

Agricultural Intensification in Nepal's Mid-Hills: Linking Improved Livelihoods with Environmental Degradation

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ABSTRACT: *In Asia, agricultural growth has arisen as a significant topic of discussion in terms of improving livelihoods and reducing environmental damage. Until the mid-twentieth century, shifting cultivation, the initial stage of agricultural development, was the most widely used agricultural method in South and Southeast Asia. This study examined agricultural intensification in Nepal's mid-hills from the viewpoints of livelihood and the environment. Agricultural intensification has benefited the economy, food security, job possibilities, decision-making, labor division, including local institutions including leadership. However, as greenhouse gas emissions have increased, soil deterioration has intensified. In addition, the possible links between agricultural intensification and degradation, as well as long-term marginalization routes, are discussed. However, the institution's catalytic function and farmers' perceptions of intensification are both critical. Sustainable agricultural intensification guided by strong institutional structures is suggested to guarantee socioeconomically and ecologically sound output.*

KEYWORDS: *Agricultural intensification, greenhouse gases, institution, livelihood, soil degradation.*

1. INTRODUCTION

It entails simple tools and methods, minimal inputs, and subsistence-level output and consumption, all of which were insufficient to sustain the increasing population as well as their subsistence requirements. The situation was much worse in emerging nations, as colonial powers made relatively little investment in food production systems. Their circumstances deteriorated dramatically after independence. Shifting farmers were under pressure to shorten the fallow time due to rising population and government control over common property resources. Meanwhile, shifting farmers are entitled to a better quality of life that was previously unavailable due to the poor returns given by their farming practices. As a result of these conditions, farmers have been driven to seek out more productive agricultural systems, which might have resulted in famine and malnutrition throughout Asia. The "crisis" was recognized by the United States President's Science Advisory Committee, which issued a report in 1967. The study found that "the size, intensity, and length of the global food issue are so enormous that mastering it would require a huge, long-range, creative endeavor unparalleled in human history." As a result, the Ford Foundation and Rockefeller Foundation collaborated to create the worldwide agricultural research system, which allows scientific discoveries to be shared. High yielding cultivars, increased use of chemical fertilizers, irrigation, and other chemical inputs all contributed to Asia's exceptional output in the late 1960s. The term "Green Revolution" was created to describe such a drastic shift from famine to dramatically enhanced yields[1], [2].

The purpose of this article is to examine and connect agricultural intensification in Nepal's mid-hills from a livelihood and environmental viewpoint. Improvements in livelihood are measured by economic, social, and institutional indicators, whereas environmental degradation is measured by soil degradation and greenhouse gas emissions. Agricultural intensification is linked to the degradation or marginalization thesis in this article, which is discussed.

1.1. Nepal's Agriculture Development Evolution:

From the beginning of the 11th century until the 19th century, shifting agriculture was widely used in Nepal. It was almost completely replaced by permanent agriculture by the end of the nineteenth century. There were no significant efforts to start systematic economic growth under the Rana administration until 1930. In 1937, the 'Udyog Parishad' (Development Board) was established with the primary goal of promoting the growth and expansion of agricultural, industrial, and commercial activities in the nation. Agricultural Council was one of the first specialized development organizations to follow down the Development Board. It was founded with the goals of increasing farming methods, irrigation, and the implementation of agricultural development programs. During this period, the Food and Agriculture Organization (FAO) sent a team. Following the establishment of a democratic political system in 1951, the first U.s Agency For international Development (USAID) started providing aid[3].

1.2. Indicator Of The Economy:

Several studies conducted in the mid-hills indicate that the farmers' economies have improved as a result of agricultural intensification. Farmers in the Khani Khola region of Dhading district, for example, have improved the soil by cultivating vegetables. Over the past 15 years, this has resulted in a doubling of family income. Both cereal-based and vegetable-based cropping patterns have shown yield increases of 41% and 61%, respectively. When compared to cereal crop production, the net revenue from vegetable cultivation is considerably higher[4].

1.3. Indicator of Social Change:

Food security is a crucial social factor of one's well-being. Food security has increased considerably in Nepal's mid-hills, mostly among the poor and disadvantaged populations, as a result of the transition from subsistence grain cultivation to intensive vegetable-based farming. Growers of vegetables have boosted their farm revenue by selling crops at neighboring markets, allowing them to purchase food and other household goods from the same market. According to reports, just half of the farmers who depend on cereal-based farming patterns can satisfy their food needs for half of the year. However, over half of the farmers have improved their family income as a result of intensive vegetable growing in order to prevent food shortages. As a result of agricultural intensification, the amount of food produced increased, food security improved, and farmers were able to eat more nutritious food by including more green vegetables in their diet.

