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# The Effect of Sustainable Livelihood Assets on the Soil and Water Conservation Level Adoption In Sumber Brantas Village, Indonesia

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**Abstract.** SWC plays an important role in addressing environmental problems. This research is located in Sumber Brantas Village which is a watershed of Brantas river and has potential as farming land for horticultural crops, especially vegetables besides horticultural crops also have productivity figures that consistently always go up, agricultural land in Sumber Brantas Village is 60% mostly sloping land with steep slopes more than 30 degrees which is recommended to implement conservation farming to preserve the environment. This study aims to analyze the influence of livelihood assets on the level of SWC adoption. This research was conducted from December 2022 to February 2024 and used 86 horticulture farmers as a sample calculated by slovin formula and simple random sampling method. This research method used is Tobit regression or often referred to as censored regression; this is because the dependent variable has an upper limit and a lower limit, the software used in this study is Stata 14. The results of this study show that natural capital, social capital, financial capital and physical capital significantly influence the level of adoption of soil and water conservation farming systems.

**Keywords**: livelihood assets; soil and water conservation; Tobit regression

## INTRODUCTION

Excessive human activities on agricultural land can cause a decrease in soil quality or often also called soil *degradation* so that various disasters such as landslides and soil movement or soil *creep* can occur. Thus, to prevent the destruction of land resources, a policy to adopt soil and water conservation farming systems is needed (Hafif, 2019). Having the same opinion, Yuniti et al., (2022) said that community activities that cause forest land to be damaged, conversion to agriculture and tourism activities in upstream areas can cause sedimentation in downstream areas and the pattern of agriculture that does not follow the conservation method in the upstream watershed area with commodity crops and horticulture results in the downstream part of the watershed narrowing and shallowing of the river flow shallowing of the river flow. Conservation agriculture practice has potential for benchmarking the conserving of water in agriculture and improving soil health, crop productivity and ensuring agricultural sustainability (Rahman et al., 2024)

Soil conservation is the placement of each land parcel in a use that is by the capabilities of the land and treats it following the necessary conditions so that land damage does not occur so that it can support life sustainably or sustainably, meanwhile water conservation, the other hand, is the efficient use of rainwater that falls on the ground for agricultural use and the timing of flow to avoid destructive flooding and to have enough water during the dry season. Of course, this aims to create sustainability because it is managed sustainably (Arsyad, 2010). Based on the Law of the Republic of Indonesia Number 37 of 2014 concerning Soil and Water Conservation, the implementation of soil and water conservation must be based on the principles of Participation, Integrity, Balance, Justice, Benefit, Local Wisdom, and Sustainability. Soil and water conservation plays an important role in the agricultural production system, soil and water conservation can also overcome problems or challenges to the environment. (Qanti et al., 2023).

Conservation Agriculture practices have also been shown to have the potential to increase agricultural yields, improve livelihoods, and contribute to the conservation of natural resources (Ngaiwi et al., 2023). It has also been proven by research conducted by (Rotich et al., 2024) who found

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that by increasing the adoption of soil and water conservation agriculture livelihoods are improved and can contribute to increased food security as well as rural development in the areas where his research took place. In addition, implementing soil and water conservation systems can also increase farmers' income indicate that compared to non-adopters, the profits are 35 % higher for the adopters (Dayakar & Kavi Kumar, 2024)

However, the level of adoption of soil and water conservation farming systems is influenced by several factors including knowledge, income, ease of accessing information, environmental awareness, and land area (Prokopy et al., 2019). Soil and water conservation farming systems in watersheds are also influenced by the age of the household head, land size, household size, and training and extension services (Belayneh, 2023). To adopt soil and water conservation farming systems, the above capitals are needed, which have been summarized into five main capitals namely human capital, natural capital, social capital, financial capital, and physical capital often also called *livelihood assets.* Everyone must have these five assets to create a better home environment (Xu et al., 2023).

