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RESEARCH

Conservation Area Buffer Based Community Empowerment in Climate Change Mitigation

Fidan Safira
Research Assistant
School of Global and Strategic Studies, Universitas Indonesia
Email: fidansafira19@gmail.com
ORCID: 0000-0002-9107-041

Dr Evi Frimawaty
School of Environmental Science, Universitas Indonesia
Email: evi.frimawaty11@ui.ac.id
ORCID: 0000-0002-9016-4062

ABSTRACT

PURPOSE: This paper explores the intricate relationship between livelihoods and environmental change, focusing on the impacts of climate change and conservation initiatives. The study delves into the key assets that underpin livelihoods, namely human, natural, social, physical, and financial capital.

DESIGN/METHODOLOGY/APPROACH: This study used a qualitative research methodology, more specifically, a literature review, to examine how environmental changes impact community livelihoods.

FINDINGS: In response to these challenges, communities are adopting various strategies, including livelihood diversification, migration, and technological innovation. However, the effectiveness of these strategies is often influenced by factors such as access to resources, education, and social support networks.

ORIGINALITY/VALUE: Ultimately, addressing the complex interplay between livelihoods and environmental change requires a multi-faceted approach that involves policy-makers, researchers, communities, and other stakeholders. By understanding the underlying factors and implementing appropriate interventions, it is possible to build resilient and sustainable livelihoods in the face of environmental challenges.

KEYWORDS: *Buffer Area; Climate Change; Environmental Conservation; Livelihood Changes*

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INTRODUCTION

Livelihoods can be defined simply as the means to earn an income and survive. A livelihood is the set of skills, resources, and activities required to support oneself. Livelihoods establish material links between the environment, people, and social institutions. Livelihood is a very flexible term and can be used in areas such as livelihoods in rural or urban areas, livelihoods such as farming, raising livestock, or fishing, social distinctions such as livelihoods based on gender and age, livelihood pathways and livelihood trajectories, dynamic patterns such as resilient or sustainable livelihoods, and many more.

To date, many people have used nature as a source of livelihood. People can maintain their quality of life by utilising the various benefits offered by nature. Fedele *et al.* (2021) explain that nature is very important for everyone's existence and certain populations depend more on nature than others to meet basic needs; food, water sources, shelter, and entertainment can be obtained from nature. In order to achieve favourable livelihood outcomes that satisfy environmentally affected livelihood objectives, people employ livelihood strategies, which are methods of combining and utilising assets.

The literature review on livelihoods produced a wealth of references to approaches, perspectives, techniques, and frameworks. Livelihoods force people to degrade natural resources in search of livelihoods, income, and scarce jobs. In order to lessen reliance on natural resources and economic activities that harm natural systems, it is necessary to increase and diversify livelihood initiatives.

Various livelihood measures can be used as incentives for community-based nature conservation (Hanifa *et al.*, 2024). These can be direct incentives that encourage communities to use and manage certain natural resources more sustainably. However, ecological changes can occur in nature at any time, especially due to climate change triggered by increasing global warming; this can threaten and change the original livelihoods that people have.. There is also the risk of species extinction or irreversible biodiversity loss in ecosystems including forests, coral reefs, and Arctic regions (Lee *et al.*, 2023).

Therefore, livelihood is not only measured by its productive output but also by its resilience to shocks, seasonal changes, and trends. Shocks can include natural disasters, wars, and economic downturns. It is considered sustainable when a livelihood can withstand shocks and stresses, bounce back, and maintain or increase its resources, activities, and capacities in the present and future without compromising the natural resource base (Serrat, 2017).

These changes impact the availability of assets and opportunities to convert those assets into livelihoods. Under such conditions, communities must adapt existing strategies or develop new ones to survive. Ni'Mah *et al.* (2018) added that community participation, as a form of social capital, can contribute to extinguishing forest fires, thereby enhancing livelihoods. This capital is a prerequisite for creating or enhancing other capital in addition to financial capital. However, Yang *et al.* (2024) explained that to be able to make decisions related to livelihood changes, adaptation behaviour to climate change has different risk resilience and adaptation capabilities, even within the same climate change perception (Yudhista *et al.*, 2024).

