Evaluating Ecological Resilience under Various Agro-Ecosystems
- Progress Report for Sub-theme 1-2 -

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Abstract

To evaluate soil capability of arable land and coping behavior of local people in relating to social-ecological resilience under various agro-ecosystems, field experiments were conducted in five villages, which were Sianemba, Siameja, Chanzika, Kanego and Siachaya village, in 2007. These villages are located under different topographic and agro-climatic conditions - between lower and upper flats in the Southern Province. Details of each plot are referred to in the FY2007 FR1 Project Report. In this report, we explain to the results of field experiments.

1. Experimental Plots and Measurement Methods

1-1. Topographic Positions

ASn1, ASm1 and ASm2 are situated from the highest to the lowest in that respective order. BCh1 is located in the middle of a gentle slope and BCh2 is at the foot of the slope near a stream. BKa1 is located at the flat top of a slope and BKa2 at the middle of a steep slope. At Site C, four plots were selected in a catchment; CSa1, CSa2, CSa3, and CSa4 are located at the flat top, the upper to middle slope, the lower slope and the bottom end of a shallow valley, respectively.

1-2. Plot Design

The approximate dimensions of a plot were 20 x 20 m^2. Maize, planted in all 11 plots, are the medium maturing local variety known as *Jileile* among Tonga people. Each plot had a cultivation density of about 31,500 maize plants per ha.

1-3. Measurement Methods

Within one plot, 12 smaller sub-plots were allocated for the measurement of aboveground biomass and grain yields (Fig.1). The dimension of each sub-plot was 4 x 4 m^2. In the sub-plot, aboveground biomass was measured directly by the sum of the weights of grain, cob, stems and leaves from each maize plant. Grain yield was also measured by the weight of grain. All standing maize in the sub-plot was used for the biomass measurements. Aboveground biomass per hectare and yield biomass per hectare were estimated by the value of 12 sub-plots.

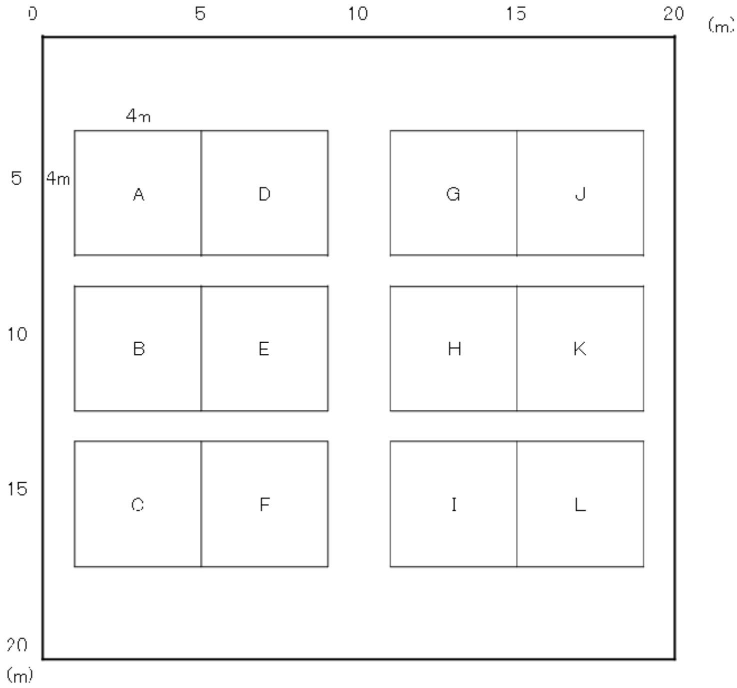


Fig. 1 Plot Design

Sub-plots from A to L were allocated for the measurements. The approximate dimension of the overall plot is 20 x 20 m^2; the small plots are about 4 x 4 m^2.

2. Results and Discussion

2-1. Precipitation in the 2007-2008

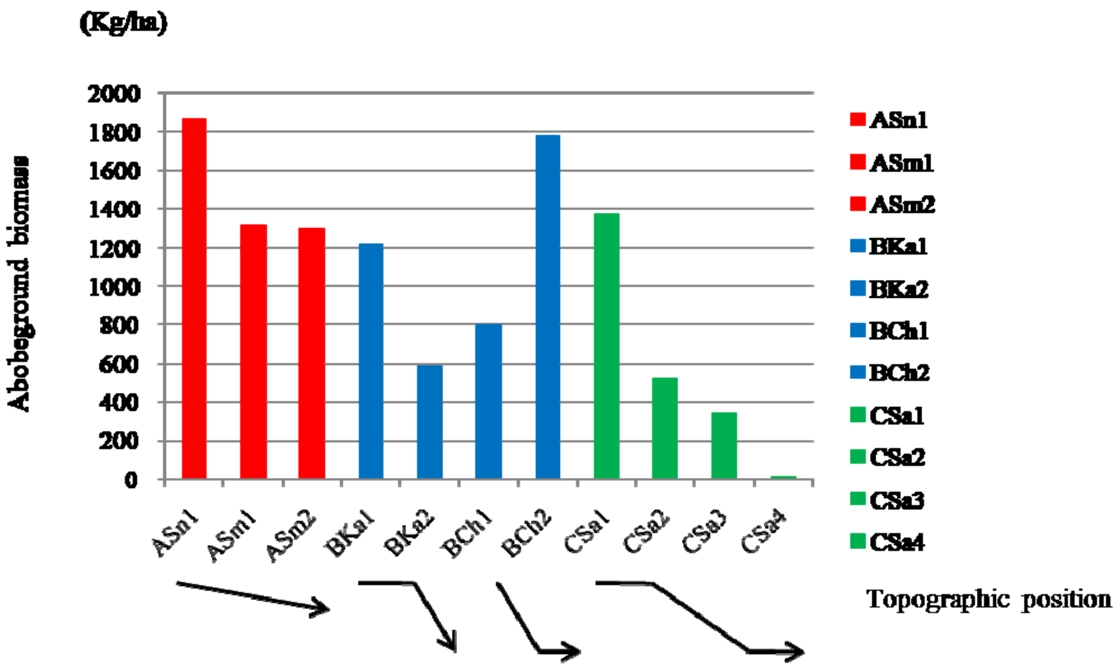
Total precipitation at Site A, B and C in 2007-2008 rainy season were 1600 mm, 1586 mm and 1426 mm, respectively (Kanno and Saeki, 2008). These values are considered high in comparison with the mean annual precipitation in this area which is less than 800 mm.

