



# Biological Water Quality Indicators in Upland Catchments: Family Biotic Index as an Assessment Tool

Correspondence: Subekti Rahayu (s.rahayu@cgiar.org), Indra Suryadi, Bruno Verbist, Meine van Noordwijk and Rudy Harto Widodo

## Introduction

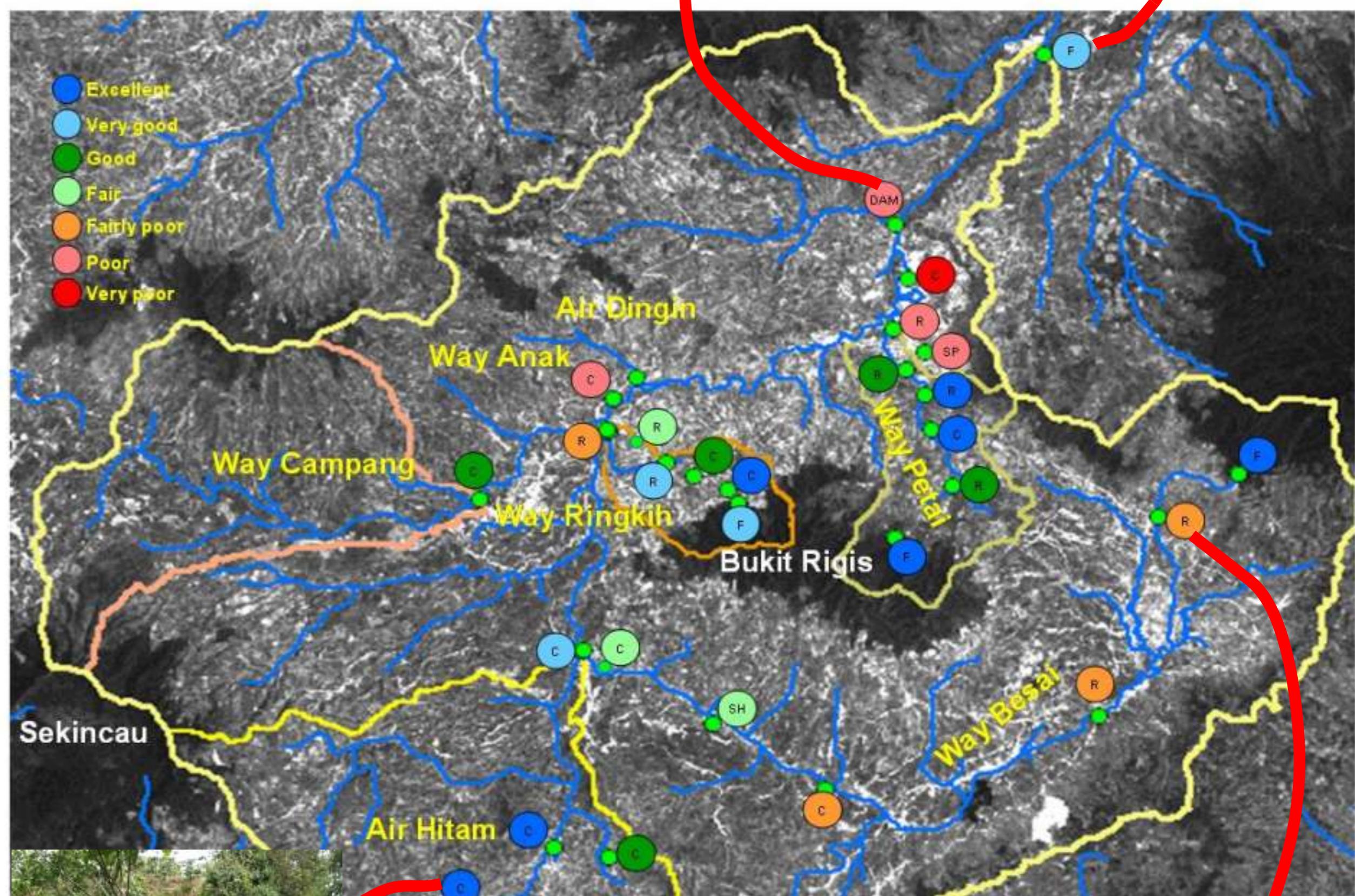
Forest conversion to agriculture such as coffee garden and rice field rapidly occurred in the upper Way Besai watershed, Sumberjaya, Lampung, Indonesia which involved activities such as land clearing, soil tillage, planting, weeding and applying fertilizers and pesticides by farmers. Those activities affect the water quality along the stream and river through sedimentation and accumulation of nutrients and pesticide residues.

## Method

In the upper Way Besai catchment 30 sample points were selected and sampled in August 2005. Three subcatchments (Way Ringkih, Way Petai and Air Hitam) representative of the land use types in the upper Way Besai were sampled in more detail.

Flow of activities:

1. Rapid test of physical and chemical characteristics
2. Kick-sampling to collect macro-invertebrates
3. Picking out of macro-invertebrates
4. Identification of macro-invertebrates up to family level
5. Calculate FBI (Hilsenhoff, 1988)



The Air Hitam watershed, with virtually no forest cover and characterized by a lot of (extensively managed) monoculture coffee gardens, has the excellent to good water quality. Intact riparian areas, a stony river bed and relatively high flow velocity, support a diverse and abundant macro-invertebrate community.