To date, livelihood studies have focused on the context of policy initiatives, such as those aimed at reducing poverty. These initiatives seek to identify gaps in the system and barriers that make it difficult for the poor to plan sustainable livelihoods. In addition, research on this topic has mostly explored the impact of ecological change on local livelihoods as a case study and considered the concept of sustainability (Yang *et al.*, 2024). In addition, nature conservation activities that have an impact on livelihood changes were found, for example, changes in rural women's livelihood outcomes while working in the fish processing industry.

Research on livelihoods and environmental change is an important area of study, especially given the impacts of climate change. This research aims to map scientific publications that examine livelihood changes due to nature conservation activities using a systematic literature review method. This research is closest to discovering how changes in people's livelihoods occur due to environmental and climate changes, and maps the main livelihoods, conditions that drive change, alternative livelihoods, impacts, and recommendations that can be made. This study is important for several reasons: stakeholder power in land management, public understanding of climate change and the environment, and academics' ability to identify future research subjects.

METHODOLOGY

This research employed a qualitative research methodology, specifically a literature review, to investigate the impact of environmental changes on community livelihoods. This approach was selected as it aligns with the study's objective of understanding how environmental shifts have influenced livelihood strategies. The methodology involved a systematic review of scholarly literature, primarily focusing on peer-reviewed journal articles and books. Reputable databases such as Scopus and digital libraries were utilised to ensure the reliability and credibility of the information sources. A meticulous search process was undertaken to identify relevant studies that addressed

the research question. To analyse the collected data, the qualitative data analysis framework involves four stages:

1. **Data Collection:** This stage involved systematically gathering relevant literature from various sources.
2. **Data Reduction:** The collected data were analysed and categorised to identify key themes and patterns.
3. **Data Display:** The findings were presented in a clear and concise manner, using tables, charts, or narratives.
4. **Conclusion Drawing:** Based on the analysis, conclusions were drawn regarding the impact of environmental changes on livelihoods and potential strategies for adaptation and mitigation.

RESULTS

This section explains the results of the research based on the research objectives. This includes the initial conditions of livelihoods, conditions that encourage livelihood changes, and alternative forms of livelihoods.

Nature's Main Livelihoods

Nature conservation has become a necessity in the face of worsening climate change, rampant pollution, and the depletion of natural resources. The impacts of this environmental crisis are far-reaching, affecting not only nature but also human health, economies, and social structures. Activities required to meet the needs of life are categorised as livelihood activities that utilise natural resources. Farming is the most discussed form of livelihood (Fedele *et al.*, 2021; Shaffril *et al.*, 2019). People farm to meet their daily food needs by growing sorghum, maize, watermelon, and beans; some also farm for trade, such as cotton, timber, and coconut (Shaffril *et al.*, 2019). Early livelihoods were fishing (Brattland *et al.*, 2019; Shaffril *et al.*, 2019), such as river fishing (Eneh, 2024). This is followed by hunting animals in the forest (Eneh, 2024) and forest timber management (Soriano *et al.*, 2017).

However, the literature emphasises that long-term ecological integrity and balance between land, people, livelihood options, and sustainability are challenges for environmental conservation and climate change activities. The case study countries come from developing countries such as Indonesia, East Africa, Bangladesh, and China. Table 1 gives some trends in livelihood changes in Bangladesh.

