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NEPAL

Impact of the November 2023 earthquakes

DIEM-Impact report
April 2024



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Abbreviations

DIEM	Data in Emergencies Information System
FAO	Food and Agriculture Organization of the United Nations
GIS	geographic information system
HDDS	household dietary diversity score
LCSI	livelihood coping strategy index
Nr	Nepalese rupee
rCSI	reduced coping strategy index
WFP	World Food Programme

Main results

The November 2023 earthquakes that affected the Karnali province in Nepal had a devastating effect on the livelihoods of the people living in the most affected districts: Jajarkot, Jajla, Rukum West and Salyan. These districts are mostly made up of hills and mountains, and the primary sector is the most important source of livelihood, engaging more than 70 percent of the workforce. This survey, conducted in Jajarkot and Rukum West districts, highlighted the loss of productive assets for crop and livestock farming as the most critical issue.

Twenty percent of farmers reported damages to agricultural land (62 percent of which was to more than half the land), and 21 percent reported damages to irrigation systems (69 percent of which was substantial or total). About a quarter of the respondent farmers reported seed and hand tool losses. Similar to crop production, what is worrying is the destruction and loss of livestock productive capital, as 35 percent of households reported the destruction of animal shelters and 18 percent the loss of stocked fodder.

Food security indicators show consumption gaps and a particularly poor diet demonstrating that consumption is achieved with severe coping strategies and asset depletion (either sold or destroyed by the earthquake) for a third of the population.

Introduction

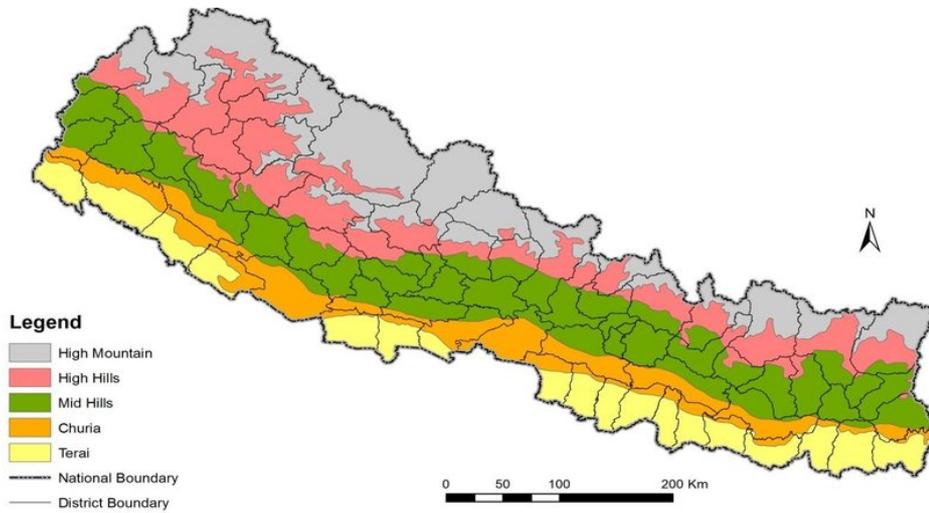
On 3 November 2023, an earthquake with a magnitude of 5.7 on the Richter scale struck Nepal. The epicentre was in Jajarkot district, Karnali province. Additional 5.6 and 5.7 magnitude aftershocks occurred on 4 and 5 November 2023 in the same area (GDACS, 2023), resulting in the loss of 154 lives and leaving 60 478 families without homes (DPNet, 2024a). The National Disaster Risk Reduction and Management Authority has estimated the cost of replacing the destroyed homes at 69 billion Nepalese rupees (Nr) (DPNet, 2024a). Beekeeping was also affected, with 152 households facing total losses of USD 10 400. The agriculture sector estimated that 192 hectares of wheat and mustard crops were destroyed, resulting in a loss of around 480 tonnes. Additionally, 88 metric tonnes of stored food suffered damage in the collapsed structures (DPNet, 2024b).

