

ISSN: 0258-2724

DOI : 10.35741/issn.0258-2724.56.5.3

Review article

Environmental Sciences

**EFFECT OF HUYULA LOCAL WISDOM ON PARTICIPATORY CRITICAL
LAND REHABILITATION IN THE AGROFORESTRY MODEL****呼余拉地方智慧对农林模式下参与式关键土地恢复的影响**Dewa Oka Suparwata ^{a, *}, Didi Rukmana ^b, Andi Nixia Tenriawaru ^b, Risma Neswati ^c^a Student of Doctoral Agricultural Science, Hasanuddin University Postgraduate School
Makassar, Indonesia, suparwata_do@umgo.ac.id^b Department of Agribusiness, Faculty of Agriculture, Hasanuddin University
Makassar, Indonesia, drukmana@unhas.ac.id, nixia_gany@yahoo.com^c Department of Soil Science, Faculty of Agriculture, Hasanuddin University
Makassar, Indonesia, neswati76@gmail.com*Received: June 15, 2021* ▪ *Review: July 13, 2021* ▪ *Accepted: August 18, 2021* ▪ *Published: October 30, 2021**This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>)***Abstract**

Land criticality takes place because of a complex set of technical, biophysical, social, and cultural factors. Socially, participation in rehabilitating degraded land is a measure of the success of a rehabilitation project. Therefore, this study aims to determine the form and extent of the contribution of local wisdom in participatory critical land rehabilitation efforts using agroforestry patterns. An exploratory approach designed in qualitative research was used, and data collection was conducted through brainstorming techniques and Focus Group Discussion (FGD). Furthermore, a descriptive qualitative analysis was used, and data acquisition includes reduction, presentation, conclusion, and verification. The results showed that community participation is involved in the stages of planning, implementation, and evaluation of activities, all of which can be enhanced by an empowerment approach aimed at rural communities. Meanwhile, sustainable agroforestry participation can be achieved by integrating local huyula wisdom into agroforestry development. The Huyula configuration is practiced in group deliberations during planning activities relating to locations, plant types, planting, maintaining plants, and recommendations. The aim is to achieve environmental improvement and to rehabilitate critical land through agroforestry. Furthermore, agroforestry development should be conducted on a massive scale in the future via the integration of various sectors to optimize the rehabilitation of critical land and create a sustainable environment.

Keywords: Community Participation, Critical Land Rehabilitation, Huyula, Agroforestry

摘要 由于一系列复杂的技术、生物物理、社会和文化因素，造成土地危机。在社会上，参与恢复退化土地是恢复项目成功与否的衡量标准。因此，本研究旨在确定当地智慧在使用农林业模式的参与式关键土地恢复工作中的贡献形式和程度。使用在定性研究中设计的探索性方法，并通过头脑风暴技术和焦点小组讨论（烟气脱硫）进行数据收集。此外，使用了描述性定性分析，数据采集包括简化、呈现、结论和验证。结果表明，社区参与涉及活动的规划、实施和评估阶段，所有这些都可以通过针对农村社区的赋权方法得到加强。同时，将当地的虎育拉智慧融入农林发展，实现农林可持续参与。胡尤拉配置在与位置、植物类型、种植、维护植物和建议相关的规划活动期间以小组审议的形式进行实践。目的是通过农林业实现环境改善和关键土地的恢复。此外，未来应大规模开展农林业发展，通过整合各部门，优化关键土地的恢复，创造可持续的环境。

关键词: 社区参与、关键土地恢复、呼尤拉、农林业

I. INTRODUCTION

Resource exploitation, ecological imbalance, and non-conservative human activities result in degraded and critical land [1]. Generally, land criticality can occur on agricultural land and in forest areas [2]. The impact of degraded land is a decrease in soil quality, reduction of the conservation [3], and damage to hydrological and environmental functions [4]. Furthermore, it continuously damages the socio-economic life of the community [5]. Therefore, land management efforts should be conducted conservatively to increase vegetation and reduce erosion [6]. This is because prolonged erosion can reduce the productivity of agricultural land [7]. In addition, soil resources should be protected because they are prone to degradation, and rehabilitation should also be conducted [8]. The process of rehabilitation of critical land is aimed at restoring, maintaining, and increasing the carrying capacity and function of forests as well as land to increase the level of productivity [9]. Therefore, land-use planning requires proper consideration so that environmental functions can be fulfilled sustainably [10].

Many approaches are used in rehabilitating land that has become critical and unproductive. One of the methods used by communities is the agroforestry pattern, which restores the productivity of abandoned and degraded land and also the environmental quality [11]. Furthermore, agroforestry land-use systems combine woody crops, food, and livestock/fish with specific time and space management to improve community welfare and sustainability [12], [13], [14], [15]. Community acceptance is quite good in agroforestry development, which is shown by the fact that 50% of the work is done by members of the community [16]. The participatory agroforestry development model requires the interconnection of various sectors, especially forest communities, to maintain sustainability.

The active participation of forest area farmers is the main key in achieving program objectives [17]. Furthermore, conceptual participation is directly correlated with forest sustainability, and land as well as farmer welfare [18]. It must also be noted that agroforestry patterns make the environment greener and benefit residents [19].

Restoration of critical land should be conducted between technology and local cultural characters in an integrated manner [20]. A society with local wisdom contains principles, norms, and values that are upheld in the social structure as a guide and controller to protect nature and its environment [21]. The contribution of local wisdom to the conservation of critical land is high enough because of the belief and obligation attributed to it [22]. For instance, the local wisdom of the Huyula and the Gorontalo people has a similar configuration that has been practiced for generations. The former has become a spirit for collaboration, common interests, social cooperation, and the foundation for cooperation in all forms of social activities including agriculture [23], [24], [25], [26], [27], [28], [29].

