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The Economy and Environment Program for Southeast Asia (EEPSEA) was established in May 1993 to support training and research in environmental and resource economics across its 9 member countries: Cambodia, China, Indonesia, Laos, Malaysia, Papua New Guinea, the Philippines, Thailand, and Viet Nam. Its goal is to strengthen local capacity for the economic analysis of environmental problems so that researchers can provide sound advice to policymakers.

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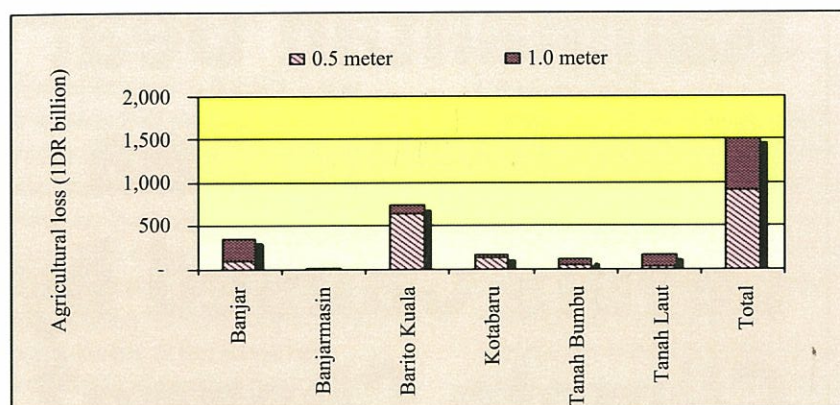
Protect or Retreat – How Should Kalimantan Deal With Rising Sea Levels Caused by Climate Change?

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Many scientists think that a rise in sea levels caused by global warming will be one of the key future environmental challenges facing many low-lying coastal regions. In Indonesia, there is considerable concern about the impact this problem will have on large areas of reclaimed coastal swampland in South Kalimantan. It is thought that over 150,000 ha of this land, which is →

**A summary of EEPSEA research report, 2009-RR1 'Sea Level Rise in South Kalimantan, Indonesia — An Economic Analysis of Adaptation Strategies in Agriculture' by Akhmad R. Saidy and Yusuf Azis, Faculty of Agriculture Lambung Mangkurat University and Environmental Research Centre, Lambung Mangkurat University, Kampus Unlam Simpang Empat, Jalan Ahmad Yani KM 36 Banjarbaru 70714, Indonesia.
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“farm-dike establishment is a more ...



Projected net losses in agricultural production due to SLR in South Kalimantan Province

→ currently being farmed for rice and other food crops, are at risk, and that this will jeopardize the livelihoods of many thousands of farmers and their communities.

To help decide what the best response to this unfolding crisis is, Akhmad Saidy and Yusuf Azis from Lambung Mangkurat University looked at different strategies that the government could take to respond to the problem. Their study focuses on the province of South Kalimantan which is already experiencing salination of its freshwater due to rises in sea level, especially during the dry season. The study finds that building dikes to protect farmland is the most cost-effective response. It finds that this approach would cost society less than doing nothing and that it is a better option from an economic point of view than relocating farmers to new farmland at a higher altitude.

The Challenge of Rising Sea Levels

Reclamation of costal swampland in Indonesia began when the Indonesian government introduced the Tidal Swampland Development Project. This was done in order to achieve rice self-sufficiency. Twenty-five years of swamp development has resulted in 89,036 ha of swampland being reclaimed for agriculture in the province of South Kalimantan. The three areas in the province where this work has been carried out are the regencies of Kabupaten Tanah Laut, Kabupaten Banjar, and Kabupaten Barito Kuala. The most common agricultural crop that is grown on this land is rice and it plays a significant role in food production in the province: rice production from the reclaimed swampland accounts for over 38% of the total rice production in South Kalimantan.

Satellite data indicates that climate change will cause a mean sea level rise of 15 mm per year in the Java Sea, which lies between

Southern Kalimantan and Java. Several measures could be taken to reduce the risk of loss of life, or damage to property and land that this sea level rise would cause. Proposals to maintain the economic and environmental viability of coastal areas include using hard structures such as dikes and sea walls. An alternative option is to abandon the reclaimed land to the sea and to establish new agricultural areas inland which would not be affected by any rise in sea levels.