Karnali province, the epicentre of the earthquake, is located in a less developed and isolated part of the country. A joint Food and Agriculture Organization of the United Nations (FAO) and World Food Programme (WFP) survey in 2022 revealed that the province was particularly affected by economic shocks. It was estimated that 31 percent of households were facing moderate or severe recent food insecurity (RFI) and 4 percent were facing severe RFI (FAO & WFP, 2022).

Nepal has three main agroecological zones that run parallel from west to east (Figure 1). All of the different agroecological zones are represented in Karnali province. Terai and Churia zones have the lowest altitude and are more diversified in terms of economic activities, including market-oriented agriculture. The area has benefitted from more extension services historically and has a higher rate of adoption of new technologies (Floyd *et al.*, 2003). Cropping patterns are more diversified, and the area has livestock (mostly cattle) (Rahut *et al.*, 2014; Dhakal *et al.*, 2013). In Hills and Mid Hills zones, crop production is the main livelihood and, in particular, staple crops, as well as various species of livestock. In the High Mountain zone, farming is practiced less, in favour of livestock, especially small ruminants. It is also a more isolated part of the country, compared to the other zones.

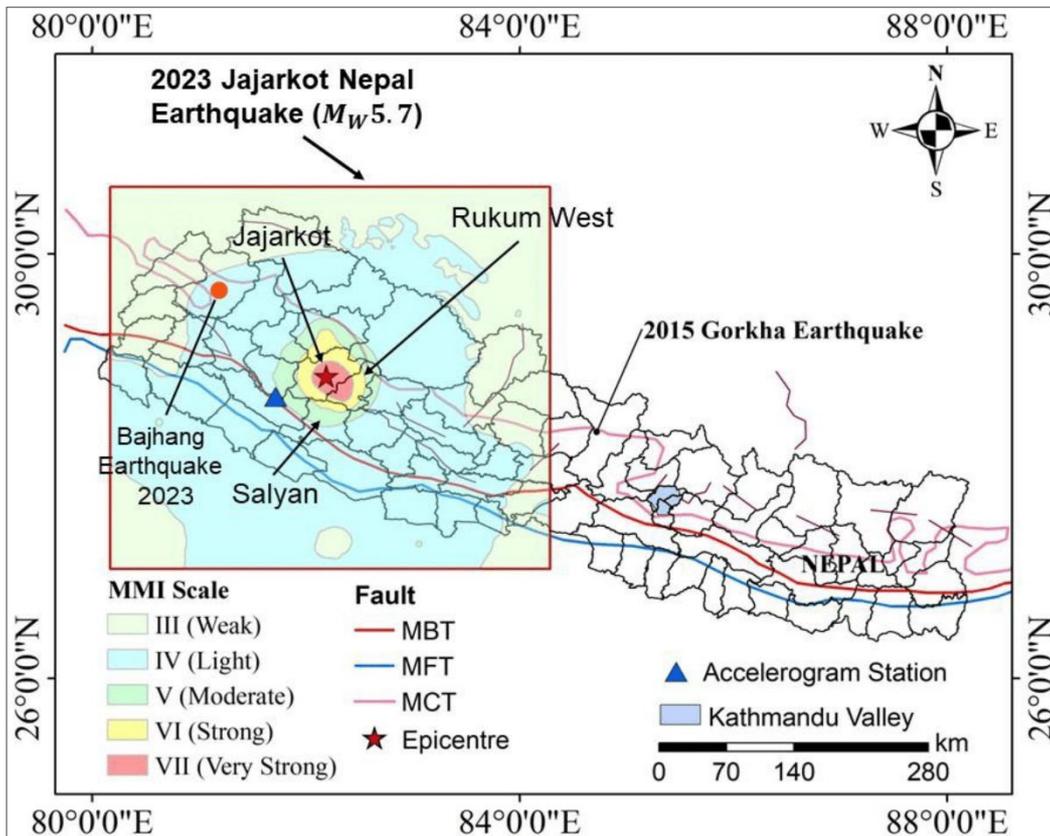
The earthquakes in November 2023 mostly affected four districts: Jajarkot, Jajla, Rukum West and Salyan. These districts are mostly made up of hills and mountains, rather than terai (Figure 2). The primary sector is the most important source of livelihood in the area, engaging more than 70 percent of the workforce, compared to 50 percent of the whole country (National Statistical Office, 2021).