In reality however, local wisdom is increasingly fading due to the emergence of individualism of farmers, agricultural pragmatism, and the latest advances in technology. The dark side of agricultural technology has created a gap in social cooperation that is constantly increasing. In addition, community social cooperation has been replaced by a wage system and agricultural monetization [30], [31], [32]. The reduced sense of togetherness correlates with the low level of participation in protecting nature, the environment, and agricultural land. To counteract the decline in participation, it is necessary to consider local wisdom in the implementation of activities. Furthermore, the community is given the authority to determine the patterns that are good for development on their land, especially in

agroforestry activities. The social configurations should be revived to increase the awareness of rehabilitating critical land. Therefore, this study aims to determine the form and contribution of local wisdom in participatory critical land rehabilitation efforts with an agroforestry pattern. It explicitly gives space and flexibility to the community to participate.

II. MATERIALS AND METHODS

This study used an exploratory approach in the form of a qualitative design to examine the participation, views, and *huyula* forms in the rehabilitation of critical land with agroforestry patterns in forest fringe communities. The study was conducted in Dulamayo Barat Village, Telaga District, Gorontalo. Furthermore, the location was purposively selected with several considerations; namely: (a) Dulamayo Barat is the upstream part of the Limboto river basin, which is a buffer area to be protected and preserved; (b) one of the villages has developed an agroforestry pattern; (c) from a social perspective, all the participants reside in forest fringe areas and (d) have a spirit of togetherness in agricultural activities. Most of the area surrounding the village is protected, and there are several businesses based on forestry and agroforestry in the area.

Data collection was conducted using a brainstorming approach and Focus Group Discussion (FGD). A small discussion group was formed to find socio-cultural realities to configure the local wisdom applied by the agroforestry community. In substance, the FGD activity was directed at finding data that can support the rehabilitation of critical land. In addition, a brainstorming activity was also conducted to trace community complaints. An outpouring of opinions, issuing ideas, opinions, suggestions, criticisms, and expectations comprised the data searched. Meanwhile, a descriptive data analysis was used and several acquisition steps were conducted, including: (a) reduction consisting of data classification and coding, (b) data presentation, and (c) drawing conclusions and data verification. Generally, the resulting data were described and set out in a qualitative framework.

III. RESULTS AND DISCUSSION

Given the chaotic agricultural conditions, which are increasingly leading to pragmatic and instant dogmas, it is not uncommon for many social inequalities to occur in society, such as the declining value of participation, which has also weakened agricultural civilization. Agriculture

still remains in a semi-modern order, and in some cases, it is employed mainly for subsistence. However, agricultural progress is not accompanied by an awareness of environmental conservation required in farming management. Furthermore, the differences in paradigms and main objectives often become debates and barriers to the development of environmentally friendly agriculture. This is based on three basic development frameworks (economic, social, and environmental). The mismanagement and coercion increasingly cause agricultural land to become critical. This gives rise to negative speculation and dilemmas on the progress of agriculture with a relatively slow rate of land improvement. The agroforestry paradigm bridges the dispute over priority targets in agricultural development. Technically, the agroforestry pattern has been widely adopted and practiced, but socio-economically speaking, it still needs attention, especially in the aspect of community participation. It manages critical agricultural land by implementing an agroforestry system [49].

However, the development of agroforestry always encounters a classic obstacle, such as "difficulty in continuing the program due to low community participation." The community domain conducts farming with monoculture patterns and a target of one product in one land. Therefore, this study reviews the participation of agroforestry as empowerment and the local *huyula* wisdom to drive the spirit of rehabilitation, resolves the dilemma in the community between clearing or maintaining plant diversity, and considers agroforestry patterns as a form of control and improvement of critical land. In general, the results reduce the current phenomenon of social reality and the literature review from a few contemporary issues of agricultural problems.

A. Community Participation in Agroforestry Development: An Empowerment Process

Conducting brainstorming and FGDs in rural communities poses many challenges. Moreover, the social life setting of the local community should be accessible. It is also worth considering the uniqueness and social reality of the rural community as a means for empowering and increasing participation in protecting agricultural land. This is a process in which people exchange thoughts, opinions, and ideas to realize solutions to environmental degradation and an increasingly critical land. The obstinacy of the discussion illustrates the many problems and hopes of the community to live a life supported by agriculture (Figure 1). Moreover, with the condition of the

informant community, 85% with primary school education have not graduated from elementary school, with an average income of Rp. < 1,000,000 per month. It is very difficult for such people to participate in farmer group donations. To overcome this, mutations of thought have been developed to re-apply the local huyula wisdom throughout the community. Through local wisdom, the huyula community can substitute wages for labor from social cooperation run by farmer groups.



Figure 1. Discussion on the development of participatory and integrated agroforestry

In this study, participation given by the community in agroforestry development came in the form of identifying common land, determining the types of plants developed, jointly determining cropping patterns, providing plant seeds (Figure 2), and crop management (planting, maintenance, and supervision). Although commercial crops, both forestry and fruit trees, as well as several types of local plants were used, agroforestry has not been massively conducted in rural areas. Due to the conflicting views in the community, which still considers the practices economically unfavorable, and for a relatively long time, the results can be reaped. Some people tend to prefer monoculture farming with corn as the main crop commodity. The strengthening step taken by farmer groups to overcome this contradiction is to make agroforestry a vehicle for empowering forest-fringe communities and raise awareness of the importance of protecting the environment. Moreover, the Dulamayo area is an upstream part of the Limboto Watershed and bears a moral responsibility to maintain nature.



Figure 2. Plant development

The empowerment of agroforestry breaks up clashes that are always contradicting the paradigm of agriculture and forestry. The existence of agroforestry provides solutions and intermediaries that contribute from economic, socio-cultural, and environmental aspects. At the farmer level, the practice of agroforestry has been practiced for a long time, with traditional planting techniques based on the urgency of the community's crop needs. Many people that manage land have applied this model effectively. The Dulamayo area is dominated by sloping lands, and the community living there has both economic and environmental objectives. The community discussions that take place in the area require assistance, the involvement of all elements, and guidance on the prospects for agroforestry.

Progress in mentoring and facilitation of agroforestry communities has caused a degree of conflict and a question. This is because the agroforestry demonstration plot projects were running only when assistance was still intensive. After the project period ended, the community did not understand the next step to be followed. The criticism of this condition is that the community should be prepared for independence before taking off. This strengthens community motivation and responsibility when there is recognition, appreciation, and guidance from various parties to continue developing agroforestry. Furthermore, strengthening agroforestry empowerment is conducted in a participatory manner to rehabilitate critical agricultural lands. According to the community, agroforestry minimizes the criticality of land, especially with the characteristics of the upstream area, which is mostly hilly. This development is a challenge in agriculture, but it can answer the prolonged dilemma of sustainable agricultural land use.

