Annex E. Feature stories from the project for promotion

1. LAND MANAGEMENT OF UPPER SOLO WATERSHED: STARTING FROM THE SMALL TO THE MORE COMPREHENSIVE ACTION

By: Nining Wahyuningrum

As the world's population increases and the demand for food and other agricultural commodities grows, it is inevitable that more demands will be placed on land which is marginal for agriculture. Much of the world's marginal land is on medium to steep slopes and is very prone to water erosion. Not only are farmers' yields declining, but erosion from the sloping areas is causing serious problems downstream, including the silting up of streams and dams, damage to hydro-electric and irrigation schemes, and an increased frequency and severity of flooding. The causes of these problems should be understood widely by politicians, administrators and, to some extent, the public in general including farmers. These stakeholders are responsible for the impact caused by erosion in accordance with their roles.

There are various reasons for the failure of soil conservation schemes, but one of the most important reasons is the lack of understanding by the planners of the basic processes of soil erosion and the principles of its control and prevention. The basic process of soil erosion is that raindrops falling on a bare soil break down the structure of the surface soil and detach particles. If the land is sloping and the water cannot be immediately absorbed by the soil, or detained by the micro topography, the water moves down the slope in the form of run-off, carrying dislodged particles with it. The basic factors affecting water erosion are the erodibility of the soil, the erosivity of the rainfall, the slope of the land and the type of land use. The first and the second factors are given factors while the third and the fourth factors can be manipulated or managed. Soil conservations are normally managing these two factors, slope and landuse.

Soil conservation measures are usually described under the two convenient methods i.e. biological measures and physical or mechanical measures. In practice, there are commonly applied both types of measures. The basic principle of biological measures is that vegetation is used, alive or dead, in sufficient amount to cover the soil surface from the detachment force of raindrops and to create a uneven surface which will physically prevent run-off and slow down its erosive velocities. Mechanical conservation works to prevent the effect of raindrop impact, slow down, partially or entirely, the movement of run-off, so that the infiltration rate is increased and the velocity of run-off is decreased.

Problems in The Upstream Bengawan Solo River Basin

Preliminary studies have been conducted, including the identification of issues/problems in the main study area, which is located in Naruan micro-watershed, upstream part of Bengawan Solo river basin. The main issue in the study area is soil erosion, which contributes to the high rate of sedimentation in the Multipurpose Reservoir of Gajah Mungkur (MRGM), located in the downstream. The issue has become a national issue, because the reservoir MRGM has a strategic function as a flood control in the Upper Solo watershed, as suppliers of agricultural water in many districts downstream, and as electricity power plant.

The Naruan micro-catchment is naturally prone to erosion hazard. It can be seen from the Figure 1, of the 957 ha more than 50% area are occupied by steep slope (>25^0). In addition, this condition is compounded

by rainfall intensity (1963 mm/year) and its three-days daily cumulative rainfall (201-300 mm). By USLE model, it is predicted that 33% area are potentially to encounter the extremely heavy erosion (>480 ton/ha/year). The erosion problems are mainly from the agriculture area. Figure 2 shows the water flow from settlement (a) and from agriculture area (b). The picture (a) and (b) were taken simultaneously soon after rain with moderate intensity down for approximately one hour. Water from agriculture area has a thicker color contained more sediment resulted from soil detachment and displacement.

Land capability assessment showed that 56% of the area was classified into VIg class and 42% into VIIg class with gradient as limitation. These classes are normally not suitable for seasonal crops, but for agroforestry or undisturbed forest instead. In contrast, it was found that dominant landuse in the area is dry land cultivated by cassava, maize and ginger while the woody plant normally planted along the land boundary. This actual fact may accelerate soil erosion occurrence although traditional soil conservation has been applied. Figure 3 shows strip cropping pattern with furrows, grass barriers in the waterways while Figure 4 shows land preparation stage which are prone to erosion hazard.