The horticulture sub-sector holds an important role and occupies a strategic position in the development of the agricultural sector (Kasmin et al., 2023). The decline in fruit and vegetable production is most likely due to the short planting period and is mainly caused by reduced water supply, not only a decrease in production the lack of water supply can also affect the growth and development of horticultural crops, so to be able to increase production it must survive the shocks that exist (Malhotra, 2017). Reduced water means it requires conservation treatment. In addition, the place that became the research location, namely Sumber Brantas Village, is the Brantas River Watershed. Where, watersheds must be managed with a conservation system to prevent environmental degradation (Izzati et al., 2021), (Wijayanto et al., 2021). Also, watershed management must consider and prioritize aspects of sustainability, which is the principle of conservation (Andes Putra et al., 2019).

The purpose of this study is to analyze the effect of livelihood assets on the level of adoption of soil and water conservation agriculture systems. This objective departs from the statements above where the adoption of soil and water conservation farming systems is needed.

## METHODS

### Time and Place of Research

This research was conducted in Sumber Brantas Village, Bumiaji District, Batu City. Geographically, Sumber Brantas village is located in the North with Forest/Mojokerto, South with Forest / Tulungrejo Village, East with Mount Arjuna, and West with Anjasmoro Mountain Forest area and Jombang district (**Figure 1**).

Determination of the research location is done intentionally *(*purposive) based on the consideration that Sumber Brantas Village has the potential as farming land for horticultural crops, especially vegetables which are the target in this study besides horticultural crops also have productivity figures that consistently always go up, agricultural land in Sumber Brantas Village is 60% mostly sloping land with steep slopes more than 30 degrees (Suhartini et al., 2024). Sumber Brantas Village is also a Brantas Watershed which is recommended to implement conservation farming to preserve the environment. This research is included in quantitative research with a descriptive approach and was conducted in December 2023-January 2024.

### Research Techniques and Tools

The sampling approach in this study is a probability sampling approach using a simple random sampling technique. The population in this study were horticultural farmers in Sumber Brantas Village totaling 866 people.

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The sample size was determined using the Slovin formula with an error rate of 10% and the sample obtained was 86 horticultural farmers with different genders.The data collected in this study are primary data and secondary data. Primary data in a study is obtained directly from the source by taking measurements, and counting itself in the form of questionnaires, observations and interviews, in other words, primary data is data obtained directly from research respondents (Dewi et al., 2021), while secondary data is obtained from previous studies and relevant agencies (Central Berau of Statistic) such as demographic, social and economic data of the research site.