Figure 1. Agroecological zones of Nepal



Source: Ministry of Agricultural Development. 2017. *The state of Nepal's biodiversity for food and agriculture*. Kathmandu. https://www.researchgate.net/publication/344605863_The_State_of_Nepal's_Biodiversity_for_Food_and_Agriculture#fullTextFileContent

Figure 2. The epicentre of the 2023 Jajarkot Nepal earthquake with the modified mercalli intensity distribution



Source: Subedi, M.; KC, R.; Sharma, K.; Misra, J. & KC, A. Reconnaissance of the Effects of the M_w 5.7 (M_L 6.4) Jajarkot Nepal Earthquake of November 3, 2023, Post-Earthquake Responses, and Associated Lessons to Be Learned. *Geosciences*, 14(1), 20. <https://doi.org/10.3390/geosciences14010020>

Although livelihoods do not change much across the area, some differences were found, as one of the districts – Salyan – is more economically diversified with a diverse cropping pattern and livestock production (mostly cattle, buffaloes and pigs) (Ministry of Agriculture and Livestock Development, 2022). The districts produce 20 percent of the province’s cereal crops, 23 percent of oilseeds and 34 percent of pulses. In the more mountainous and sparsely populated districts of Jumla and Rukum West, livelihoods are more frequently based on livestock, in particular sheep and goats.

A geographic information system (GIS) analysis conducted by FAO in the aftermath of the earthquake allowed for the identification of the most exposed areas (FAO, 2023a). By layering cropland and livestock density maps, the analysis indicated the potential loss. The highest number of exposed animals by moderate to very strong macroseismic intensity were found in Dailekh, Jajarkot, Jumla, Rukum West and Salyan districts in Karnali province, meaning the earthquake is likely to have particularly impacted livestock production in these locations. Even though the highest exposed cropland area was found in Bardiya, Kailali, Kapilbastu and Rupandehi – cropland zones that were affected by moderate or light macroseismic activity – the most intense seismic magnitude (higher than VI) was found in Jajarkot and Rukum West districts, villages within the Nalagad and Sani Bheri municipalities, and Aathbiskot and Kuse municipalities.

A DIEM-Impact household survey was conducted by FAO in December 2023, in collaboration with DPNet, to inform the agriculture sector about the impact of the earthquake, to assess the food security situation and livelihood changes, and to identify the appropriate response and recovery needs.

Methodology

Interviews were conducted face-to-face and were supported by Kobo, a data collection platform. Sampling was two-step cluster. Due to lack of an exhaustive list of communities with population estimates, 2 km x 2 km estimate grids were obtained via remote sensing in order to randomly select clusters with probability proportional to size.