Figure 1. The overview of the Naruan micro-catchment
(Photo by: Nining Wahyuningrum)

(a) (b)

Figure 2. Water flow from settlement (a), from agriculture area (b)
(Photo by: Nining Wahyuningrum)

Since each unit of land has its own particular characteristics or capabilities limitations therefore landuse arrangement should fall within the capabilities of the particular unit. If this is done properly, it may lead to the optimum and sustainable production. To introduce appropriate landuse, it may require people displacement from the steep slopes to the area that relatively flat or landuse change to the type of landuse system which are less intensive or at least which are compatible with the capabilities of the land. This may cause problems. For political, social and economic reasons, it may not be possible to move the people. Moreover, more suitable land may not be available or people are generally reluctant to move from their established homes, families and communities.

There may be a number of reasons why changes in land use are difficult. Where commercial agriculture is being practiced, farmers are growing certain crops because of the pricing structure and are unlikely to change unless it can be clearly demonstrated that the growing of other crops can be at least as financially attractive. In the case of most sloping land, the need to grow seasonal crops to meet the immediate needs of the family is the farmer's primary concern. In such cases, a compromise is needed in determining the cultivation pattern. Cultivations patterns that financially benefits the farmers and also ensures the sustainability of the land may become the best solution.

Figure 3. Pattern applied in the area: strip cropping with furrows, grass barriers in the waterways (Photo by: Nining Wahyuningrum)

Figure 4. Land preparation for seasonal crops: erosion prone period (Photo by: Nining Wahyuningrum)

Finding The Most Profitable Solution

Based on preliminary studies, participatory management plans for the area have already been arranged including plan draft contains the indicative area that should be rehabilitated as well as community development plans and coordination mechanism between the parties. Based on this, the action to overcome the degradation process can be executed. The key of the action is participation.

Participation is the active engagement of people in decision-making processes. It is about communities having access and control over common resources and about giving voice to those who are disadvantaged and excluded. It is also about the right to engage in these processes. Not only the farmers but also the entire stakeholders involved should take part in the action. Because the arranged plan has already considered the interests of many parties, it is expected all parties may contribute during implementation based on their function.

The activity should be start within plot since, the limitation of the resource. Plot by plot could be made until all degraded land in micro-catchment resolved. This happen if the built plots are able to achieve the financial and environmental goal. Conservation agriculture with minimal soil disturbance, year-round land cover, and crop rotations, is being promoted in improving the efficiency of water-use, reducing soil erosion, and increasing crop production. Cropping pattern that can meet this goal is agro-forestry that combines seasonal crops and perennial trees.

At the research area, it has been applied seasonal crops and timber plants, but the applied cropping pattern has not fulfilled the purpose of conservation, because permanent vegetation is generally only applied in the boundary of land tenure. Thus there are stages of land preparation for annual crops, which is so vulnerable to rain water splashing as shown in Figure 4. The pattern design is made to encounter this problem. The applied pattern is to combine the timber plants with seasonal crops, timber plants not only planted in the boundary alone but throughout the field with the appropriate spacing. The selected plants are in line with the landowners' interest.

The success of the activity can be monitored from the aspects of land productivity, erosion control and sedimentation, and hydrology. In addition, social and institutional aspects are managed to ensure the sustainability and development of activities to a wider location. The success of managing this micro-catchment may become the good example to the other micro-catchments.

2. MULTI STAKEHOLDERS PARTICIPATION ON MICRO WATERSHED MANAGEMENT

By: Dewi Retna Indrawati

Taking into account the critical condition of the Solo watershed and looking back at the efforts that have been made to improve its condition, a question arises: Why are efforts to improve the condition of the Solo watershed have not shown real results? Is there anything wrong with the management?

It cannot be denied that the Solo Watershed covers a large area (1.6 million hectares) and across administrative boundaries. In addition, in the Solo Watershed there are a lot of resources utilization involving many parties. Therefore, efforts to improve the Solo Watershed can't only be done by a single sector or party, it needs to be done in an integrated manner by all those who manage and utilize the resources in the Solo Watershed. Unfortunately it's almost never done. Each party undertakes its activities without paying attention to the framework of watershed conservation.

In relation to the Solo Watershed Management, BPDASHL Solo has developed a plan for the management of Solo Watershed, but the scope is too wide because it encompasses the entire Solo Watershed and the parties has not been involve in its implementation. As a result, the activities of BPDASHL Solo and the parties are only done partially at different spots, so it does not have a real impact on improving the condition of Solo Watershed.

