineral	SGRH-BTS	CULT-30UP	BTS-ORGN	CULT-30DWN	BEDLOAD	KD-PAYAK	SEMERU ASH
1	Ribbeite	1	0	0	0	0	0	0
2	Vincentite	0	0	0	0	0	1	0
3	Jarrygibbsite	1	0	0	0	0	0	0
4	Nasonite	1	0	0	0	0	1	0
5	Luberoite	1	0	0	0	0	0	0
6	Eglestonite	1	0	0	0	0	0	0
7	Geffroyite	1	0	0	0	0	0	0
8	Fergusonite-beta-	0	1	0	0	0	0	0
9	Chkalovite	0	0	1	0	0	0	0
10	Furutobeite	1	1	0	0	0	0	0
11	Terlinguaite	0	0	1	0	0	0	0
12	Serendibite	1	0	0	0	0	0	0
13	Odintsovite	0	1	1	0	0	0	0
14	Abhurite	0	0	1	0	0	0	0
15	Cobaltlotharmeyerite	1	0	1	0	0	0	0
16	Nerite	0	0	1	0	0	0	0
17	Balkanite	0	1	0	0	0	0	0
18	Rammelsbergite	1	0	0	0	0	0	0
	Namansilite	1	1	0	0	0	0	0

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Sources of sediment

Lesti basin

Sample site									
TWR	GDK	SND	BK2	BK1	C10	C25	C30	C40	SMR
7	38	14	27	14	8	8	9	14	13

Brantas Origin

Sample site					
KDP	BLD	C30D	BORG	C30U	SMR
6	7	6	15	7	13

Deposited sediment

River reach	Layer depth (m)	Num. of mineral	Remarks
The Lesti river	1	6	
	2	2	
	3	11	
	4	23	
	5	5	
The Brantas river	1	12	
	2	23	
	3	7	
	4	8	
	5	8	

Mineral name	Formula	Remarks	Environment
Barytocalcite	$BaCa(CO_3)_2$.	PDF 15-285	
Petitjeanite	Bi3O(PO4)2(OH)	PDF 35-543	
Anorthite	CaAl2Si2O8	PDF 41-1486	Magmatic and metamorphic rocks
Scorzalite	$Fe^{2+}_{0.75}Mg_{0.25}Al_2(PO_4)_2(OH)_2$	PDF 35-632	Highly aluminous metamorphic rocks and granitic pegmatites.

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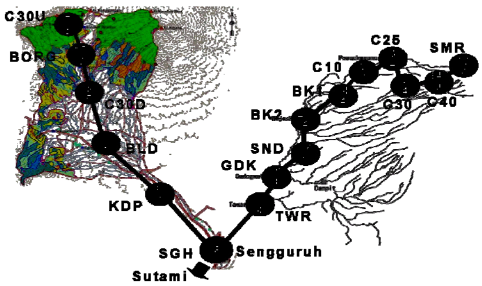

x = Number of mineral in sample
y = Number of mineral in sample which similar to the reservoir's

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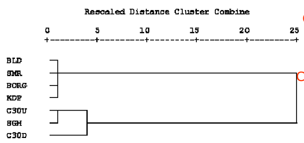

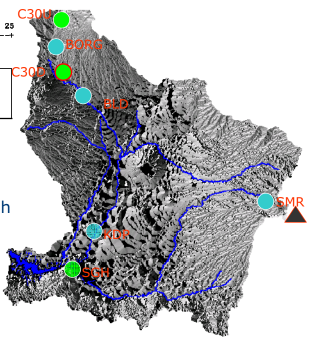

1-m layer of deposit sediment in Brantas-reach

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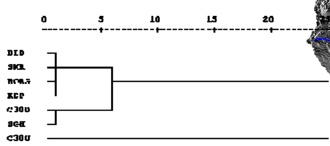

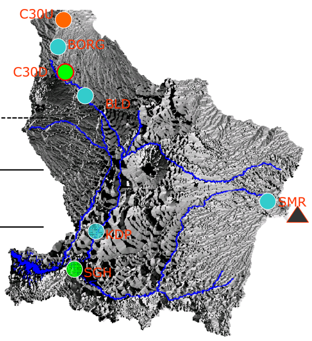

2-m layer of deposit sediment in Brantas-reach

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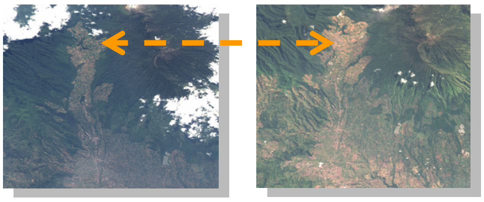

June 1997 by ADEOS/AVNIR   May 2002 by LANDSAT7 ETM+

Cultivation with deforestation is observed headwater of Brantas origin.