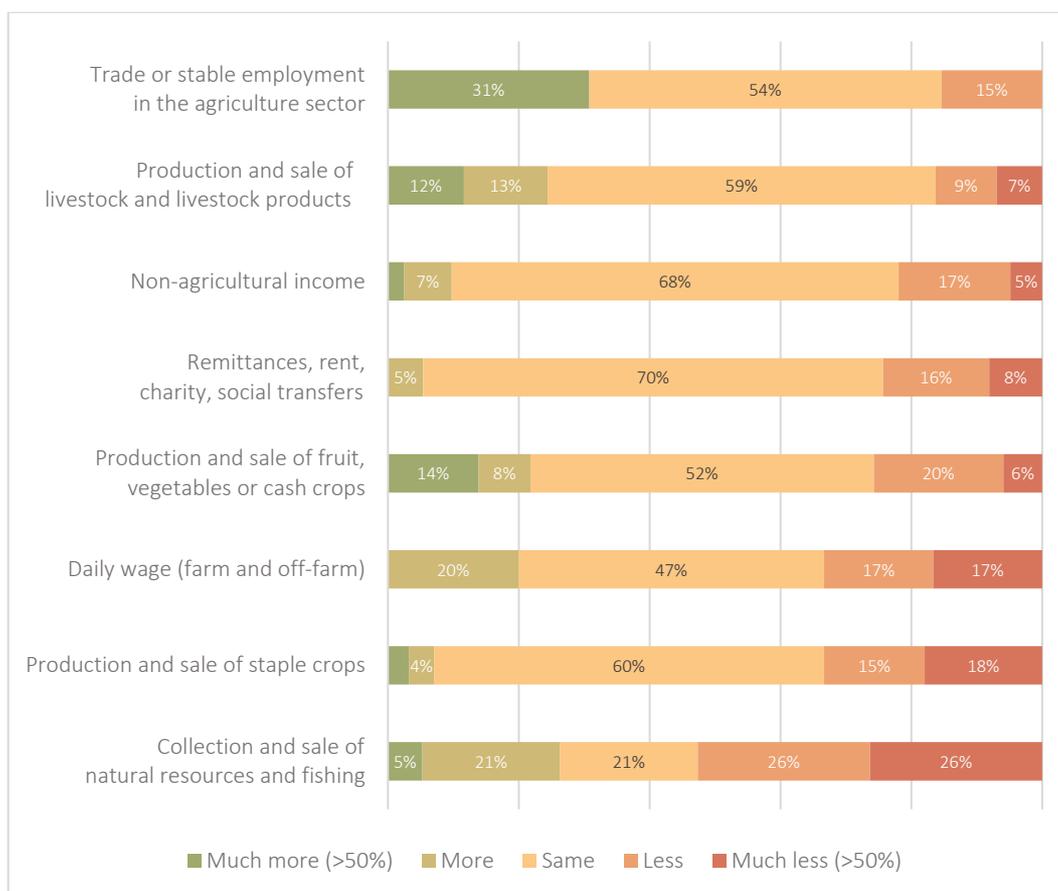
The survey covered the most impacted municipalities of Jajarkot and Rukum West districts as a single stratum and reached 304 households in addition to key informant interviews conducted at community level. Data were weighted by a wealth proxy (source of drinking water).

Results

Income and shocks

Households were asked to list their main sources of income, and compare them to 12 months preceding the interview, before the earthquake in a normal livelihood context (Figure 3). In general, as expected given that it is the main source of livelihoods in the region, agricultural incomes – except from the sale of livestock and livestock products – declined more frequently. This was not only due to the earthquake, but reflects preexisting conditions and shocks. For example, for households whose main income is the sale of staple crops, the most frequent shock, after the earthquake, was plant diseases.

Figure 3. Comparison of income sources at the time of the survey and 12 months before (percentage of households)



Source: FAO. 2023. Nepal: Impact of the November 2023 earthquakes — DIEM-Impact report, March 2024. In: *FAO Data in Emergencies Hub*. Rome. [Cited 15 March 2024]. <https://data-in-emergencies.fao.org>

In the season between planting and harvesting rice, remittances from seasonal migration to India are important resources and 12 percent of the respondent households reported remittances as an income source. This source has been hindered by the earthquake.