In Naruan Micro Watershed management, there is an interesting phenomenon where watershed management uses a micro-scale watershed approach and involves the parties in its implementation. There are several advantages of using this micro-scale watershed approach that is to ease the coordination of the parties to conduct integrated management, community participation in activities, also monitoring and

evaluation of its success.

The involvement of stakeholders begun with an effort to synchronize the perception of stakeholders on the importance of integrated watershed management. Subsequently, the stakeholders were informed of the management plan of the Naruan micro catchment, which was developed participatively with the community, and stakeholders were asked to commit and support the implementation of the activities. The effort is considered as an effort of offering or marketing the planning to stakeholders.

(a)

(b)

Figure 1. Stakeholders' FGD in each district (a) Karanganyar; (b) Wonogiri

That effort was successful, because there were several parties involved in the implementation of activities. Jasa Tirta I has provided seedlings of perennial crops such as sengon, suren, alpokat and kopi for Bubakan Village, while PDAM Giritirtasari provided seedlings of perennial crops for the conservation of springs in Bubakan Village. Besides these two agencies, there are several institutions that commit to engage in the implementation of activities in the form of extension, conservation and livestock. It shows that offering or marketing the planning to stakeholders is an appropriate breakthrough to engage stakeholders in integrated watershed management.

3. THE POTENCY OF HOUSEHOLD ECONOMIC BASED ON LOCAL RESOURCES IN NARUAN MICRO CATCHMENT

By: Purwanto

From economic aspect, Naruan Micro Catchment has comparative advantages than other locations. In terms of potential natural resource: the soil is very fertile with top soil more than 30 cm, solum of more than 1 meter, and Lawu Vulcan as its parent material. Rainfall in the Naruan Micro Catchment is 2,405 mm per year (observations in 2016-2018) with significant differences between the rainy season and the dry season, so this area is suitable to be developed into upland dry land agriculture.

In terms of human resources, 72% of FPs have experience of seasonal migration and some of them are still do so until now. They generally sell meat ball, noodles and traditional herbal medicine. During seasonal migration, they have enough experience and income, so they can participate in developing infrastructure in their village.

FP sources of income are from annual crops (28.1%), timber (24.6%), livestock (20.8%), trade (14.3%), and salaries and other sources (12.1%). Seasonal crops, timber, and livestock are the three main sources of FP's income, so agroforestry and silvo-pasture systems is potentially to be developed in those areas.

In this agroforestry pattern, plant species that have economic value and is suitable for planting in the Naruan Micro Catchment is albizia (*Paraserianthes falcataria*). The plant can be harvested after 6 years. Based on the farmer's experience, if albizia is planted in monoculture pattern, the harvest volume is more or less 1.3 m3 / tree. Market opportunities for the timber are also promising because there are many tradesmen who buy timber from the community. In addition, there are wood processing and plywood industries in Sukoharjo District which are between 20-50 km from the Naruan Micro Catchment.

Besides timber, community in the Naruan Micro Catchment also want to plant fruit especially avocados and durians. The growing culinary business influences the increasing demand for fruits. The results of the interview indicated that at harvest time, the sale of avocados was Rp. 1,500,000 per tree. To increase the value of avocados, post-harvest processing needs to be done.

Another potency of economic that can be developed is livestock. The survey results state that income from livestock is the third biggest source of income after annual crops and timber. Income from livestock is Rp. 4,268,000 per year. The average livestock ownership in the Naruan Micro Catchment is presented in Table 1. This is also supported by abundant animal feed. Farmers have planted various types of plants that can be used as sources of animal feed. However, integrated farms have not been developed in these areas. Training on making organic fertilizer and pesticide by the APFNet Research Team, and comparative studies are efforts to encourage the development of integrated livestock business. Excursion to Sukorejo and Banyuanyar Village (Boyolali District) and Mundu Village (Klaten District) is an effort to encourage the community to integrate land conservation, livestock, post-harvest processing and their associated efforts.

Table 1. Description of development of livestock in the Naruan Micro Catchment

Village	Livestock ownership per person		Animal feed	
	Cow	Goat	Source	Condition
Wonokeling	2	5	own land	Adequate - abundant
Wonorejo	1	5	own land	Adequate
Bubakan	2	2	own land	Adequate

Source: Primary data, 2018