Table 1 Trends in Source of Livelihood in Bangladesh

Livelihood Activity	Past	Present	Future
Household Maid	Rare	Common	Increase
Paddy Husking	Common	Increase	Decrease
Boiling Paddy	Common	Increase	Decrease
Day Labour	Rare	Increase	Increase
Rickshaw Pulling	Common	Increase	Increase
Agriculture	Common	Increase	Decrease
Fishery	Common	Decrease	Decrease
Shrimp Cultivation	Rare	Increase	Increase

Source: Hossain, 2012

In Bangladesh, there is a notable shift from traditional agricultural activities such as paddy cultivation and fishing towards non-agricultural livelihoods, such as household work, rickshaw pulling, and day labour. Shrimp cultivation has emerged as a significant livelihood option, indicating a growing trend in aquaculture.

In China, there is some diversification but the overall trend suggests a relatively stable agricultural livelihood pattern; there is a slight decrease in the proportion of the population engaged in non-agricultural livelihoods (Table 2). It is important to note that these are specific trends observed in particular regions and may not represent the entire country's livelihood dynamics. Further research and analysis are needed to understand the broader picture of livelihood changes in these countries and identify the factors driving these shifts. But, these data do not represent the livelihood changes of the entire country, only a few foci from the literature.

Table 2 Trends in Source of Livelihood in Bangladesh

Agricultural Diversification Index	Decrease	No Change
No change in agricultural livelihood	0.118	0.110
No change in part-time agricultural livelihood	0.192	0.177
No changes in non-agricultural livelihood	0.131	0.102
Transition towards agricultural livelihood	0.130	0.121

Source: Zhu *et al.*, 2022

Finally, the intricate relationship between human livelihoods and the environment is a complex and dynamic one. As climate change and environmental degradation continue to intensify, it becomes increasingly important to understand the impacts on people's livelihoods and explore strategies for adaptation and resilience. However, the degradation of these resources, coupled with climate change, poses significant challenges to people's ability to earn a living and meet their basic needs.

Causes of Livelihood Changes

The results of this study identified the conditions that led to changes in community livelihoods related to the utilisation of natural resources or the triggering events. These fall into three categories: climate change adaptation, nature conservation activities, and land use change. Climate change adaptation (Shaffril *et al.*, 2019; Inman *et al.*, 2020) includes changes in forest cover, changes in river depth, channel width, and riparian vegetation cover type on the Ekulu River in Enugu, Nigeria (Eneh, 2024), and environmental and socio-ecological changes (Fedele *et al.*, 2021; Brattland *et al.*, 2019).

The World Meteorological Office (WMO, 2023) states that the worldwide mean temperature anomaly for each of the datasets for 2023 (data up to October) linked to four distinct baselines. The uncertainties displayed are the standard deviations of those available multiplied by 1.645 to give a 90% uncertainty range for the three contemporary baselines (Table 3).

Table 3 Annual Global Mean Temperature Anomalies (Relative to 1850-1900) from 1850 to 2020

Period	1850-1900	1961-1990	1981-2010	1991-2020
HadCRUTS	1.40	1.05	0.71	0.52
NOAA GlobalTemp	1.37	0.99	0.68	0.50
GISTEMP	1.39	1.02	0.70	0.51
ERA5	1.43	1.07	0.74	0.55
JRA55	1.39	1.02	0.70	0.52
Mean of five datasets	1.40±0.12	1.03±0.04	0.71±0.03	0.52±0.03

Source: WMO, 2023

The data highlight a pronounced trend of global warming, especially over the past few decades. This temperature increase is predominantly attributable to anthropogenic activities, notably the combustion of fossil fuels that emit substantial quantities of greenhouse gases into the atmosphere. The impacts of this warming are extensive, encompassing sea-level rise, an increased frequency and severity of heatwaves, and alterations in precipitation patterns. It is important to emphasise that these temperature deviations are measured relative to the 1850-1900 reference period. Although the magnitude of the absolute temperature rise may appear modest, its ramifications for the Earth's climate system and human society are profound.

Nature conservation activities include land conservation areas (Soriano *et al.*, 2017; Ray *et al.*, 2023) and animal conservation. Community development programmes, such as population, health, and environment (PHE) projects (Sellers, 2019), Payment

for Ecosystem Services (PES), market-based policy instruments (Wang *et al.*, 2021), donor-sponsored community forestry programmes using biodiversity conservation, sustainable livelihoods projects, and land use change (Charnley, 2023).