How Best to Adapt to Sea Level Rise

Saidy and Azis set out to see which adaptation strategy would make the most economic sense. To do this they assessed the costs and benefits of both options – building dikes and relocating farmers by establishing new agricultural lands. To help make this comparison, geographic information system software was employed to determine the total agricultural area that will be affected by sea level rise. This estimate was based on the prediction that there will be a sea level rise of 0.5 m in the study area in 2039, and that a 1.0-m sea-level rise will occur in 2072.

The study started by finding out how much the people who farm reclaimed coastal areas know about the issue of climate change and the sea-level rises it may cause. An assessment was also made to see the effect a rise in sea level would have on their farmland and other assets and to see what they would like to be done about it. A household survey was used to get the views and

economically viable adaptation strategy.”

opinions of farmers.

The survey was carried out in three regencies: Barito Kuala, Tanah Laut, Banjar. During the interview, the interviewers showed farmers photos and discussed what sea level rises might occur and why it might happen. This survey was a vital part of the study, as the farmers' understanding of the climate change issue will help shape the implementation of any adaptation strategies.

Looking at the Impact of Sea Level Rise

Estimates of the potential agricultural loss due to a rise in sea level were made by identifying the type, productivity and level of agricultural activity in the areas that would be affected.

To assess the costs and benefit of establishing farm dikes it was assumed that dike construction would be carried out for all the impacted agricultural areas and that their construction would take place in five-year stages. Costs were estimated by assessing the expenditure that would be incurred by the project. This expenditure would include construction, installation, and maintenance costs.

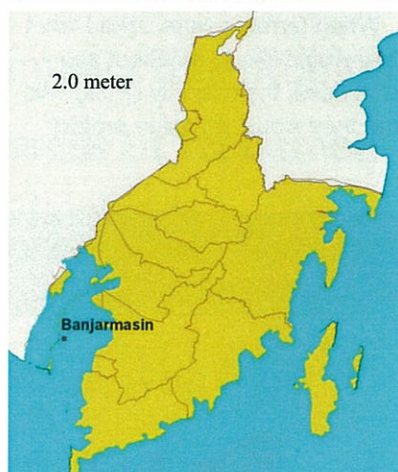
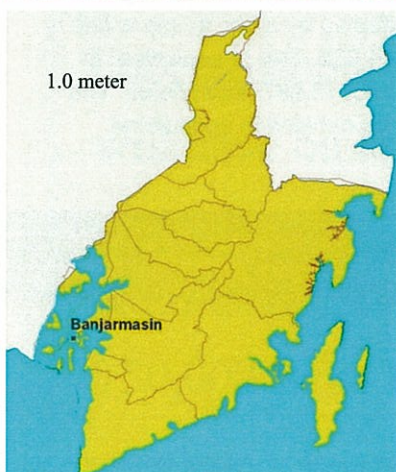
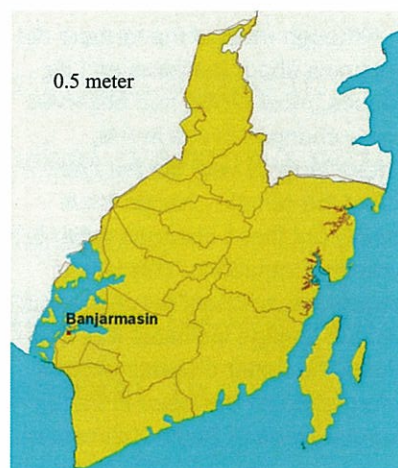
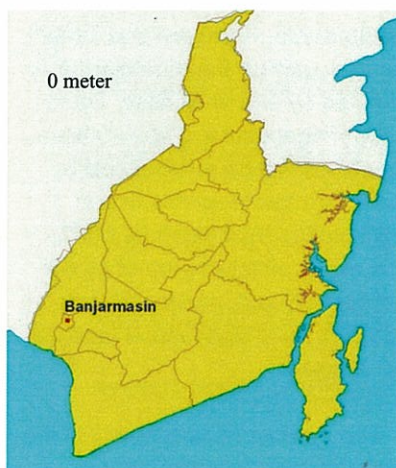
The benefits that would result from the construction of the dikes were estimated by assessing how much income farmers would have lost had the dikes not been built. It was also noted that dikes would bring enhanced productivity to some farms.

