THE DISTURBANCE OF SEDIMENT TRANSPORT BALANCE IN MANGROVE FOREST EAST LAMPUNG, LAMPUNG

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Abstract. Mangrove ecosystem in coastal area of east lampung regency had had serious disturbance. the disturbance of sediment transport balance in the coastal of east lampung regency affected the mangrove ecosystem a lot. This research aimed to determine the disturbance of sediment transport balance and mangrove ecosystem that affected the coastal area of east lampung regency. The result of this research showed the disturbance of sediment transport balance and mangrove ecosystem happened through 3 phases. Phases 1 : abrasion process increased but it had not passed the balanced limit and also the wide of mangrove ecosystem; phase II: the abrasion process was getting increased and passes the balanced limit; phase III: the abrasion process was getting increased passed the mangrove ecosystem limit. The cause of the balanced disturbance was carrying capacity of the coastal area of east lampung had ecosystem disturbance.

Keywords: sediment transport, mangrove, abrasion, coastal, East Lampung.

INTRODUCTION

Coastal area in east lampung regency was one of the places that had many mangrove ecosystems. The condition of the mangrove ecosystem was very fragile with the activities of people and environment (Alongi DM, 2009; Hogarth PJ, 2007; Saenger P, 2002). The mangrove ecosystem in coastal area of east lampung was getting changed. This was more caused by the sediment transport process such as “erosion”, “abrasion”, and “there was no change” in the soil in Coastal area of east lampung. Many researches that had been done related to the mangrove ecosystem in the coastal area of east lampung regency. The researches that related to the mangrove ecosystem in east lampung had been done a lot with the description of abrasion sediment condition in certain year and/or the research that more emphasized the social economy for utilization and management of mangrove ecosystem. But, it could not answer the essence of the real problem happened.so that there were till many questions related to the phenomenon that happened at the change of coastal area in east lampung that must be answered. Later, the answer can be used to manage the better coastal area in future.

The questions included: whether the abrasion process that occured was a natural cycle that had a period of 30 years and/or the abrasion process was caused by the use of coastal areas for economic and development interests that beyond the capability of the coastal carrying capacity of East Lampung Regency (Pariwono JI, 1998).

The natural form factor of the sediment transport was the sea waves. These sea waves appeared due to there was wind waves as we knew that wind generator was caused by: wind speed, fetch length, and wind duration (Army US, 1984). The sea

waves caused the occurrence of sediment tranport. The next question was how to describe the physical characteristics of soil in East Lampung coastal where the process of sediment transport and mangrove ecosystem. This research was expected to answer the questions above by measuring the balance of sediment transport and mangrove ecosystem in changes in coastal area of East Lampung Regency.

MATERIAL AND METHODS

The research location was done in East Lampung coastal included the area of Bukit Barisan National Park up to Labuhan Ratu village. This research was done by making a sediment transport model, which were the occurences of abrasion, sedimentation, balanced, and mangrove ecosystem that occured as well as describing the physical characteristic of soil such as sediment in mangrove ecosystem in the east lampung coastal. The research was done by making a model in a 41 year period started in 1983-2014 which were divided into: from 1973-1982, 1983-1993, 1994-1996, 1997-2003, 2004-2010, 2011-2012, 2013, and september 2014 related to the sediment transport and mangrove ecosystem.

RESULTS AND DISCUSSIONS

Results regarding the wind data. The wind from ERA-Interim reanalysis (Dee DP et al., 2011) data on September 30, 1973-2013 were corrected on September 30, 2017 by using the formula (Army US, 1984) which was done at the point 3 and 4 data stations (Table 1).

Table 1

Correction of wind observation location, East Lampung, 2017

Year / Measurement	30 September 1973- 30 September 2013 (m/s)	30 September 2017 (m/s)
Station 3	2.622	2
Station 4	2.179	2.2

Result regarding the calculation and polygon image mangrove. The calculation of sediment transport model in east Lampung Coastal approached the accurate condition in field. This was because the area of sediment transport calculation model was almost the same as the calculation of the area of mangrove growth polygon in satellite image (Table 2).