The most frequently declining income source was natural resource utilization and beekeeping. It should be noted that the subsample with an income derived from beekeeping was not large enough to produce reliable estimates. Anecdotal evidence (enumerator reports) and key informants confirmed the extent of damage to beehives and other equipment, and the loss of ready to harvest honey, an important source of income in the area (Gaire *et al.*, 2014) (Figure 4).¹

Figure 4. Damaged bee hives in Jajarkot district, December 2023



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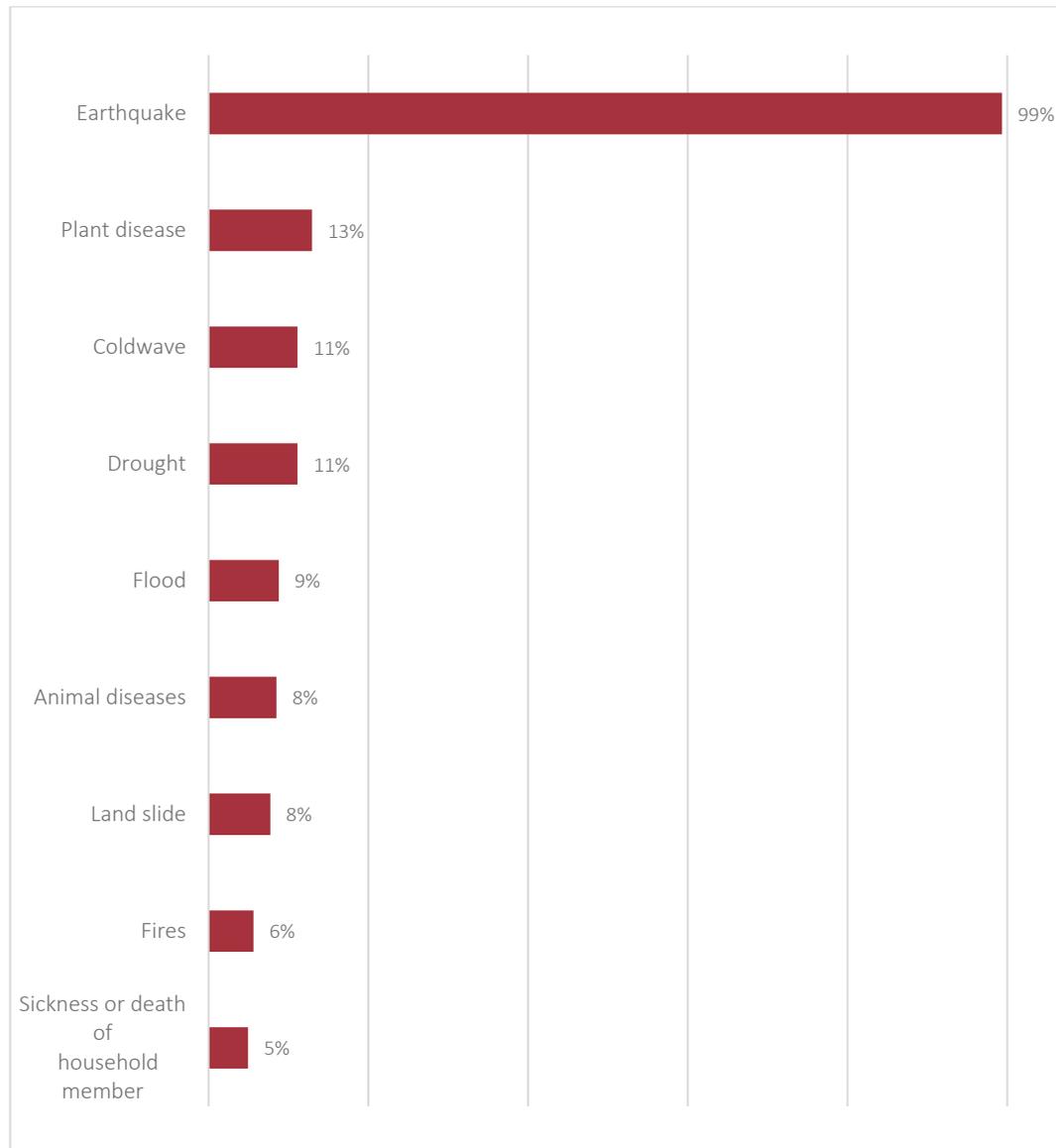


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¹ Although not directly estimated, the effects of the damages and losses could be long lasting. Apart from the obvious use of honey for food and income, the use of the serene bee (wild species) implies a likely abandonment of colonies after the earthquake's shaking and destruction. Households reported the worry that colonies may take time to re-establish and cross-pollination could be affected.