After the intensification process was implemented, the decision-making processes at the home level were altered. The household head's autonomous decision-making process has been replaced with a consensus-based decision-making process including all family members. The way people make decisions has evolved, especially when it comes to choosing crop types, adopting new technology, and selling agricultural products. In Nepal, there is a definite distribution of work and duties amongst family members. Ploughing, digging, threshing, and selling are mainly done by male members. Female members assist in agricultural planting, manure application, and harvesting. The transition from cereal-based to vegetable-based agriculture has altered local social norms and eliminated the previous division of work between men and women, as well as between caste systems. Both men and women work on land preparation, planting, fertilizer purchase and application, and crop harvesting. Both of them are engaged in the sale of their farm products on the market as well as the purchase of home consumables and vegetable inputs. Such marketing efforts assist them in obtaining access to pricing information, exposing themselves to other communities and interacting with them, increasing their agricultural goods' bargaining power, and enabling them to participate in the market[5], [6].

1.4. Indicator for Institutions:

Institutional indicators, such as local institutions and leadership, are indications of improved livelihood. Conservation and Development Groups (CDGs), Community Forest User Groups (FUGs), and Women Groups are examples of community-based local institutions in the area (WGs). CDGs are focused on integrated farmland and resource management, with all member families attending a regular meeting to share their agricultural experiences. Such social assets are energizing.

1.5. Soil degradation and greenhouse gas emissions are the other side of agricultural intensification:

Farmers in the mid-hills began embracing new agricultural techniques and sophisticated inputs as a result of globalization and industrialization, which were virtually unknown to most illiterate farmers before. They adopted after seeing others do so. In addition, insufficient training and a lack of effective controls surrounding subsidy programs made contemporary inputs cheaper, resulting in their overuse.

1.6. Degradation of the soil:

Soil degradation refers to the loss of soil quality as a result of human activity. It is primarily characterized by three processes: physical crusting, compaction, and erosion; chemical nutrient depletion, leaching, acidification, and salinization; and biological depletion of soil organic matter and decrease in soil biodiversity. Soil erosion, nutrient depletion, water quality, and soil organic matter depletion are among issues raised by agricultural intensification. These issues are most pressing in Nepal's mid-hill areas, where the land has been extensively farmed and the bulk of the people relies on it to meet their fundamental requirements. In the mid-hills, soil erosion is a major issue. The problem of rapid erosion arose from a variety of studies and impressionistic writings claiming that by the year 2000, Nepal will have sunk under the Ganges, and that the Nepalese hill farmer was to blame[7].

1.7. Emissions of greenhouse gases:

The most important greenhouse gases produced by agricultural activities are methane (CH₄) and nitrous oxide (N₂O). Agricultural intensification, via a number of mechanisms, contributes directly to emissions. However, the study will

concentrate on emissions from agricultural intensification, including chemical fertilizer input levels, tillage frequency, number of crops per year, and cultivation methods. The two biological processes of nitrification and denitrification generate the majority of the N₂O in soils. N₂O was produced in soils by nitrifying bacteria oxidizing ammonium to nitrate under aerobic circumstances or by denitrifying microbes reducing nitrate under anaerobic conditions. When soils are treated with ammonium or ammonium-producing chemical fertilizers, the process is expedited. Similarly, enhanced soil respiration resulting in anaerobic conditions has been shown to boost net CH₄ generation in the high-input cropping system. Because fertilized soil had a higher concentration of NH₄⁺, methane oxidation was lower in fertilized soil than in unfertilized soil. Soil tillage exposes the soil surface, releasing carbon dioxide that had been stored in soil particles[8].

1.8. Nepalese Agriculture and the Suspended Climate:

There are various indications that Nepal's climate is changing. During the past 32 years, the temperature has risen by 1.8 degrees Celsius, with an average annual increase of 0.06 degrees Celsius. The rainfall pattern is also seen as unreliable, with greater rainfall intensities and fewer wet days. Without irrigation, the emission of methane from a rice crop fertilized with 50% nitrogen fertilizer was 49 kg per hectare, which is very significant. Early monsoons caused a rain shortfall in Nepal's plains (Terai) between 2005 and 2006, reducing agricultural output by 12.5 percent on a national scale. Due to a lack of rain, about 10% of the country's arable land was left fallow, while a flood in the mid-western Terai reduced output by 30% in the same year. The increased number of crops each year is aided by the early maturity of the crops as a result of rising temperatures[9].