Research by Ardikoesoema and Karuniasa (2025) explained that factors leading to livelihood change are categorised according to four dimensions of livelihood outcomes:

1. conservation;
2. economic;
3. governances; and
4. social.

The findings of this study mostly accommodate the first dimension, conservation. This is both in terms of the impacts of climate change and the environment, as well as conservation programmes run by various actors. Lax and Krug (2013) identified that there are five interrelated categories of project attributes for a programme to be successful:

1. project design and implementation;
2. stakeholder engagement;
3. policy context;
4. monitoring and evaluation; and
5. technical capacity.

This is in line with Sellers' (2019) findings that population, health, and environment (PHE) projects can produce value-added outcomes, including changes to established gender roles as well as time replacement and new income investments into sustainable livelihood activities, particularly among women.

Sellers' (2019) study states that these are changes to gender roles, time substitution, income effects and improved community co-operation, but the programme of population, health, and environment (PHE) projects can produce value-added outcomes, including changes to established gender roles as well as time replacement and new income investments into sustainable livelihood activities, particularly among women. Several emergency environmental change conditions were then identified, such as deforestation and illegal mining, changes in agricultural areas, natural resource grabbing, and infrastructure development failure (Charnley, 2023). This has resulted in a decrease in people's income (Soriano *et al.*, 2017) and limited sources of food supply.

These strategies should be translated into community-wide measures that lower risks and strengthen the ability of affected people to respond to and adapt to the effects of climate change (Pangestu and Habib. 2024). Shaffril *et al.* (2019) mapped five categories affected by climate change: livelihood diversification, social and physical

infrastructure, awareness-knowledge-experience, conservation, and law enforcement. Furthermore, climate and ecological changes have altered life and natural livelihood support systems, leading to socio-cultural, economic, and environmental challenges and vulnerabilities. Eneh (2024) found that the presence of anthropogenic waste activities has multiplied over the years. With the discharge of waste generated by the increasing population into the Ekulu River, the depth of the river has decreased, the width of the river channel has narrowed, and the type of riverbank vegetation cover has changed. The study also mapped the causes and effects of lowering depth in River Ekulu because of climate change.

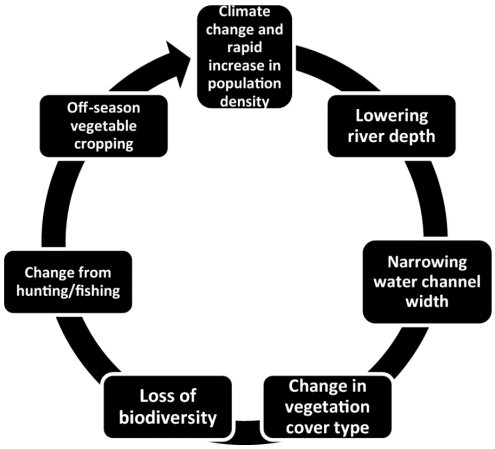

Figure 1 Livelihood adaptation to changes in River Ekulu depth because of Climate Change

Source: Eneh, 2024

Environmental change and its impacts on human livelihoods represent an urgent global concern. With the accelerating pace of climate change and the ongoing depletion of natural resources, communities across the globe are increasingly vulnerable to severe economic and social challenges. Addressing these threats necessitates the adoption of sustainable resource management, the diversification of livelihood options, and the strengthening of social and institutional support systems to enhance resilience in the face of environmental pressures.