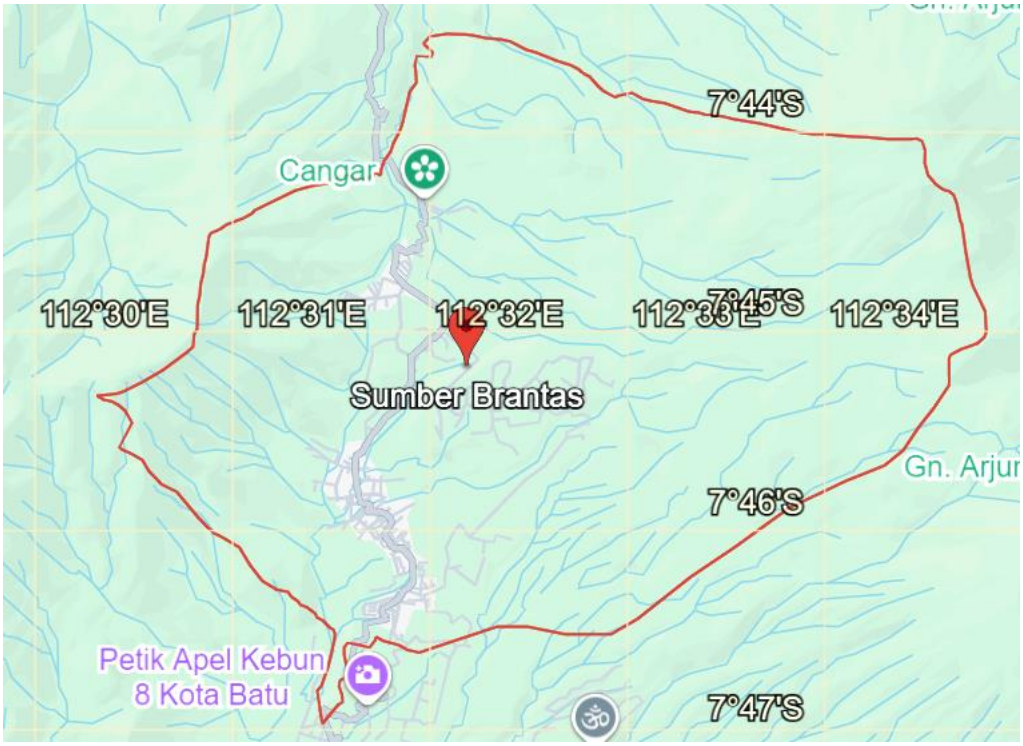


**Figure1**. Map of research location

**Tobit Regression Analysis**

Tobit regression is one of the econometric techniques that is often also called censored regression where censored means that the dependent variable has a limiter, tobit regression is also often used in management and economic research (Amore & Murtinu, 2021). To analyze the influence of Sustainable Livelihood Assetson the level of adoption of soil and water conservation farming systems in Sumber Brantas Village, Stata.14 *software* was used The regression model is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon \text{.....(1)}$$

Description:

$Y$ =Adoption Rate of Soil and Water Conservation Farming Systems
$\beta_0$ =Intercept
$X_1$ =Human Capital
$X_2$ =Natural Capital
$X_3$ =Social Capital
$X_4$ =Financial capital
$X_5$ =Physical capital
$\varepsilon$ =Error term

## RESULTS AND DISCUSSION

**Influence of Sustainable Livelihood Asseton Adoption Rate of Soil and Water Conservation Farming System**

The effect of Sustainable Livelihood Assets on the level of adoption of soil and

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water conservation farming systems was analyzed using tobit regression often also called censored regression where the dependent variable, the level of adoption of soil and water conservation farming systems, is bounded or censored and influenced by independent variables such as human capital, natural capital, social capital, financial capital and physical capital. The results of this study, which was analyzed using Tobit regression and assisted by Stata.14 software, can be seen in **Table 1**.

**Table 1.** Tobit regression results of the effect of livelihood assets on the level of adoption of soil conservation and air

| Variables | Regression Coefficient | Standard Errors | P>[t] |
|---|---|---|---|
| Human Capital | 0.050 | 0.031 | 0.121 |
| Natural Capital | -0.120*** | 0.024 | 0.000 |
| Social Capital | 0.041* | 0.023 | 0.075 |
| Financial Capital | 0.096*** | 0.023 | 0.000 |
| Physical Capital | 0.108*** | 0.026 | 0.000 |
| Constant | 1.223 | 0.360 | 0.001 |
| Pseudo $R^2$ | 0.5161 | | |
| Prob>$chi^2$ | 0.000 | | |

Source: Primary data (processed), 2024
Note: ***,**,* Significance at α 1%, 5%, dan 10%

In the analysis results it can be seen that the Prob>$chi^2$ value obtained is 0.000 which means that the independent variables namely human capital, natural capital, social capital, financial capital, and physical capital have a simultaneous influence on the level of adoption of soil and water conservation agricultural systems. To see how the percentage of the influence of the independent variable affects the dependent variable, namely by using the *goodness of fit* test viaPseudo $R^2$ (Leo & Anindita, 2022). In this study, the value of Pseudo $R^2$The value obtained is 0.5161 which means that the independent variables in this study can explain the dependent variable by 51% and the other 49% is explained by other variables not included in this study such as knowledge about soil and water conservation, etc.

Human capital in this study formal education, farmers skills and farming experience. The result shows that human capital is not a significant influence; this is because the population in Sumber Brantas Village is not too concerned with formal education and does not include knowledge about soil and water conservation in the human capital indicator. Another study stated that the level of education enables farmers to adopt soil and water conservation (Gebeyehu, 2023).