The other sampling spot on the Way Besai has fairly poor to very poor water quality compared to the upstream with forest cover. Likely a large area of intensively managed paddy rice with pesticides and high fertilizer rates is responsible for this.

$$FBI = \sum n_f t_f / N$$

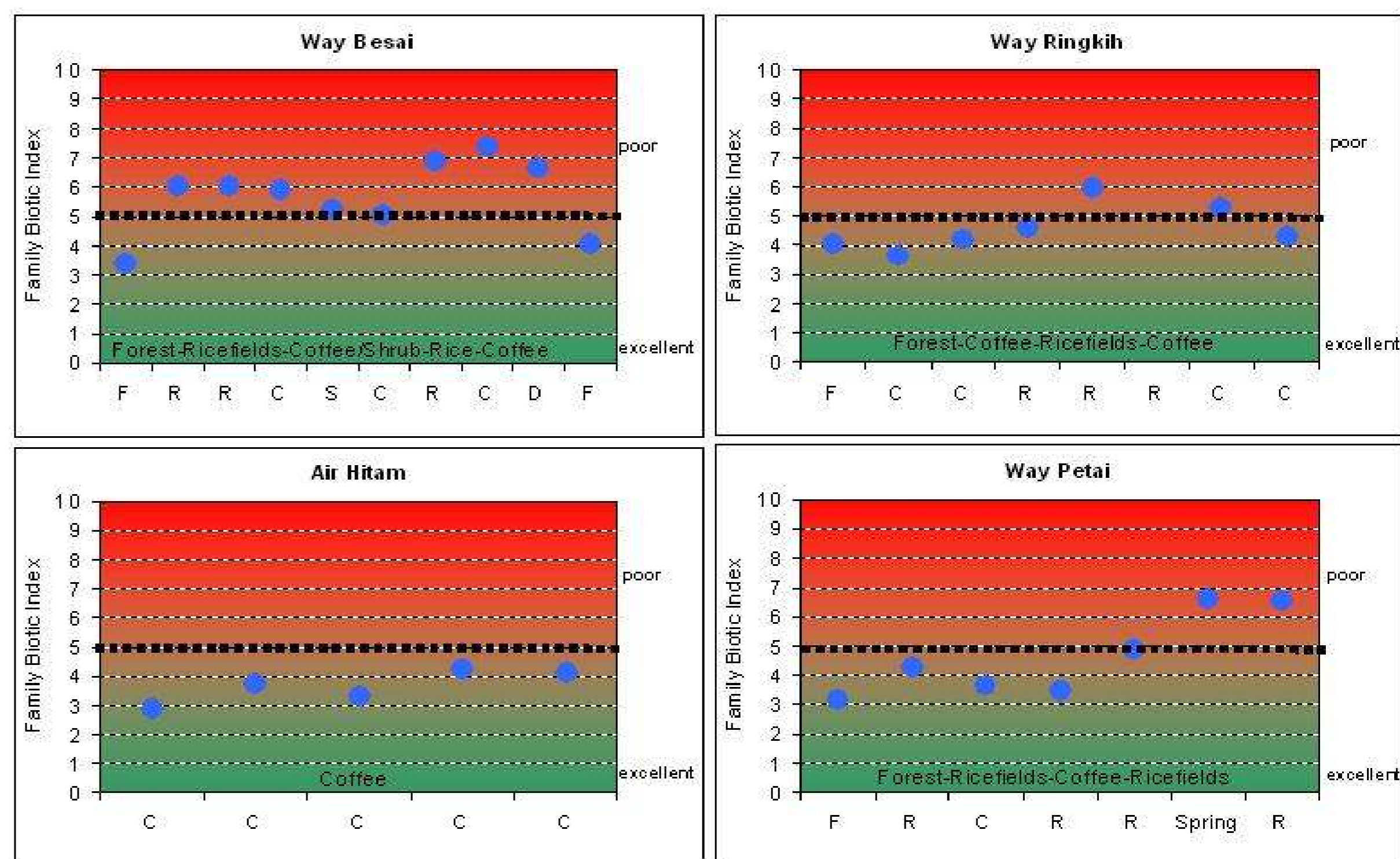
where:

$n_f$  = the individuals of a family in the sample  
 $t_f$  = the tolerance value of organic pollution of a family  
 $N$  = the total number of individuals in the sample

Family Biotic Index	Water Quality	Degree of organic pollution
0.0 - 3.75	Excellent	Organic pollution unlikely
3.76 - 4.25	Very good	Possible slight organic pollution
4.26 - 5.00	Good	Some organic pollution probable
5.01 - 5.75	Fair	Fairly substantial pollution likely
5.76 - 6.50	Fairly poor	Substantial pollution likely
6.51 - 7.25	Poor	Very substantial pollution likely
7.26 - 10.00	Very poor	Severe organic pollution likely

## Results

Biological water quality in the upper Way Besai catchment (43.000 ha upstream of the Hydro-Powerhouse) is in range excellent to very poor. Water quality in forest area indicate excellent it's mean that no organic material pollution. Air Hitam watershed, with virtually no forest cover and characterized by a lot of monoculture coffee garden indicate the best water quality compared to Way Petai and Way Ringkih.



## Conclusions

- Overall water quality reduces towards the downstream part. At some points however this trend is not confirmed.
- There seems to be a correlation with high FBI and areas with paddy field where pesticides and fertilizers are extensively used.

## Acknowledgment

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