Table 2

The Wide of Mangrove Calculation Model and Polygon in Satellite Image East Lampung, 2017

Year / Physical effect	2013	Up to september 2014
Result of mangrove area calculation model (ha)*	544,42	551,98
Result of polygon image mangrove area calculation (ha)**	543,66	551,36

*Calculation result of soil process which had sediment and balance

**Mangrove ecosystem which planted by mangrove due to the existence of sediment transport

At above showed (Table 2) that sediment transport models like sediment, abrasion, balanced, and mangrove ecosystem in this research were valid and rilible, it could be said that the model accuracy was high which meant that the model closed to the facts in the field. The result of mangrove model calculation in 2013 was 544,42 ha while on polygon calculation result on satellite image 543,66. In September 2014 was 551,98 ha whereas on polygon calculation result on satellite image 551,36 ha. The measurement of polygons in satellite image in 2013 and satellite image in September 2014 was used because the satellite image was very clearly visible in the Coastal area of East Lampung Regency starting from Margasari Village to Labuhan Ratu Village (Fig. 1).

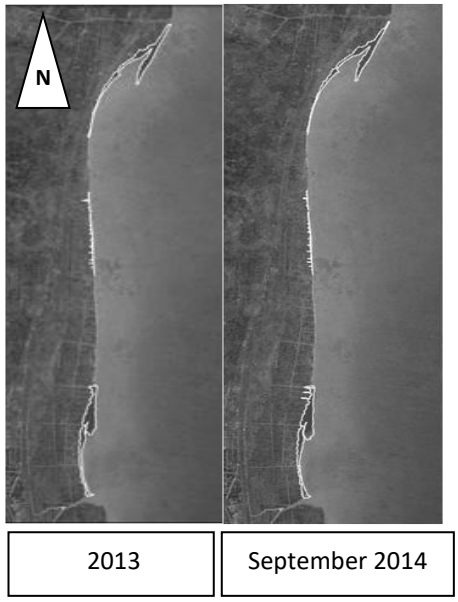

Fig. 1. Polygons of mangrove ecosystem area on satellite image

Measurement of sediment transport model conducted in the East Lampung Coastal divided into regions: Way Kambas National Park (WKNP) and Margasari Village to Labuhan Ratu Village. The image through satellite image showed that the area of WKNP from 1984 to 2014 about sediment transport was not clear. Although, the process of sediment transport existed and occured. This due to the sediment transport was still stable, that was: between the sediment, abrasion, and balanced processes in the area. Sediment transport conditions and mangrove ecosystems on satellite image in coastal areas of WKNP (Fig. 2).

Based on the observation of satellite images of sediment transport disturbances and mangrove ecosystems in 1973-2013 took place in the coastal area of Desa Margasari to Labuhan Ratu Village. Based on the measurement of the calculation model of the area of sediment transport and mangrove ecosystems were getting increased in the Coastal area of East Lampung District, especially that occurred from the Village Margasari to Labuhan Ratu Village. The results of the calculation model

showed the sediment transport and mangrove area occurred from the village of Marga Sari to Labuhan Ratu village (Table 3).

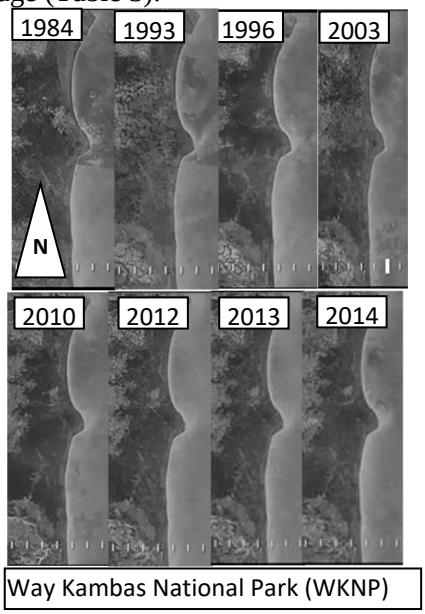

Fig. 2. Sediment transport in coastal area WKNP

Table 3

Calculation model of sediment transport and mangrove ecosystem, East Lampung, 2017

Year / Sediment transport and mangrove ecosystem	1973-1982	1983-1993	1994-1996	1997-2003	2004-2010	2011-2012	2013	2014*
Sediment (ha)	14,72	31,21	35,32	44,83	54,23	57,04	58,39	59,07
Abrasion (ha)	51,90	226,47	301,60	482,49	621,80	661,98	682,19	696,93
Balance (ha)	60,24	197,63	245,50	346,65	443,51	471,24	486,03	492,91
Mangrove area (ha)	74,96	228,84	280,82	391,48	497,74	528,28	544,42	551,98

*calculation result of 2014 only to September

Calculation Model of sediment transport and mangrove ecosystem (Table 3) was illustrated in graphical (fig. 3). calculation model graph of Sediment transport and mangrove area in east Lampung coastal especially in Margasari Village to Labuhan Ratu Village to make pattern improvement. The graphic pattern was an illustration of the imbalance of sediment transport that caused landscape change in Coastal area of East Lampung Regency due to human and natural activities. Based on the graph of the model of sediment transport calculation showed that starting in 1993 there was an increase of abrasion process that beyond the balanced process and mangrove area. The increase continues until 2014 (fig. 3).