B. Huyula Local Wisdom in Agroforestry and Critical Land Rehabilitation Efforts

Designing a sustainable land and environment requires the critical effort of being conscious of the event conducted. Communities, especially those living in forest fringe areas, certainly have opportunities and challenges in their farming. As a thick community with customs, principles, rules, and regulations are very important. The resulting interactions form a bond and social forces for the pattern of relationships between these communities. One of the images of social ties is reflected in the local wisdom of the

Huyula. Meanwhile, *Huyula*, in all aspects, is defined as a form of cooperation. It forms a bond of social cooperation with an attitude of togetherness, caring, partnership, cooperation, empathy, a sense of belonging, and a feeling of co-existence. It contains the meaning of empowerment which strengthens the foundation of community participation in various forms of development undertaken. In agriculture, *Huyula* is widely practiced in the form of *Ti'ayo*, which is social cooperation in the community to participate in all activities.

In agroforestry development, *Huyula* is often used both in planning, implementing, and evaluating agroforestry activities. In planning community activities together to prepare a meeting place, deliberations to determine sample land, the location of plant nurseries, and plan the types of plants to be combined. In the implementation aspect, the community jointly performs land plowing, making holes, planting, maintaining good weeding, fertilizing, and controlling plant pests. Furthermore, *Huyula* is most intensively conducted in the implementation of agroforestry activities. In the evaluation, the form of activities such as jointly observing plants and analyzing the obstacles encountered during the implementation of the activity. This includes the difficulty of *Huyula* activities that characterize the character of rural civil society. However, it is lately weakened due to the emergence of individualism and the need to use labor outside the group. The wage system also triggers the waning of the local wisdom, and transformation is important for the reincarnation and strengthening of the group, which is characteristic of the Gorontalo people. Traditional leaders and the community introduced and remarketed *Huyula* during the onslaught of era progress which also influenced the decline.

The community acknowledges that selfishness, individualism, and pragmatic attitudes have led to a lack of concern for the land and the environment, which has resulted in a decline in land productivity. Farming is only focused on improving the economy since the agricultural system has become a monoculture. This pattern is carried out continuously, resulting in decreased land productivity and decreased environment's carrying capacity. The emergence of agroforestry is recognized as a solution in optimizing agricultural land use. However, farmers often encounter obstacles such as mixed cropping patterns, which require adaptation to combine crops properly and correctly. Other patterns applied include planting various fruit

trees, intercropping coconut and corn plants, cloves with corn, fruits, and seasonal crops. In its maintenance, the community puts up a sign prohibiting it from damaging wild animals, which often interfere with agroforestry crops (Figure 3). Therefore, the rehabilitation of critical land will gradually be achieved through agroforestry since biomass in the form of litter is contributed more than the monoculture pattern.



Figure 3. Signs of prohibitions on agroforestry

C. Plant Eradication or Plant Diversification: A Dilemma That Must Be Resolved

This persistent dilemma has led to ambiguity and injustice towards the perspective of land and environmental management. The ambiguity raises concerns about eradicating or diversifying woody plants, particularly in cultivating food crops such as maize. Plant eradication is defined as the behavior of destroying all plants in the cultivation area. Furthermore, plant eradication is conducted to remove shade that can inhibit seasonal plant growth. This destruction is ecologically massive and radical, resulting in land clearing. Moreover, many cropping patterns are found on sloping lands that do not follow soil and water conservation principles. Prolonged coercion, which should not have been for the development of seasonal crops, results in increased erosion, decreased soil fertility, erosion of topsoil, and landslides. Indirectly, when this becomes critical, farmers will look for new land to cultivate.

One of the ways to stem eradication is by adopting an attitude of diversification. Critical awareness should also be conducted to form a conscious soul with plant diversification. Meanwhile, diversification is defined as an effort to cultivate various kinds of plants in a certain land area within the specified time and space. This is where the agroforestry system, which was introduced to forest fringe communities, received a good reception. This view is as implanting a naturalism paradigm in society to fight the hegemony of the anthropocentrism paradigm. Efforts are made for the community to respect nature by integrating local wisdom since the acceleration of land improvement can be

conducted. Understanding ecology will not be sufficient to preserve the environment because more efforts are needed to understand naturalism. This is where crop diversification is given special attention to generate interactions between the economy, society, and environment as a sustainable system. Furthermore, diversification aims at reforestation and diversifying the composition of plant species contributes positively to carbon sequestration, protection of endemic fauna and flora, conservation of genetic resources, providers of water resources, and others. This is because of the vital roles played by forests in human life. It is necessary to reflect on the decrease of forest areas, which is occurring very fast. Through empowerment, forest and land management efforts can inspire feelings, intuition, awareness of the importance of forests for human life. Empowerment models such as forest villages need to be encouraged because they contribute to the addition of forest areas. In addition, it analyzes the needs of life and the contribution to protecting the environment. Determining the types of plants requires a use-value and commercial approach but does not leave local plants and community wisdom behind. Therefore, the needs of the community are properly identified and facilitated for the welfare of their lives.

D. An Empirical Review of Agroforestry for Conservation of Critical Lands

Ignoring conservation in land management results in a decrease in the function of the land, such as degradation. This happens because of the complexity of the influencing factors such as erosion and runoff. Criticality is often linked to land use interventions [5] and is an important topic to consider [33]. Furthermore, it is necessary to have appropriate rehabilitation efforts for agricultural land [34]. The handling can be conducted by technical and vegetative means that are implemented simultaneously [35]. Efforts to apply conservation techniques involve rehabilitating critical agricultural lands. However, past rehabilitation activities often regard the community as an object since involvement, a sense of belonging, and concern for maintaining rehabilitation plants are very low [36]. This is also because technical civilian conservation techniques are perceived as being applied by the community. Furthermore, conservation directions can be conducted vegetatively through agroforestry activities to control critical land, soil conservation, water management, and community income [3]. However, limited information and knowledge

about conservation practices, inadequate land, low access seeds, weak market access, and suboptimal integration due to pests and diseases are obstacles and barriers to the broad application of agroforestry [37], [38]. Therefore, it is very important to have an empirical visualization review of the realities of adaptive and contextual agroforestry development.