The results of the analysis show that natural capital has significant effect with a negative direction on the level of adoption of soil and water conservation agricultural systems with a coefficient value of 0.120, this means that every increase of one unit of natural capital will reduce the level of adoption of soil and water conservation agricultural systems by 12%. Based on interviews that have been conducted with farmers when the larger the land area, the availability of adequate water, and a good climate for farming make farmers not want to switch from the usual agricultural system and feel no need to use an agricultural system that prioritizes the concept of sustainability because there are still adequate natural resources available and support their farms. In addition, the majority of farmers in Sumber Brantas Village have small land and it is rather difficult to implement terracing which is one of the conservation activities on small land. To the larger land also certainly requires more water while farmers in Sumber Brantas Village are currently experiencing

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environmental degradation where there is a shortage of water due to drought and based on research conducted by Belayneh, (2023) stated that farmers with small farmland do not adopt conservation farming systems because it will reduce their farmland and thus prioritize the amount of production rather than using sustainable farming systems. In addition, the combination of several indicators makes natural capital have a significant influence but with a negative direction (Kry et al., 2020).

Social capital significance influences the level of adoption of soil and water conservation agricultural systems with 10% and coefficient value of 0.04. This means every increase in social capital by one unit will increase the level of adoption of soil and water conservation agricultural systems by 4.1%. Social capital consists of the level of trust in relatives, participation of farmer groups, and participation of social organizations and most support the system is participation in farmer groups and level of trust in relatives because farmers can reach the information from the community and they can apply the system because the level of the high-level trust in relatives. This is also supported by previous research, which states that social capital is a key factor influencing te adoption of soil and water conservation farming systems because farmers obtain information from fellow farmers through social capital (Li et al., 2024)

Financial capital has a positive significant influence with a coefficient value of 0.096, where each increase of one unit of financial capital will increase the level of adoption of conservation agriculture systems by 9,6%. Adopting an innovation certainly requires financial support, such as high monthly income and savings, and it is adopting a new innovation that requires financial support and credit access. Sumber Brantas farmer's monthly income is around IDR 3.500.000 – IDR 14.079.000. This is supported by previous research (Leo & Anindita, 2022), using income and saving as indicators for financial capital. Where farmers with higher financial access felt no need to use conservation techniques and chose to allocate their money to other techniques (Ngaiwi et al., 2023).

Physical capital is significant and has a positive direction in influencing the level of adoption of soil and water conservation farming systems with a coefficient value of 0.108 which means that every increase of one unit of physical capital will increase the level of adoption of farming systems by 10%. In the presence of physical capital, the level of adoption of soil and water conservation farming systems will increase due to the availability of complete agricultural tools and ownership of property such as technology to access information that makes it easier for farmers to access the level of adoption of conservation farming systems. Most predominantly owned by the farmers is property ownership such as cars, smartphones, and agriculture technology to make it easy to access this system. Previous research also states that the better the physical assets mean advanced technology owned by farmers, the higher the probability of availability of farmers in adopting a new technology (Kuang et al., 2020). Thus, physical capital is strongly recommended to be increased to increase the adoption rate of soil and water conservation farming systems (Leo & Anindita, 2022).

## CONCLUSION

The research that has been done shows the results that natural capital (the area of land owned by farmers for horticultural farming, the climate that supports farming, and the availability of water sources), social capital (the level of trust in surrounding neighbors, the number of relatives outside the farm, the participation of farmers in farmer groups and the participation of farmers in other social organizations), financial capital (monthly income, saving and credit access), and physical capital (ownership of the equipment to run the farm and ownership of property) significantly affect the level of adoption of soil and water conservation farming systems.

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The results of the study are based on the reality that occurs in the field where interviews have been conducted with farmers when the larger land area makes farmers not want to switch from the usual agricultural system. In addition, farmers in Sumber Brantas Village mostly have small land; besides that, the larger land also requires more water, so the level of conservation adoption has a significant effect in reducing the level of adoption conservation by 12%. Then social capital has a significant influence because farmers generally get information through other farmers that it can increase 4% the level of adoption of conservation agricultural systems, financial capital positif influence and can increase the level of adoption by 9%, finally physical capital also has a high level of significance and affects the level of adoption of soil and water conservation agricultural systems by 10% for every 1 unit increased because through physical capital where the availability of agricultural tools and technology to support farmers in adopting soil and water conservation.After discussing the matter, it has been recommended that it is essential to improve and augment natural capital, social capital, financial capital, and physical capital to enhance the adoption rate of soil and water conservation agriculture systems. This is because these four types of capital have a notable impact on the adoption rate of soil and water conservation agriculture systems.