In early 1973 the condition of East Lampung Coastal starting from Margasari Village to Labuhan Ratu Village on the process of sediment transport and mangrove ecosystem was still stable and run naturally there had been no disturbance of balance in coastal areas. According to one of the resident information started in the 1970s people began to open mangrove forests to be used as ponds (Pariwono IJ, 1998). The forest opening that people did triggered a higher rate of abrasion process than in previous years in the graphic image of sediment transport model beginning in 1976. This was the beginning of phase I disturbance. According to research results that there was a close relationship related to band wide structure of mangrove trees influenced by height, density and canopy cover to minimize sea wave height causing abrasion process and trapping of sediment (Bao TQ, 2011).

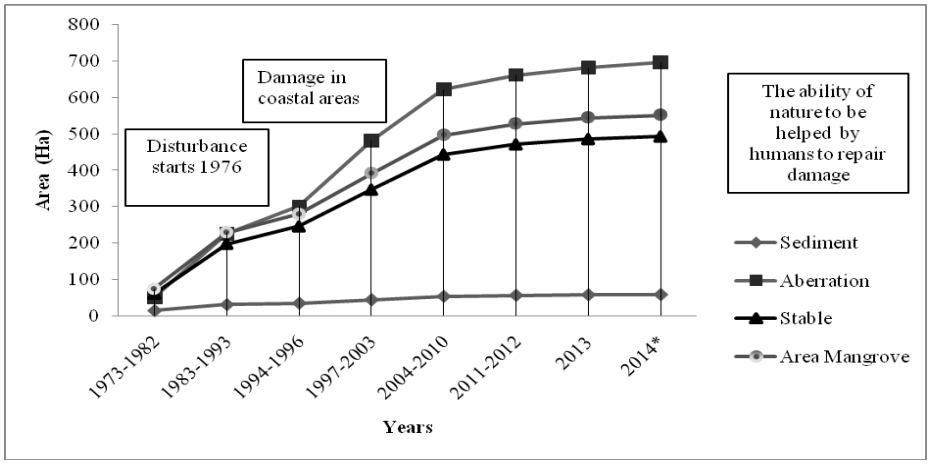

Fig. 3. Calculation model graph of sediment transport increase and area of mangrove ecosystem

Activities of people who were on the coastal, especially from the Village Margasari to Labuhan Ratu got to increase and intensive (Pariwono IJ, 1998) based on the resident information that the levee on the edge began to be damaged in the 1980s due to the process of abrasion. Based on the graphic images of the model of sediment transport calculation, this occurence started in 1983 and in the same phase there was an increase of abrasion back in 1988. In the first phase of 1983 to 1988 the carrying capacity of the coastal from Margasari Village to Labuhan Ratu Village was able to help the rate of damage. This was because the area of mangrove ecosystem and balanced process was still greater than the abrasion process that occurred.

CONCLUSIONS

Human and natural activities on the coastal area of East Lampung Regency occurred in Margasari Village to Labuhan Ratu Village that influenced the process of soil landscape through sediment, abrasion, balance, and mangrove growth. The sediment transport was influenced by natural factors: wind direction, effective fetch, wind stress factor, significant wave height, wave period which limited by effective

fetch, coastal slope, soil particle size, and refraction angle. Based on the results of the research showed that the cause of the increase of abrasion process was not a natural cycle that had a 30 year period. But due to the utilization of coastal areas for economic and development interests that beyond the capability of carrying capacity of East Lampung coastal by proven the occurrence of sediment transport that began to had balance disturbance from the Village Margasari to Labuhan Ratu Village and the continuous increase in the difference between the process of abrasion and balance process starting from 1976 to 2010. Nevertheless nature helped by humans provided the ability to balance the occurrence of abrasion process through the mangroves growth in soils that had a process of sedimentation and balance.

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