An agroforestry pattern protects the environment from the threat of erosion and the sedimentation of rivers and reservoirs and reduces runoff, lowering the risk of flooding [39]. Agroforestry design is degraded by the landscape as woody plants placed on critical land are planted in ridge areas and multi-purpose tree systems (MPTs). Furthermore, commodity crops are directed to slopes, while seasonal/secondary crops are better planted in flat areas [40]. Some agroforestry systems implemented by communities on critical lands include silvopasture, multi-purpose tree systems [34], alley cropping [35], agrisilviculture, and agrosilvopastura. Meanwhile, the existing agroforestry system is a traditional system managed according to local conditions and wisdom [41]. The application of an agroforestry system restores degraded land, making it productive and improving the quality of the environment [11], [42]. The existence of agroforestry in a watershed plays a role in slope stability, which also reduces erosion [43]. [44] reported on agroforestry land, especially agrosilviculture, that erosion was smaller than the allowable one (< 31.6 ton/ha/yr). Furthermore, the actual erosion in the agrosilvopastura pattern was the lowest (3.31 ton/ha), compared to other types of agroforestry [43]. Predictions of light erosion have also been made for volcanic mainland with agroforestry patterns with a density of $< 25\%$ [39]. Technically, it contributes to controlling land degradation due to soil erosion. Also, the socio-economic model of agroforestry increases income, improves community welfare, and is feasible to develop [11], [38], [40], [41], [44], [45], [46]. This reality shows that agroforestry can be used as an alternative in the rehabilitation and conservation of critical land [47] by integrating technology and the local cultural character of the community [20].

Developments in agroforestry should be adopted by farmers at household and business scales. This is because extensive critical land can be utilized to become productive through agroforestry. In the development of agroforestry, various stakeholders should be involved, taking small roles to enhance the continuity of the

program. Furthermore, all elements of the development should not be concerned with their respective sectorial egos but should participate in a collaborative system to achieve successful critical land rehabilitation. The experience of previous failures has become a lesson for future economic-social-environmental reforms, leading to consistent sustainable, conscious behavior. Therefore, the emergence of participation is a central issue that should be encouraged. With the development of agroforestry, efforts to manage critical agricultural land are expected to be enacted quickly. In addition, the level of active participation should be determined based on local wisdom. Huyula is a driving force in the Gorontalo community's participation in agricultural development. Therefore, in achieving agroforestry sustainability, socio-cultural aspects cannot be separated from Indonesian society.

IV. CONCLUSION

Conservation of critical land is conducted through rehabilitation using agroforestry patterns. In simple terms, agroforestry is a combination of agricultural and forestry crops designed in space and time. This combination provides macro and micro effects in reaction to the relationship between humans and nature. Furthermore, communities can choose various agroforestry techniques that have the objectives of controlling critical land, nature conservation, and providing commercial benefits. In addition, land management combines plants that provide short, medium, and long terms benefits. In achieving agroforestry sustainability, a community is the main force that drives the program. Community participation in agroforestry activities rehabilitates critical agricultural land.

Participation plays an important role in the success of agroforestry development. Participation is required in the planning, implementation, and evaluation processes of activities. Increasing community participation in agroforestry can be achieved with an empowerment approach, by providing self-reinforcement, motivation, access to agroforestry information, training, and intensive assistance to agroforestry farmer groups. Sustainable participation can be accomplished by integrating local wisdom from the community. For the people of Gorontalo in particular, they recognize the Huyula configuration as the norm and possess a spirit of social cooperation in fulfilling all their needs. In the agricultural sector, it takes the form of *Ti'ayo*, which is a collective entity in the conduct of work. Local wisdom is the guide for rural communities, especially in the development

of agroforestry. The Huyula configuration is practiced in group deliberations, planning activities, determining the location, selecting plant types, planting, maintaining plants, and providing recommendations through a series of evaluations. Therefore, environmental improvement and the criticality of agricultural land can slowly be resolved through agroforestry.

The Huyula study contributes to the development of the field of the socio-economics of agriculture. Ethnographically, this reality can be studied using Arnstein's participation ladder theory [48]. Therefore, a comparison can be made of the extent to which Huyula contributes and plays an active role in participation. The participatory configuration crystallized through local wisdom provides a unique and interesting spectrum. This is because it deeply examines the lives of the critical land rehabilitators, who are rarely studied. Furthermore, the hidden norms and values provide solutions for massive critical land participation.

ACKNOWLEDGMENT

The authors are grateful to the Education Fund Management Institution (LPDP) for providing material support to develop knowledge and hone experiences in education.

REFERENCES

- [1] SARMINAH, S., KARYATI, KARMINI, SIMBOLON, J., and TAMBUNAN, E. (2018) Rehabilitation and Soil Conservation of Degraded Land Using Sengon (*Falcataria moluccana*) and Peanut (*Arachis hypogaea*) Agroforestry System. *Biodiversitas*, 19 (1), pp. 222–228.
- [2] ROSYADA, M., PRASETYO, Y., and HANI'AH. (2015) Penentuan Tingkat Lahan Kritis Menggunakan Metode Pembobotan Dan Algoritma NDVI (Studi Kasus: Sub DAS Garang Hulu). *Jurnal Geodasi Undip*, 4 (1), pp. 85–94.
- [3] INDRIHASTUTI, D., MURTIKSONO, K., and TIAHJONO, B. (2016) Analysis of Critical Land and Recommendation for Land Rehabilitation in the Regional Development in Kendal, Central Java. *Tata Loka*, 18 (3), pp. 141–156.
- [4] ANNAS, M.R. (2019) *Pemetaan Zonasi dan Karakteristik Lahan Kritis Pada Morfometri Bentang Lahan di Wilayah Perhutani Bagian Kesatuan Pemangku*

Hutan (BKPH) Kalibodri Kabupaten Kendal. Skripsi, Universitas Negeri Semarang.