Livelihood Alternatives

Alternative livelihoods are often used in conservation programmes to reduce the impact of local communities on threatened resources. Livelihood outcomes evolve

as communities respond to certain types of social-ecological change; these can include triggering events or interventions that catalyse people to take action. There are seven types of alternative livelihoods resulting from ecological change and nature conservation activities:

- agriculture that is not limited to farming (Inman *et al.*, 2020; Wang *et al.*, 2021; Charnley, 2023; Eneh, 2024), such as eucalyptus, coffee, khat, nuts, and wood (Soriano *et al.*, 2017);
- animal husbandry (Charnley, 2023);
- buying and selling (Shaffril *et al.*, 2019; Wang *et al.*, 2021);
- professionals in companies (Shaffril *et al.*, 2019; Wang *et al.*, 2021);
- handicrafts;
- tourism; and
- hunting.

Several suggestions have been made to enable communities to make a living and endure despite the ever-changing natural and environmental landscape. This research maps out the following categories: strategy change, immigration, increasing financial capital, and investment (Charnley, 2023), as well as coaching and mentoring from experts and government (Sellers, 2019). In line with this, Khan *et al.* (2020) stated that three main strategies are used to survive: agricultural intensification, livelihood diversification, and migration. All three are relevant to the results of this research analysis, where agricultural intensification is an alternative livelihood recommendation listed. Moreover, Brattland *et al.* (2019) found that local adaption tactics during challenging years included: (1) "riding out the storm", (2) obtaining other jobs, and (3) requiring a larger boat to fish outside the fjord.

Strategic changes to the first livelihood source were the most frequently mentioned recommendation. Therefore, livelihood-strengthening options through adaptation and collaboration (Sellers, 2019) can be done. Eneh (2024) introduced a new boat quota system to significantly change the adaptive capacity and adaptation strategies of coastal Sami households. Brattland *et al.* (2019) says that in the context of declining fish catch, it is necessary to invest in macro-algae regrowth to support cod nursery areas and increase carbon sequestration. Investing to enter the closed fishery or finding alternative occupations to combine with non-quota regulated fisheries were the remaining options.

Charnley (2023) assessed livelihood investments as an effective incentive-based conservation strategy for community forestry initiatives, and in what context; also, once external project support ends, whether community forestry based on this incentive

strategy persists. The results showed that livelihood and infrastructure investments have often been used in incentive-based conservation projects. However, their role as incentives for community forestry in Africa, the contexts in which they are most effective, and whether they persist as conservation incentives once projects end, are poorly documented.

As environmental pressures intensify, communities must be empowered to adopt resilient strategies that ensure their long-term well-being. Key strategies for promoting sustainable livelihoods include:

1. encouraging communities to explore a range of livelihood options, reducing reliance on single-income sources, and increasing resilience to shocks;
2. investing in education, training, and skill development to enhance human capital and enable individuals to adapt to changing circumstances;
3. promoting sustainable practices, such as agroforestry, conservation agriculture, and eco-tourism, to conserve natural resources and reduce environmental degradation;
4. implementing social protection programmes to provide financial support and safety nets for vulnerable communities; and
5. creating enabling policy environments that support sustainable livelihoods, including access to land, credit, and markets.

DISCUSSION

Livelihood changes caused by natural ecological changes and climate change are not easily felt by people who depend on nature all their lives. The availability of supportive assets is needed to encourage change. As previously stated by DFID (1999), this is related to five categories of assets in livelihoods: human, natural, social, physical, and financial capital (Figure 2).