1.8.1. Insecurity in the Food Supply:

Agriculture will be impacted mainly by changes in temperature, rainfall patterns, and growing season. The potential of a reduction in agricultural production, which may lead to food insecurity, is a major worry for developing nations as a result of climate change. Some crop types may suffer as a result of the changing climate. Specific effects may be difficult to predict; nevertheless, most studies found that fauna and plants are very sensitive to minor climatic changes. Global warming, for example, tends to increase the duration of the possible growing season, allowing for earlier planting, maturity, and harvesting, as well as the possibility of growing two or more crops in the same season in the middle and higher latitudes. However, additional crops need greater tilling of vulnerable ground in the mid-hills, resulting in soil deterioration. The usage of chemical fertilizers also results in the release of greenhouse gases, which has an impact on the unique weather pattern.

1.8.2. Health Concerns:

Agricultural intensification provides food in bigger quantities and with a greater variety of flavors. This scenario improves food supply for farmers at reduced prices, resulting in food access. On the one hand, agricultural intensification may decrease foodborne disease, but on the other hand, production may suffer as a result of atypical temperature and rainfall patterns. In the mid-hills, where the soil is extremely unstable, the situation may be even worse. Overuse of agrochemicals contaminates soil, air, water bodies, or even plants in various ways. Human health will suffer as a result of direct and indirect exposure to fertilizers and pesticides. The economic loss caused by farmer illness is a source of worry. Many outbreaks of water/vector-borne illnesses have occurred as a result of irrigation canals, ditches, and other similar structures.

1.9. Problems with Migration:

As previously mentioned, there has been evidence of increased soil erosion, nutrient depletion, and soil acidity in the mid-hills. Nitrogen, phosphorous, sulphur, and other micronutrients are in short supply in the soils. As a result, the mid-hill region's soil fertility is insufficient to meet the increasing population's need for greater agricultural output. Marginal families become less able to obtain the labor or capital inputs needed to manage changing soil conditions, and as a result, individuals are more likely to consider abandoning the land and relocating to a more fruitful location[10].

2. DISCUSSION

Agricultural development has been a hot issue in Asia in terms of boosting lives and minimizing environmental harm. Shifting cultivation, the first stage of agricultural growth, was the most commonly employed agricultural technique in South and Southeast Asia until the mid-twentieth century. Simple tools and techniques, limited inputs, as well as subsistence-level production and consumption were all inadequate to support a growing population and their sustenance.

Tillage, fertilizer inputs, and irrigation, which are all significant aspects of agricultural intensification, increase CH₄ and N₂O emissions from agricultural soil. To get a better understanding of the effects of agricultural intensification, more comprehensive information about the connections between intensive agriculture, environmental deterioration, and potential pathways to marginalization is being produced. Government entities or market processes, for example, play a critical role in adopting laws that should enable and encourage environmental sustainability based on the local resources and knowledge.

An approach to sustainable agricultural intensification might be a good place to start if you want to find a middle ground that meets both your demands and the requirements of the environment.

3. CONCLUSION

Because agriculture is Nepal's primary profession, the country's development plans have centered on boosting agricultural output in order to satisfy the country's rising population's food demands. Farmers in the mid-hills are increasingly adopting intensification via the use of chemical fertilizers, pesticides, the introduction of Agro-equipment, and the planting of more crops each year. Agricultural intensification improves livelihood security through improving economic circumstances, social factors such as food security, job opportunities, and enhanced division of labor; and improving institutions.

However, intensification has the potential to negatively impact soil degradation via soil erosion, nutrient loss, and soil acidification, as well as climate change through greenhouse gas emissions. Tillage, fertilizer inputs, and irrigation, all important components of agricultural intensification, enhance CH₄ and N₂O emissions from agricultural soil. More detailed information of the links between agricultural intensification, environmental degradation, and possible routes to marginalization is developed in order to have a better grasp of the consequences of agricultural intensification. Institutions such as government institutions or market processes, for example, play an important role in enacting policies that should allow and promote sustainable based on local expertise and resources. An approach to sustainable intensive agriculture would be a think piece to pursue a middle road that secures both livelihood and the environment.

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