NAKAGAWA, H. , SATOFUKA, Y. , MUTO, Y., OISHI, S. SAYAMA, T. , TAKARA, K.: **On Sediment Yield and Transport in The Lesti River Basin, Experiences From Field Observations and Remotely Sensed Data**, 1st International Workshop on Water and Sediment Management in Brantas River Basin, 2005

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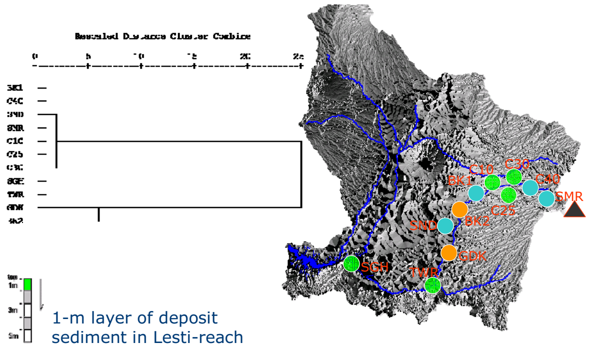

1-m layer of deposit sediment in Lesti-reach

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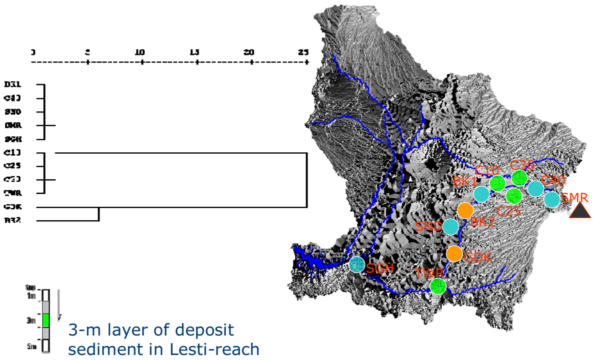

3-m layer of deposit sediment in Lesti-reach

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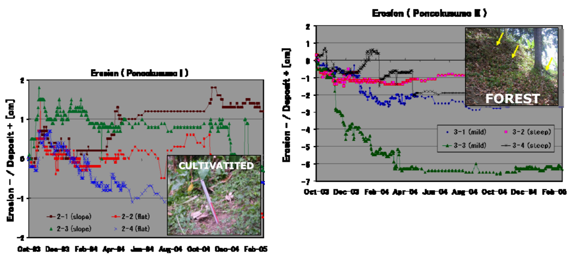

severe erosion occurred in nearly flat (cultivated) and mild slope (forest) rather than steeper slope.

OISHI S., SAYAMA T., NAKAGAWA H., SATOFUKA Y., MUTO Y., Sisinggih D., SUNADA K.: **Study on the estimation of sediment yield of fine particle by using raindrop size distribution**, Journal of Hydraulic Engineering, JSCE, vol. 49, February 2005

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June 1997 by ADEOS/AVNIR   May 2002 by LANDSAT7 ETM+

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SEDIMENT FINGERPRINT

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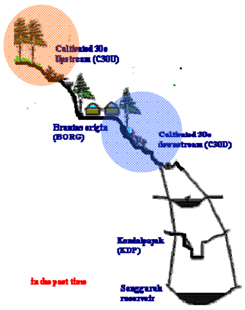

In the past, only cultivation downstream of brantas origin gave contribution to the reservoir sedimentation.

Recently, the increasing contribution from the cultivation upstream of brantas origin was identified.

Background | Problem | Objective | Method | Results | Conclusion

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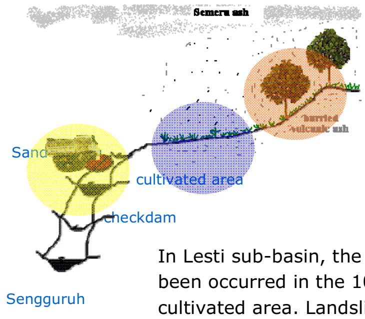

In Lesti sub-basin, the erosion has been occurred in the 10 – 30º of cultivated area. Landslides probably occurred in the higher slope (>40º).

Background | Problem | Objective | Method | Results | Conclusion

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CONCLUSION

Background | Problem | Objective | Method | Results | Conclusion

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- The sediment fingerprinting for Sengguruh reservoir was well done by analyzing the minerals composition of sediment sources and the deposited sediment.
- X-ray Powder Diffraction was useful to identify the major minerals composition in the sediment samples.

Background | Problem | Objective | Method | Results | Conclusion

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- Applying the statistical approach could grouped sample based on the minerals composition.
- Using the nature of sample environment and field survey data, then fingerprint of sediment was obtained.

Background | Problem | Objective | Method | Results | Conclusion

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- In the Brantas origin sub-basin, countermeasures should be considered the deforestation and cultivated area in the downstream of Brantas spring.
- In the Lesti-sub basin, the cultivated area in the moderate slope (10º – 30º) had been detected as major sources since the past time. The landslide and bank collapsed (>40º) seem occurred, but they were not instantaneously delivered to river body.

Background | Problem | Objective | Method | Results | Conclusion

ACKNOWLEGDMENT

21st COE-UY, SUNADA CREST, NILIM, DPRI-KU, JASA TIRTA and FT-UB.

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THANK YOU

Comments and suggestions are welcome