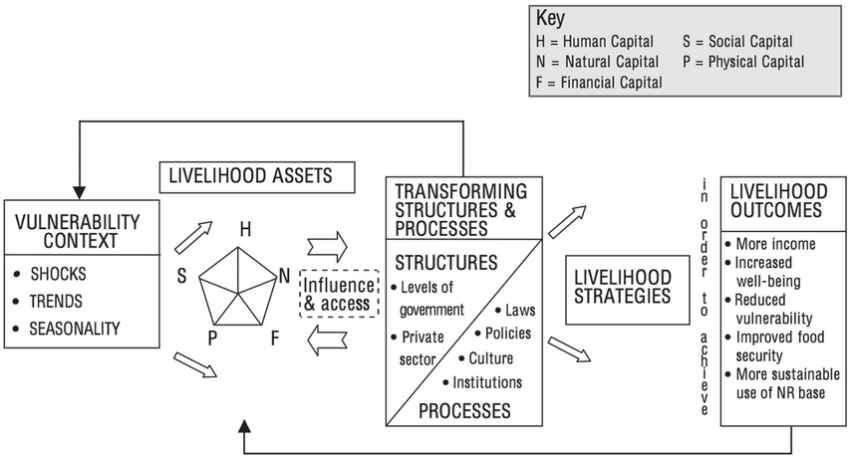

Figure 2 Livelihood Resources

Source: DFID, 1999

Figure 2 illustrates a model that is commonly used in livelihood studies, particularly in the context of environmental and social change. The model attempts to show how various factors interrelate and influence each other in shaping a person's or community's livelihood. The arrows in the figure indicate the reciprocal relationship between the various components. For example, an increase in social capital can improve access to information and business opportunities, which in turn can increase income. Conversely, natural disasters can damage physical capital and reduce income, thereby increasing vulnerability. Figure 2 presents a conceptual framework that is useful for understanding livelihood dynamics. By understanding how various factors are interrelated, we can design more sustainable and inclusive development strategies.

By understanding and strengthening these five types of capital, individuals and communities can improve their livelihoods and resilience to shocks and stresses.

For communities that depend on natural wealth and resources, natural capital is the main asset and there is potential to increase income from existing livelihood activities by reducing dependence on forest resources (Soriano *et al.*, 2017). Furthermore, the availability of other assets, such as human assets, also needs to be ensured; these include knowledge, skills, and the ability to work outside of fields that utilise natural resources. Communities that use nature as their main source of income would have a high level of experience in crop farming. Physical assets, such as road infrastructure, livestock infrastructure, etc., are also key assets in livelihood change, especially for those who are starting a particular business. In addition, social assets indicate the involvement

of individuals in more social groups. This leads to higher access to information, business opportunities, social power, influence and financial assets, which can provide opportunities to choose commercial strategies. Limited social support systems have a long-term negative impact on rural households' social capital.

The basic asset that the household starts with to execute a livelihood strategy is a financial asset. Mostly, the amount of money affects borrowing and credit availability from official and informal sources. Financial assets are the most significant assets in facilitating the implementation of livelihood strategies that do not utilise environmental resources. Furthermore, Azumah *et al.* (2023) also mentioned that financial capital must be productive and survive due to the high rate of land acquisition. However, based on the research results of Azumah *et al.* (2023), capital has been reduced due to ecological changes. This is an indication that farmers must engage in various income-generating activities to increase their financial assets.

Referring to DFID's (1999) asset classification conceptual framework (Table 4), although the five categories of assets are important for livelihood sustainability, they can be adapted to individual and environmental conditions. To ensure sustainable livelihoods, a balance of various assets is crucial. Human capital, including knowledge and skills, is essential, especially for transitioning to alternative livelihoods. Physical assets such as infrastructure and equipment support livelihood strategies, while social capital facilitates access to information and resources. Financial capital, although vital, can be constrained by ecological changes. Moreover, government and community efforts are essential to promote sustainable livelihoods. Raising awareness about climate change, its impacts, and mitigation strategies is crucial. Policy interventions that support sustainable agriculture, improved access to resources, and community-based natural resource management can contribute to resilient livelihoods. Soriano *et al.* (2017) showed that the most needed assets for people who earn income from forests and livestock are local ecological knowledge assets, natural assets, and financial assets. Meanwhile, for people who make income outside agriculture, physical assets, human capital, and social capital are important.

Table 4 Asset Capital Classification

Asset	Description
Human Capital	Skills, knowledge, health, and ability to work
Social Capital	Social resources, including informal networks, formal group membership, and trust relationships that facilitate co-operation and economic opportunities
Natural Capital	Natural resources such as land, soil, air, water, forests, and fisheries
Physical Capital	Basic infrastructure, such as roads, water, and sanitation, schools, ICT; and production goods, including tools, livestock, and equipment.