The earthquake was not the only shock that impacted the population of the affected districts (Figure 5). Daily workers were more frequently vulnerable to sickness or death of family members, loss of employment opportunities and poor production due to drought conditions. Animal and plant diseases have had a compounding and worsening impact on food security and livelihoods.

Figure 5. Frequency of shocks (percentage of households)

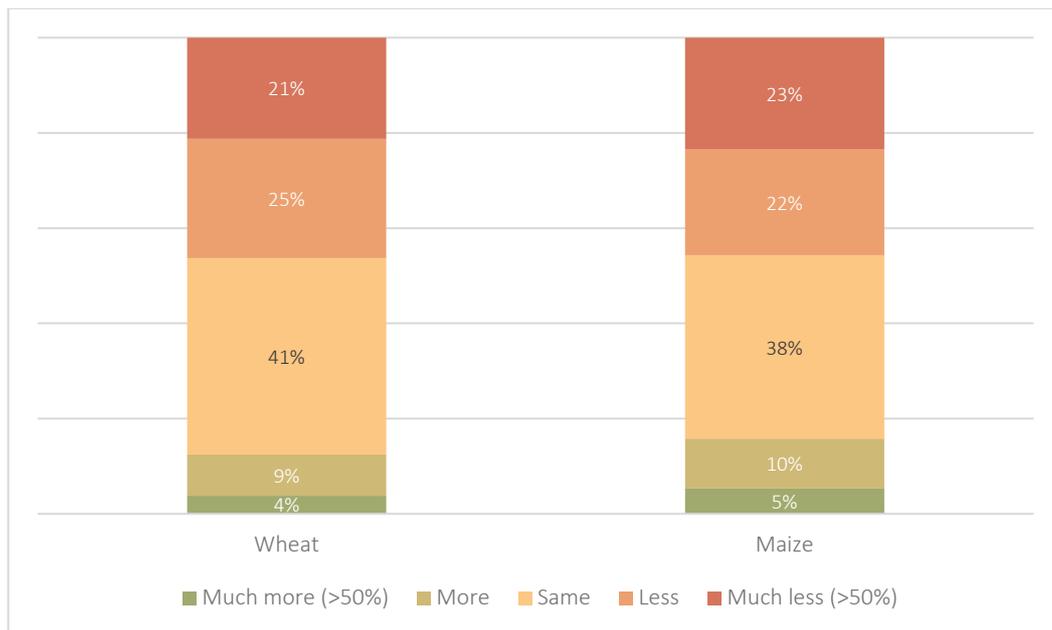


Source: FAO. 2023. Nepal: Impact of the November 2023 earthquakes — DIEM-Impact report, March 2024. In: *FAO Data in Emergencies Hub*. Rome. [Cited 15 March 2024]. <https://data-in-emergencies.fao.org>

Crop production

Overall, 31 percent of farmers reported a decrease in harvest, compared to the previous year, but for the two most common crops, wheat and maize, the percentage was higher (Figure 6). This was not only consistent with other FAO estimates² but also with the results of the joint FAO/WFP survey conducted in September 2022 that warned of declining farm profitability given the rise of input prices (FAO & WFP, 2022).