- [5] KUBANGUN, S.H., HARIDJAJA, O., and GANDASASMITA, K. (2014) Model Spasial Bahaya Lahan Kritis di Kabupaten Bogor, Cianjur dan Sukabumi. *Majalah Ilmiah Globe*, 16 (2), pp. 149–156.
- [6] AMALIAH, R., UMAR, H.R., and NASIAH. (2019) Identifikasi dan Pemetaan Lahan Kritis dengan Menggunakan Teknologi Sistem Informasi Geografis (Studi Kasus DAS Jenerakikang Sub DAS Jeneberang) Kabupaten Gowa Sulawesi Selatan. *UNM Geographic Journal*, 2 (2), pp. 112–120.
- [7] WAHYUNINGRUM, N. and PUTRA, P.B. (2018) Evaluasi Lahan Untuk Menilai Kinerja Sub Daerah Aliran Sungai Rawakawuk. *Jurnal Penelitian Pengelolaan Daerah Aliran Sungai*, 2 (1), pp. 1–16.
- [8] KARYATI and SARMINAH, S. (2018) *Teknologi Konservasi Tanah dan Air*. Samarinda-Kalimantan Timur: Mulawarman University Press.
- [9] HERMAWAN, Y., SULASTRI, S., and KUSUMAWARDANI, N.D. (2016) Keberhasilan Kelompok Tani dalam Program Rehabilitasi Hutan dan Lahan. *Jurnal Ilmu-Ilmu Kehutanan*, 1 (1), pp. 61–68.
- [10] OSOK, R.M., TALAKUA, S.M., and SUPRIADI, D. (2018) Penetapan Kelas Kemampuan Lahan dan Arah Rehabilitasi Lahan Das Wai Batu Merah Kota Ambon Provinsi Maluku. *Agrologia*, 7 (1), pp. 32–41.
- [11] NURIDA, N.L., MULYANI, A., WIDIASTUTI, F., and AGUS, F. (2018) Potensi dan Model Agroforestry untuk Rehabilitasi Lahan Terdegradasi di Kabupaten Berau, Paser dan Kutai Timur, Provinsi Kalimantan Timur. *Jurnal Tanah dan Iklim*, 42 (1), pp. 13–26.
- [12] KITTUR, B.H. and BARGALI, S.S. (2013) Perspectives of agroforestry: Present and future. *Journal of Progressive Agriculture*, 4 (2), pp. 91–94.
- [13] ACHMAD, B., SIMON, H., DINIYATI, D., and WIDYANINGSIH, T.S. (2012) Persepsi Petani terhadap Pengelolaan dan Fungsi Hutan Rakyat di Kabupaten Ciamis. *Jurnal Bumi Lestari*, 12 (1), pp. 123–136.
- [14] KASSIE, G.W. (2016) Agroforestry and Land Productivity: Evidence From Rural Ethiopia. *Cogent Food & Agriculture*, 2 (1), pp. 1259140.
- [15] RAJAGUKGUK, C.P., FEBRYANO, I., and HERWANTI, S. (2018) Perubahan Komposisi Jenis Tanaman dan Pola Tanam pada Pengelolaan Agroforestri Damar. *Jurnal Sylva Lestari*, 6 (3), pp. 18–27.
- [16] SUPARWATA, D.O. (2018) Pandangan Masyarakat Pinggiran Hutan Terhadap Program Pengembangan Agroforestri. *Jurnal Penelitian Sosial dan Ekonomi Kehutanan*, 15 (1), pp. 47–62.
- [17] WINATA, A. and YULIANA, E. (2012) Tingkat Partisipasi Petani Hutan dalam Program Pengelolaan Hutan Bersama Masyarakat (PHBM) Perhutani. *MIMBAR: Jurnal Sosial dan Pembangunan*, 28 (1), pp. 65–76.
- [18] SUDRAJAT, A., HARDJANTO, and SUNDAWATI, L. (2016) Farmer Participation on Sustainable Private Forest Management: Case of Cikeusal and Kananga Villages, Kuningan District. *Jurnal Silviculture Tropika*, 7 (1), pp. 8–17.
- [19] PAMUNGKAS, H.S.R. and KARMADI, M.A. (2015) Analisis Lahan Kritis Kecamatan Bogor Timur, Kota Bogor, Jawa Barat. *Jurnal Teknologi*, 2 (26), pp. 27–37.
- [20] KUSUMA, D.W. (2017) Tinjauan Agroforestri dan Pendekatan Karakter Budaya Lokal dalam Pemulihan Lahan Kritis di Kabupaten Limapuluh Kota. *Jurnal Solum*, 14 (1), pp. 29–39.
- [21] SALAM, R. (2017) Local Wisdom of Indigenous People in Forest Management in Wangi-Wangi Island. *Walasuji*, 8 (1), pp. 113–128.
- [22] TAMBA, I.M. (2011) Kontribusi Kearifan Lokal terhadap Konservasi Lahan Kritis. *Agrimeta: Jurnal Pertanian Berbasis Keseimbangan Ekosistem*, 1 (1), pp. 1–15.
- [23] YUNUS, R. (2013) Transformasi Nilai-Nilai Budaya Lokal Sebagai Upaya Pembangunan Karakter Bangsa (Penelitian Studi Kasus Budaya Huyula di Kota Gorontalo). *Jurnal Penelitian Pendidikan*, 14 (1), pp. 65–77.
- [24] ANNAS, F.B. and WAHYUNI, E.S. (2014) Analisis Eksistensi Kearifan Lokal Huyula Desa Bongoime Provinsi Gorontalo.

Jurnal Penyuluhan, 10 (1), pp. 1–12.

[25] DAI, J. (2019) *Studi Kearifan Lokal Huyula Dalam Kegiatan Kelompok Tani di Kecamatan Bongomeme Kabupaten Gorontalo*. Skripsi, Universitas Muhammadiyah Gorontalo.

[26] NAWAI, F.A., ABAS, D., and SUMAR, W.T. (2019) Implementation of Huyula Culture-Based Character Education in The Industrial Revolution Era 4.0. In: *Proceedings of the 3rd International Conference on Education Innovation, Surabaya, August 2019*. Atlantis Press, pp. 371–378.