Many fields were damaged by flooding and excess wetting caused by heavy rain (Fig2). According to all participating households interviewed, about 34% of their cultivated fields in the five villages were found to have been damaged.

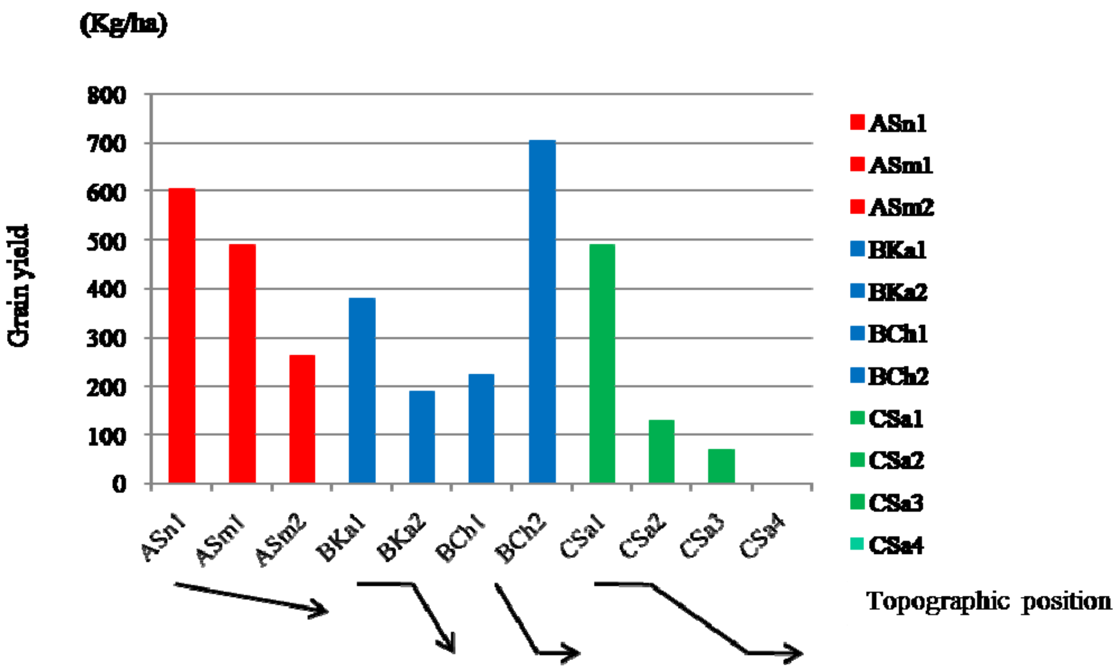
Fig. 2 Damaged Field by Heavy Rains

2-2. Maize Production

Figure 3 shows the aboveground biomass and the grain yield at each plot. As the topographic position became lower, the aboveground biomass and Grain yield decreased except for BCh1 and BCh2. As noted above, this decrease can be ascribed to the damage from flooding and excess wetting caused by heavy rain in the low land areas.



a) Aboveground biomass



b) Grain yield

Fig. 3 Aboveground Biomass and Grain Yield of Each Plot

2-3. Resilience Coping Behaviors

Many farmers converted their rain damaged fields from maize to sweet potato or beans. They planted maize and other plants on fields that could support growth in the dry season from residual water in the soil.

Vulnerability to ecological problem such as floods and droughts is controlled by environmental factors such as geographical features and soil properties. Therefore, to ascertain the land use responses by farmers to ecological problem, it is important to evaluate the environmental agents at the household level. To understand their coping strategies to accommodate climate variations, crop allocation maps for all households were made using GPS measurements. See page 101-107, Accumulating multi-spatial and temporal data to understand people's livelihoods at the village level, for the details of the crop allocation maps.

For adjusting or avoiding the ecological problem and social problem, there should be various coping behaviors, i.e., preventive, avoidance, buffer, cancellation, restoration and those combinations. In addition, the farmer's behavior for those problems would be observed differently, caused by a spatial scale (field, village and area), a social scale (individual, household, clan and community) and a time scale (week, month, season, year and several years). Even an applied technical option would also affect their behavior. The above case in our study would be a coping behavior under the household scale and the short-term scale.

Reference

Kanno and Saeki, 2008: Analysis of Meteorological Measurement Made Over the Rainy Season 2007/2008 in Sinazongwe District, Zambia FY2008 FR2 Project Report, Research Institute of Humanity and Nature