## REFERENCES

Amore, M. D., & Murtinu, S. (2021). Tobit models in strategy research: Critical issues and applications. *Global Strategy Journal*, *11*(3), 331–355. https://doi.org/10.1002/gsj.1363

Andes Putra, D., Putra Utama, S., & Mersyah, R. (2019). Pengelolaan Sumber Daya Alam Berbasis Masyarakat Dalam Upaya Konservasi Daerah Aliran Sungai Lubuk Langkap Desa Suka Maju Kecamatan Air Nipis Kabupaten Bengkulu Selatan. *NATURALIS – Jurnal Penelitian Pengelolaan Sumberdaya Alam Dan Lingkungan* , *8*(1), 77–86. https://doi.org/https://doi.org/10.31186/naturalis.8.2.9211

Arsyad, S. (2010). *Konservasi Tanah dan Air* (H. Siregar, A. Alamsyah, & S. Eryarsah, Eds.; 2nd ed.). IPB Press.

Belayneh, M. (2023). Factors affecting the adoption and effectiveness of soil and water conservation measures among small-holder rural farmers: The case of Gumara watershed. *Resources, Conservation and Recycling Advances*, *18*. https://doi.org/10.1016/j.rcradv.2023.200159

Dayakar, P., & Kavi Kumar, K. S. (2024). Soil and water conservation measures and rainfed agriculture in Telangana, India: Role of community and neighborhood conservation measures. *Land Use Policy*, *137*. https://doi.org/10.1016/j.landusepol.2023.107011

Dewi, S. K. S., Antara, M., & Arisena, G. M. K. (2021). Pemasaran Cengkeh di Desa Penyaringan Kecamatan Mendoyo, Kabupaten Jembrana, Bali, Indonesia. *Agro Bali : Agricultural Journal*, *4*(2), 246–259. https://doi.org/10.37637/ab.v4i2.719

Gebeyehu, T. A. (2023). Adoption and impacts of conservation agriculture on smallholder farmers' livelihoods in the case of Arba Minch Zuria district of Southern Ethiopia. *Cogent Social Sciences*, *9*(1). https://doi.org/10.1080/23311886.2023.2235782

Hafif, B. (2019). A Soil and Water Conservation Only be a Slogan? Case Study of Land of Smallholder Plantation. *Perspektif*, *18*(1), 1–15. https://doi.org/10.21082/psp.v18n1.2019

Izzati, A., Suwarto, & Anantanyu, S. (2021). Pemanfaatan Livelihood Assets Sebagai Strategi Bertahan Hidup Petani Daerah Konservasi DAS Solo di Desa Beruk

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1805

Kecamatan Jatiyoso Kabupaten Karanganyar. *Agrovital : Jurnal Ilmu Pertanian*, *6*(2), 75–80. file:///C:/Users/user/Downloads/2039-6568-1-PB.pdf

Kasmin, Muh. O., Helviani, H., & Nursalam, N. (2023). Identifikasi Komoditas Hortikultura Basis dalam Perspektif Pertanian Berkelanjutan di Kabupaten Kolaka, Indonesia. *Agro Bali : Agricultural Journal*, *6*(1), 211–217. https://doi.org/10.37637/ab.v6i1.1043

Kry, S., Sasaki, N., Datta, A., Abe, I., Ken, S., & Tsusaka, T. W. (2020). Assessment of the changing levels of livelihood assets in the Kampong Phluk community with implications for community-based ecotourism. *Tourism Management Perspectives*, *34*. https://doi.org/10.1016/j.tmp.2020.100664

Kuang, F., Jin, J., He, R., Ning, J., & Wan, X. (2020). Farmers' livelihood risks, livelihood assets and adaptation strategies in Rugao City, China. *Journal of Environmental Management*, *264*. https://doi.org/10.1016/j.jenvman.2020.110463

Leo, M. Y. M. K., & Anindita, R. (2022). Pengaruh Sustainable Livelihood Asset Terhadap Adopsi Teknologi Budidaya Jagung Di Desa Kenebibi, Kecamatan Kakuluk Mesak Kabupaten Belu. *AGRIMOR*, *7*(1), 18–22. https://doi.org/10.32938/ag.v7i1.1469