[27] HATU, R.A. (2018) *Problematika Tanah, Alih Fungsi Lahan dan Perubahan Sosial Masyarakat Petani (Cetakan ke I)*. Yogyakarta: CV. Absolute Media.

[28] DARWIS, R. (2018) The Synergy Between Restorative Justice Theory, Huyula and Pohala's Values in Overcoming Juvenile Delinquency Cases in Gorontalo. *IOP Conference Series: Earth and Environmental Science*, 175, 012135.

[29] KANDOWANGKO, N.Y., SOLANG, M., and RETNAWATY, E. (2020) Traditional Agro-Management Practices, Utilization and Nutritional Composition of Momala: A Local Maize Variety of Gorontalo, Indonesia. *Biodiversitas*, 21 (3), pp. 853–859.

[30] MUKRAMIN, S. and SUDARSONO. (2019) Revolusi Hijau Pada Perubahan Sosial Komunitas Tani (Studi Alat Produksi di Desa Tebongeano, Kecamatan Lambai, Kabupaten Kolaka Utara). *Walasuji*, 10 (1), pp. 47–56.

[31] BAGAS and RADJAB, M. (2019) Tergerusnya Gotong Royong di Desa Tadang Palie Kecamatan Ulaweng Kabupaten Bone. *Hasanuddin Journal of Sociologi*, 1 (2), pp. 116–126.

[32] HARIYANI, E. (2020) *Tingkat Perubahan Sikap Masyarakat Terhadap Budaya Gotong Royong di Kampung Sawit Permai*. Skripsi, Universitas Islam Negeri Sultan Syarif Kasim Riau.

[33] AMELIA, V., SINAGA, S., and BHERMANA, A. (2021) Developing Integrated Web-Based Information System for Land Resources to Support Agricultural Land-Use Planning (A Case Study of The Gunung Mas Regency, Central Kalimantan,

Indonesia). *Journal of Southwest Jiaotong University*, 56 (1), pp. 283–290.

[34] SURYANTO, H. and PRASETYAWATI, A.C. (2014) Model Agroforestri Untuk Rehabilitasi Lahan di Spoilbank DAM Bili-Bili Kabupaten Gowa. *Info Teknis Eboni*, 11 (1), pp. 15–26.

[35] MULYONO, D. (2010) Pengembangan Pertanian Budidaya Lorong (Alley Cropping) untuk Konservasi Lahan Kritis di Hulu Daerah Aliran Sungai (DAS) Cimanuk, Jawa Barat. *Jurnal Teknologi Lingkungan*, 11 (2), pp. 283–291.

[36] ASWANDI, PRATIARA, and KHOLIBRIMA, C.R. (2017) Pengembangan Agroforestry Macadamia dan Lebah Madu: Upaya Rehabilitasi Lahan Kritis di Danau Toba. *Policy Brief*, 11 (11), pp. 1–7.

[37] HIOLA, A.S. and PUSPANINGRUM, D. (2019) Pengetahuan, Sikap dan Praktek Konservasi Lahan Pada Agroforestri Ilengi. *Gorontalo Journal of Forestry Research*, 2 (1), pp. 40–53.

[38] RAHMAYANTI, S. (2012) The Community Responses Toward Agroforestry Pattern of Pulpable Species on Private Forest. *Mitra Hutan Tanaman*, 7 (2), pp. 39–50.

[39] ADI, R.N. and PRAMONO, I.B. (2018) Rehabilitasi Lahan Kritis dengan Pola Agroforestri dan Prediksi Erosinya di DTA Waduk Wonogiri, Jawa Tengah. In: *Seminar Nasional Geografi UMS IX 2018*, pp. 76–87.

[40] ALBASRI, PAEMBONAN, S.A., MILLANG, S., and MA'RUF, A. (2015) Agroforestry Design on Critical Land at Kayu Loe Village, Bantaeng District, Bantaeng Regency. *Ecogreen*, 1 (1), pp. 79–88.

[41] BUKHARI and FEBRYANO, I.G. (2019) Desain Agroforestry Pada Lahan Kritis (Studi Kasus di Kecamatan Indrapuri Kabupaten Aceh Besar). *Jurnal Perennial*, 6 (1), pp. 53–59.

[42] RACHMAN, E. (2012) Application of Agroforestry Model at Kadipaten Cathment Area, Tasikmalaya, West Java. *Mitra Hutan Tanaman*, 7 (2), pp. 65–70.

[43] FITRI, R. (2018) Prediksi Erosi Pada Lahan Petani Agroforestri di DAS Ciliwung Hulu, Provinsi Jawa Barat. *Jurnal Agrosains dan Teknologi*, 3 (1), pp. 13–18.

[44] MA'RUF, A. (2017)

Agrosilvopastoral as Planned Farming Systems Towards Sustainable Agriculture. *Jurnal Penelitian Pertanian Bernas*, 13 (2), pp. 81–90.

[45] TRIWANTO, J. (2011) Model Pengembangan Agroforestry pada Lahan Marginal dalam Upaya Peningkatan Pendapatan Masyarakat Sekitar Hutan. *Humanity*, 7, pp. 23–27.

[46] NARENDRA, B.H. and NANDINI, R. (2013) Peningkatan Produktivitas Komponen Agroforestri melalui Penggunaan Pupuk Organik Guna Menunjang Keberhasilan Rehabilitasi Lahan Kritis. In: *Prosiding Seminar Nasional Agroforestri, Malang*, pp. 151–156. Available from https://www.researchgate.net/publication/340678204_Peningkatan_produkktivitas_komponen_agroforestri_melalui_penggunaan_pupuk_organik_guna_menunjang_keberhasilan_rehabilitasi_lahan_kritis.

[47] SRIDJONO, H.H.H. and SUDIANTO, U. (2019) Rehabilitasi Sub DAS Kritis di Kawasan Pegunungan Muria Menggunakan Model Desa Koservasi dengan Memakai Pendekatan Sistem Agroforestri Berbasis Masyarakat. *Seminar Nasional Sains & Entrepreneurship*, 1 (1). Available from <http://conference.upgris.ac.id/index.php/snse/article/view/190>.