Assessing Costs and Benefits

A cost benefit analysis was used to assess the economic viability of relocating farm households that would be affected by sea level rise and opening up new farm lands. It was assumed that the total area of the new agricultural areas to which people would be moved would be equal to the agricultural areas that would be affected by a rise in sea level. It was also assumed that the relocation would be conducted in

several stages. The assessment was based on the assumption that each household would receive two hectares of agricultural land, and that 7,500 households would be moved every five years.

As with dike construction, the benefits of the relocation option were estimated by looking at the loss in income that the relocated farmers would avoid. The returns from the farms in the new sites and the residual values of the dikes were also assessed. The



Inundation zone in South Kalimantan Province for different SLR scenarios

costs of the establishment of new agricultural areas were estimated by looking at how much it would cost to construct new houses, transport people to the new agricultural areas, and cultivate new agricultural areas.

Awareness Levels Low

It is clear that most of the farmers in the province are not aware of the impact a rise in sea levels will have on their agricultural lands. Only 35% knew about climate change and its impact on sea levels. Most of the farmers who were aware of the issue had obtained information from the mass media (newspapers and television), while others had obtained information from neighbors, extension officers and other sources.

Although most of the farmers did not know about the issue and its causes, most (75%) had observed some changes in sea levels. Those farmers who did not know about the climate change issue mainly put these changes down to seasonal variations. This lack of knowledge amongst farmers about climate change indicates that there should be better dissemination of information on the issue in the coastal areas of South Kalimantan.

When farmers were asked what they would like to do about sea level rises, the majority (71%) said that they would prefer to protect

their rice fields. Only a small percentage would choose to introduce a new rice variety, convert rice fields to fish/shrimp ponds, or relocate to new rice lands.

Impacts of Rising Sea Levels High

Out of the 13 regencies in South Kalimantan Province, six coastal regencies have agricultural areas that will be impacted by sea level rises. At the provincial level, 36% of the agricultural land in South Kalimantan Province will be affected by a sea level rise of one meter. It was found that rice fields, fish/shrimp ponds, fruit farming, and animal husbandry would be the key agricultural activities that would be damaged.

Four regencies - Banjarmasin, Barito Kuala, Kotabaru and Tanah Bumbu - will be the most seriously affected by sea level rises. Up to 60% of agricultural areas in these regencies will be encroached by the 1.0-m sea level rise that is predicted to take place by 2072. The worst affected area of all will be Barito Kuala, where 68% of 121,522 ha of agricultural land will be affected.

The number of inhabitants in the areas that are expected to be affected by a rise in sea levels is 394,935. This is equivalent to about 78,987 households. The total net loss in agricultural

production in South Kalimantan will total IDR 910.65 billion when the sea has risen by half a metre and IDR 1,506.42 billion when the sea has risen by a metre.

The Incremental Benefits of the Farm-dike Establishment Project

When the costs and benefits of the two main options for responding to sea level rises were assessed, one emerged a clear economic winner. The total benefit of building farm dikes was estimated at IDR 50,449.65 billion. The benefits of relocating farmers to new agricultural areas only totaled IDR 17,306.60 billion. On the other side of the economic balance sheet, the total costs of building dikes totaled IDR 355.58 billion. The cost of establishing new agricultural areas and relocating farmers was minus IDR 18,717.29 billion.

All in all, the farm-dike project would produce a higher net present value (NPV) of benefits than the relocation project. The NPV is positive at all discount rates (worth IDR2.65 billion at 8% discount rate) whereas the relocation project has negative NPVs. A project to build farm-dikes is thus an economically viable adaptation strategy to rising sea levels and that the government should give serious consideration to its implementation.

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