Li, L., Dingyi, S., Fengluan, S., Xiujun, T., & Noor, H. (2024). Effects of social capital and technology cognition on farmers' adoption of soil and water conservation tillage technology in the Loess Plateau of China. *Heliyon*, *10*(5). https://doi.org/10.1016/j.heliyon.2024.e27137

Malhotra, S. K. (2017). Horticultural crops and climate change: A review. In *Indian Journal of Agricultural Sciences* (Vol. 87, Issue 1, pp. 12–22). Indian Council of Agricultural Research. https://doi.org/10.56093/ijas.v87i1.67138

Ngaiwi, M. E., Molua, E. L., Sonwa, D. J., Meliko, M. O., Bomdzele, E. J., Ayuk, J. E., Castro-Nunez, A., & Latala, M. M. (2023). Do farmers' socioeconomic status determine the adoption of conservation agriculture? An empirical evidence from Eastern and Southern Regions of Cameroon. *Scientific African*, *19*. https://doi.org/10.1016/j.sciaf.2022.e01498

Prokopy, L. S., Floress, K., Arbuckle, J. G., Church, S. P., Eanes, F. R., Gao, Y., Gramig, B. M., Ranjan, P., & Singh, A. S. (2019). Adoption of agricultural conservation practices in the United States: Evidence from 35 years of quantitative literature. *Journal of Soil and Water Conservation*, *74*(5), 520–534. https://doi.org/10.2489/jswc.74.5.520

Qanti, S. R., Syamsiyah, N., & Sadeli, A. H. (2023). Adopsi dan Dis-Adopsi Teknologi Konservasi Tanah dan Air Di DAS Citarum Jawa Barat. *Agricore: Jurnal Agribisnis Dan Sosial Ekonomi Pertanian Unpad*, *8*(2), 74–79. https://jurnal.unpad.ac.id/agricore/article/view/53376/pdf

Rahman, M. M., Sultana, N., Hoque, M. A., Azam, Md. G., Islam, Md. R., & Hossain, Md. A. (2024). Conservation tillage (CT) for Climate-smart Sustainable Intensification: Benchmarking CT to Improve Soil Properties, Water Footprint and Bulb Yield Productivity in Onion Cultivation. *Heliyon*, e39749. https://doi.org/10.1016/j.heliyon.2024.e39749

Rotich, B., Maket, I., Kipkulei, H., Ocansey, C. M., Justine, P. N., Mohammed Zein, M. A., Csorba, Á., & Michéli, E. (2024). Determinants of soil and water conservation practices adoption by smallholder farmers in the central highlands of Kenya. *Farming System*,

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1805

*2*(2). https://doi.org/10.1016/j.farsys.2024.100081

Suhartini, S., Dwi Cahyono, E., Maulana Ishaq, R., Nur Jihad, B., Sandi Lasitya, D., Irwandi, P., & Fajar Maulana, M. (2024). The Role of Agroforestry to Improve Farming System Sustainability in Upper Brantas Watershed. *IOP Conference Series: Earth and Environmental Science*, *1299*(1). https://doi.org/10.1088/1755-1315/1299/1/012012

Wijayanto, H. W., Anantayu, S., & Wibowo, A. (2021). Perilaku dalam Pengelolaan Lahan Pertanian di Kawasan Konservasi Daerah Aliran Sungai (DAS) Hulu Kabupaten Karanganyar. *AgriHumanis: Journal of Agriculture and Human Resource Development Studies*, *2*(1), 25–34. https://doi.org/10.46575/agrihumanis.v2i1.96

Xu, Z., Qayum, M., Afzal, J., & Aslam, M. (2023). Availability and access to Livelihood capital assets for development of sustainable Livelihood strategies of fishermen: A case study of Manchar Lake Pakistan. *Heliyon*, *9*(12). https://doi.org/10.1016/j.heliyon.2023.e22549

Yuniti, I. G. D. A., Purba, J. H., Sasmita, N., Komara, L. L., Olviana, T., & Kartika, I. M. (2022). Balinese Traditional Agroforestry as Base of Watershed Conservation. *Journal of Applied Agricultural Science and Technology*, *6*(1), 49–60. https://doi.org/10.55043/jaast.v6i1.54