[48] ARNSTEIN, S.R. (n.d.) *A Ladder of Citizen Participation*. [Online] Available from: <https://lithgow-schmidt.dk/sherry-arnstein/ladder-of-citizen-participation.html> [Accessed 12/08/21].

[49] ITTA, D., HAFIZIANOR, HIDAYAT, R., RAMPUN, E.L.A., and ELMA, M. (2021) Strategy for Developing Dukuh Agroforestry System in Ati'im Village, Pengaron Sub-District, Banjar Regency, South Kalimantan Province, Indonesia. *Journal of Hunan University Natural Sciences*, 48 (2), pp. 1-9.

参考文:

[1] SARMINAH, S., KARYATI, KARMINI, SIMBOLON, J. and TAMBUNAN, E. (2018) 使用申贡(镰刀菌)和花生(花生)农林业系

统对退化土地进行恢复和土壤保护。生物多样性, 19 (1), 第 222-228 页。

[2] ROSYADA, M.、PRASETYO, Y. 和 HANI'AH. (2015) 使用加权法和 NDVI 算法确定临界土地水平(案例研究: 加朗葫芦子流域)。未浸测日志, 4 (1), 第 85-94 页。

[3] INDRIHASTUTI, D.、MURTIKASO, K. 和 TJAHJONO, B. (2016) 中爪哇肯德尔地区发展中关键土地和土地恢复建议的分析。塔塔洛卡, 18 (3), 第 141-156 页。

[4] ANNAS, M.R. (2019) 佩胡塔尼地区森林利益相关者单位(BKPH) 肯德尔摄政区卡利博德里区土地景观形态测量中的分区图和关键土地特征。论文, 三宝壟州立大学。

[5] KUBANGUN, S.H.、HARIDJAJA, O. 和 GANDASASMITA, K. (2014) 模型茂物、钱珠和须加文摄政区关键土地的空间危害。科学杂志环球, 16 (2), 第 149-156 页。

[6] AMALIAH, R., UMAR, H.R., 和 NSIAH. (2019) 使用地理信息系统技术识别和测绘关键土地(杰纳拉基康流域案例研究, 杰内伯朗子流域)南苏拉威西戈瓦摄政。联合国大学地理杂志, 2 (2), 第 112-120 页。

[7] WAHYUNINGRUM, N. 和 PUTRA, P.B. (2018) 土地评估以评估子流域拉瓦卡武的表现。流域管理研究杂志, 2 (1), 第 1-16 页。

[8] KARYATI 和 SARMINAH, S. (2018) 水土保持技术。三马林达-加里曼丹帖木儿: 穆拉瓦曼大学出版社。

[9] HERMAWAN, Y.、SULASTRI, S. 和 KUSUMAWARDANI, N.D. (2016) 农民团体在森林和土地恢复计划中的成功。期刊伊尔穆-伊尔穆克胡塔南, 1 (1), 第 61-68 页。

[10] OSOK, R.M.、TALAKUA, S.M. 和 SUPRIADI, D. (2018) 马鲁古省安汶市围峇都美拉盆地土地能力等级和土地恢复方向的确定。农业学, 7 (1), 第 32-41 页。

[11] NURIDA, N.L.、MULYANI, A.、WIDIASTUTI, F. 和 AGUS, F. (2018) 东加里曼丹省贝劳、帕塞尔和东库泰地区的农

林业潜力和退化土地恢复模型。土壤和气候杂志, 42 (1), 第 13-26 页。

[12] 基图尔, B.H. 和 BARGALI, S.S. (2013) 农林业的前景: 现在和未来。进步农业杂志, 4 (2), 第 91-94 页。

[13] ACHMAD, B.、SIMON, H.、DINIYATI, D. 和 WIDYANINGSIH, T.S. (2012) 农民对恰米斯摄政社区森林管理和功能的看法。朱纳尔·布米·莱斯塔里, 12 (1), 第 123-136 页。

[14] KASSIE, G.W. (2016) 农林业和土地生产力: 来自埃塞俄比亚农村的证据。有说服力的食品与农业, 2 (1), 第 1259140 页。

[15] RAJAGUKGUK, C.P.、FEBRYANO, I. 和 HERWANTI, S. (2018) 达马尔农林业管理中植物类型和种植模式的组成变化。期刊西尔瓦·莱斯塔里, 6 (3), 第 18-27 页。

[16] SUPARWATA, D.O. (2018) 森林边缘社区的观点计划农林业发展。林业社会经济研究杂志, 15 (1), pp. 47-62。

[17] WINATA, A. 和 YULIANA, E. (2012) 佩胡塔尼联合社区森林管理计划的林农参与程度。工商管理硕士社会与发展杂志, 28 (1), 第 65-76 页。

[18] SUDRAJAT, A.、HARDJANTO 和 SUNDAWATI, L. (2016 年) 农民参与可持续私人森林管理: 以库宁安区西库萨尔和卡南加村为例。期刊热带造林, 7 (1), 第 8-17 页。

[19] PAMUNGKAS, H.S.R. 和 KARMADI, M.A. (2015) 西瓜哇茂物市东茂物区关键土地分析。科技杂志, 2 (26), 第 27-37 页。

[20] 库苏马, D.W. (2017) 利马普鲁哥打区关键土地恢复的农林业概述和当地文化特征的方法。期刊索伦, 14 (1), 第 29-39 页。

[21] SALAM, R. (2017) 旺吉-旺吉岛原住民森林管理的地方智慧。瓦拉筋, 8 (1), 第 113-128 页。

[22] TAMBA, I.M. (2011) 地方智慧对关键土地保护的贡献。阿格里美达: 基于生态系统平衡的农业杂志, 1 (1), 第 1-15 页。

[23] YUNUS, R. (2013) 地方文化价值观转化为民族特色建设努力 (以哥伦打洛市呼尤拉文化为例)。教育研究杂志, 14 (1), 第 65-77 页。

[24] 安娜斯, F.B. 和 WAHYUNI, E.S. (2014) 哥伦打洛省邦戈伊姆村胡尤拉地方智慧存在分析。期刊彭尤鲁汉, 10 (1), 第 1-12 页。