Asset	Description
Financial Capital	Financial resources, including savings, credit, and income from employment, trade, and remittances
Mean of five datasets	1.40±0.12

Source: DFID, 1999

However, rather than that, livelihood changes caused by natural, ecological, and climate changes require early mitigation efforts. Eneh (2024) states government and residents around the river need awareness of climate change, its causes and impacts, and ways forward in terms of policies and practices. Emphasis should be placed on the impact on livelihoods and the urgent need for environmental conservation policies and their implementation. Along the same lines, Inman *et al.* (2020) explained the need to institutionalise climate change awareness campaigns at the community level to disseminate climate change information.

Understanding of the complex factors that shape livelihood strategies, particularly the role of various asset types, is needed. By leveraging human capital, natural capital, social capital, physical capital, and financial capital, communities can build resilience and adapt to changing environmental conditions. However, it is crucial to acknowledge that the availability and accessibility of these assets can be constrained by various factors, including poverty, inequality, and policy limitations. Therefore, it is essential to implement policies and interventions that promote equitable access to resources, support sustainable livelihoods, and empower communities to adapt to climate change. Future research should continue to explore the impacts of environmental change on diverse communities, identify effective adaptation strategies, develop policies that promote sustainable livelihoods, explore the role of technology and innovation in sustainable livelihoods, and assess the long-term impacts of various adaptation and mitigation strategies. By addressing these challenges, we can work towards a more equitable and sustainable future for all.

CONCLUSIONS

Environmental conservation significantly impacts livelihoods, especially for people who depend on natural resources for subsistence. This essay examines the several ways that livelihoods are impacted by climate change and the methods people use to adjust to and deal with these changes. For many people, especially in rural areas, main sources of income are agriculture, fishing, hunting, forestry, and raising animals; these are primary livelihoods and are directly touched by alterations in climate and environmental factors. The three main factors causing livelihood changes are land use,

conservation efforts, and climate change. Climate change may lead to decreases in agricultural productivity, changes in fish populations, and disruptions to traditional hunting and gathering practices. Conservation initiatives such as the creation of protected areas may limit access to natural resources that sustain human lifestyles. Deforestation and urbanisation are two examples of land-use changes that might result in a reduction in possibilities for livelihood.

People will adopt various livelihood alternatives in response to changes in their environment and the availability of natural resources. They may engage in multiple livelihoods, such as agriculture, trading, or handicrafts, to reduce their reliance on a single source of income, and in some cases, may migrate to new areas in search of better livelihood opportunities. People may also move to non-agricultural sectors, such as construction or manufacturing, for employment. Engaging in sustainable resource management, some communities are adopting sustainable resource management practices to protect their natural resources and ensure their long-term availability.

Supporting this, several things can be done with support for adaptation and diversification. Governments and organisations should provide support for communities to adapt their livelihoods to the changing climate and diversify their income sources. Investments in sustainable resource management practices can help to protect natural resources and ensure their long-term availability for livelihoods. Facilitating collaboration and knowledge exchange between communities, researchers, and policy-makers can help to develop effective strategies for adapting livelihoods to climate change.

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BIOGRAPHY

Fidan Safira is a research analyst in the field of social science, public policy, and information science. She works as a senior researcher at Jakarta Smart City, Jakarta Provincial Government, Indonesia. Fidan earned a master's degree from Urban Development Studies, School of Global and Strategic Studies, Universitas Indonesia. Fidan is also a research assistant in the School of Global and Strategic Studies Universitas Indonesia.

Dr Evi Frimawaty is a senior lecturer at the School of Environmental Science, Universitas Indonesia. She has a PhD from Universitas Indonesia and a Masters' degree from the Institute Pertanian Bogor, Indonesia. Her research interests are in environmental issues, environmental conservation, and the energy-food-water nexus. Her research extensively explores the interactions between humans and the environment as an integrated and complex system.