[25] DAI, J. (2019) 胡尤拉在哥伦打洛县邦戈梅区农民团体活动中的地方智慧研究。斯克里普西大学, 穆罕默德迪亚戈伦塔洛大学。

[26] NAWAI, F.A., ABAS, D., 和 SUMAR, W.T. (2019) 工业革命时代 4.0 期呼尤拉文化型品格教育的实施。在: 第三届教育创新国际会议论文集, 泗水, 2019 年 8 月。亚特兰蒂斯出版社, 第 371-378 页。

[27] 哈图, R.A. (2018) 农民社区的土地问题、土地流转与社会变迁 (第一版)。日惹: 简历。绝对媒体。

[28] DARWIS, R. (2018) 恢复性司法理论、胡尤拉和波哈拉价值观在克服戈伦塔洛少年犯罪案件中的协同作用。眼压会议系列: 地球与环境科学, 175, 012135。

[29] KANDOWANGKO, N.Y.、SOLANG, M. 和 RETNAWATY, E. (2020) 莫马拉的传统农业管理实践、利用和营养成分: 印度尼西亚戈伦塔洛的当地玉米品种。生物多样性, 21 (3), 第 853-859 页。

[30] MUKRAMIN, S. 和 SUDARSONO. (2019) 农民社区社会变革中的绿色革命 (北科拉卡县兰拜区特邦吉亚诺村生产设备研究)。瓦拉筋, 10 (1), 第 47-56 页。

[31] BAGAS 和 RADJAB, M. (2019) 下一个哥通罗勇位于骨头, 乌拉旺区塔当帕列村。哈山丁摄政社会学杂志, 1 (2), 第 116-126 页。

[32] HARIYANI, E. (2020) 甘榜沙威柏迈社区对相互合作文化态度的变化程度。论文, 苏丹萨里夫·卡西姆国立伊斯兰大学廖内。

[33] AMELIA, V.、SINAGA, S. 和 BHERMANA, A. (2021) 开发基于网络的土地资源综合信息系统以支持农业土地利用规划 (加里曼丹中部古农马斯摄政的案例研究, 印度尼西亚)。西南交通大学学报, 56 (1), 第 283-290 页。

[34] SURYANTO, H. 和 PRASETYAWATI, A.C. (2014) 模型戈瓦摄政银行水坝比利比

利的土地复垦农林业。信息泰克尼斯·埃博尼, 11 (1), 第 15-26 页。

[35] MULYONO, D. (2010) 为保护西爪哇上西马努克流域 (DAS) 的关键土地而发展小巷种植农业。环境技术杂志, 11 (2), 第 283-291 页。

[36] ASWANDI、PRATIARA 和 KHOLIBRIMA, C.R. (2017) 澳洲坚果和蜜蜂农林业发展: 努力恢复多巴湖的关键土地。政策简报, 11 (11), 第 1-7 页。

[37] 希奥拉, A.S. 和 PUSPANINGRUM, D. (2019) 农林业土地保护的知识和态度和实践伊伦吉。戈龙塔洛林业研究杂志, 2 (1), 第 40-53 页。

[38] RAHMAYANTI, S. (2012) 社区对私有森林可浆化物种农林业模式的反应。米特拉胡坦塔纳曼, 7 (2), 第 39-50 页。

[39] ADI, R.N. 和 PRAMONO, I.B. (2018) 中爪哇圆切水库流域的农林业模式和预测侵蚀的关键土地恢复。在: 研讨会国家地理统一管理系统九 2018, 第 76-87 页。

[40] ALBASRI, PAEMBONAN, S.A., MILLANG, S. 和 MA'RUF, A. (2015) 万丹摄政万丹区加优洛伊村关键土地的农林业设计。生态绿色, 1 (1), 第 79-88 页。

[41] BUKHARI 和 FEBRYANO, I.G. (2019) 关键土地的农林业设计 (因德拉普里区案例研究, 亚齐勿刹区)。多年生学报, 6 (1), 第 53-59 页。

[42] RACHMAN, E. (2012) 西爪哇塔西玛拉亚卡迪帕滕集水区农林业模型的应用。米特拉胡坦塔纳曼, 7 (2), 第 65-70 页。

[43] FITRI, R. (2018) 西爪哇省上西里翁流域农林农地侵蚀预测。农业技术杂志, 3 (1), 第 13-18 页。

[44] MA'RUF, A. (2017) 农林牧草作为面向可持续农业的计划农业系统。伯纳斯农业研究杂志, 13 (2), 第 81-90 页。

[45] TRIWANTO, J. (2011) 模型边际农林业发展, 努力增加森林周边社区的收入。人性, 7, 第 23-27 页。

[46] 纳伦德拉, B.H. 和 NANDINI, R. (2013) 通过使用有机肥料来支持关键土地恢复的成功, 提高农林业组件的生产力。在: 举办研讨会全国农业林业, 玛琅, 第 151-156 页。可从

https://www.researchgate.net/publication/340678204_Peningkatan_produkktivitas_komponen_agroforestri_melalui_penggunaan_pupuk_organik_guna_menunjang_keberhasilan_rehabilitasi_lahan_kritis 获得。

[47] 斯里乔诺, H.H.H. 和 SUDJIANTO, U. (2019) 使用基于社区的农林业系统方法的保护村模型恢复穆里亚山区的关键子流域。研讨会国家科学与创业, 1 (1)。可从 <http://conference.upgris.ac.id/index.php/snse/article/view/190> 获得。

[48] ARNSTEIN, S.R. (日期) 公民参与的阶梯。 [在线] 可从: <https://lithgow-schmidt.dk/sherry-arnstein/ladder-of-citizen-participation.html> [访问 12/08/21]。

[49] ITTA, D.、HAFIZIANOR、HIDAYAT, R.、RAMPUN、ELA 和 ELMA, M. (2021) 南加里曼丹省班加尔县彭加伦分区阿提姆村杜库农林业系统发展战略, 印度尼西亚。湖南大学自然科学学报, 48 (2), 第 1-9 页。

西南交通大学学报

第 56 卷第 ... 期
2021 年 ... 月

JOURNAL OF SOUTHWEST JIAOTONG UNIVERSITY

Vol. 56 No. ...
..... 2021