Figure 6. Harvest estimates by main crop (percentage of crop producers)



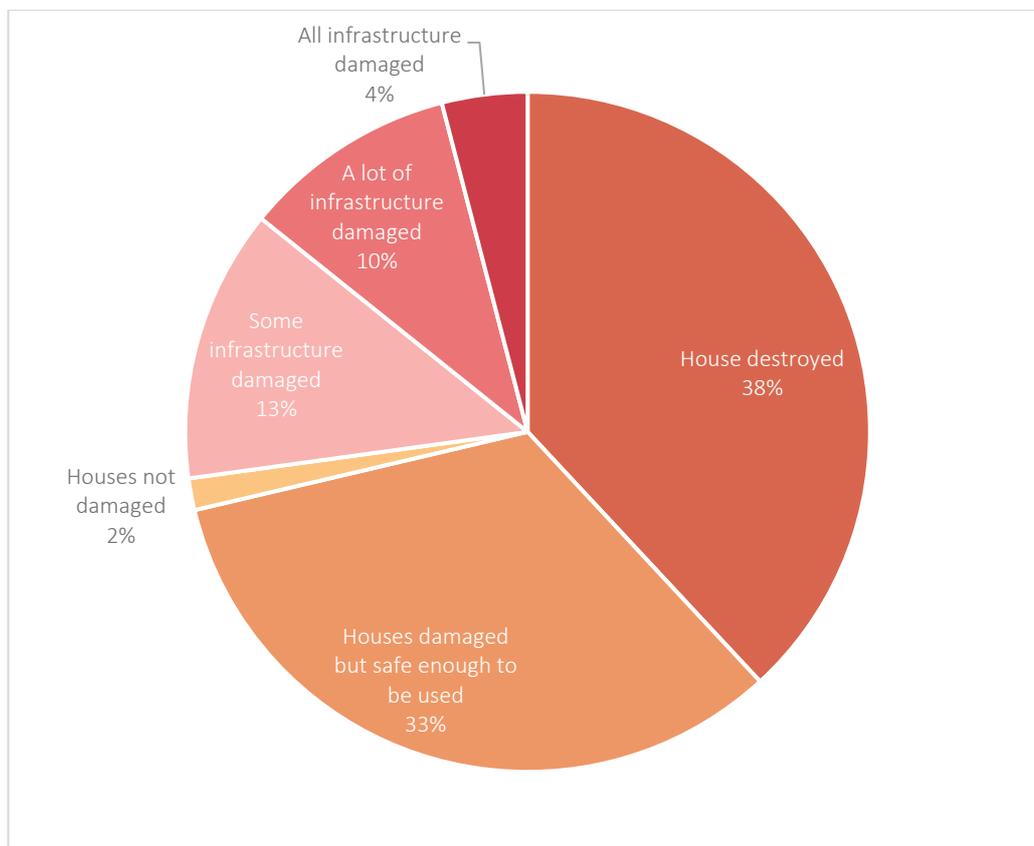
Source: FAO. 2023. Nepal: Impact of the November 2023 earthquakes — DIEM-Impact report, March 2024. In: *FAO Data in Emergencies Hub*. Rome. [Cited 15 March 2024]. <https://data-in-emergencies.fao.org>

Land size was not associated with this reduction in production, but Pearson’s Chi-squared tests revealed positive associations with rainfed (non-irrigated) farming and those citing plant diseases as a shock, suggesting that less well-off farmers were more likely affected. In addition, household characteristics were meaningful, such as the gender of the head of household (55 percent of female-headed households compared to 42 percent of male-headed households); and proxies for wealth, such as water source (28 percent among farmers with a private tap, compared to 49 percent of the others) and caste (60 percent among Dalit). This suggests that the least well-off segments of farmers coped less well with difficulties in the last agricultural cycle (facing production challenges including access to fertilizer, incidence of insect pests and diseases, and high price of inputs), in addition to the earthquake.

The earthquake affected all of the households with varying degrees of severity and destruction (Figure 7). Thirty-eight percent reported that their house had been destroyed and needed to be evacuated.

² Rice and maize outputs are forecast at below average levels of 5.3 million tonnes and 2.8 million tonnes, respectively. Production of wheat, harvested last June, is officially estimated at an average level of 2.1 million tonnes (FAO, 2023b).

Figure 7. Severity of the Karnali earthquake at household level (percentage of households)



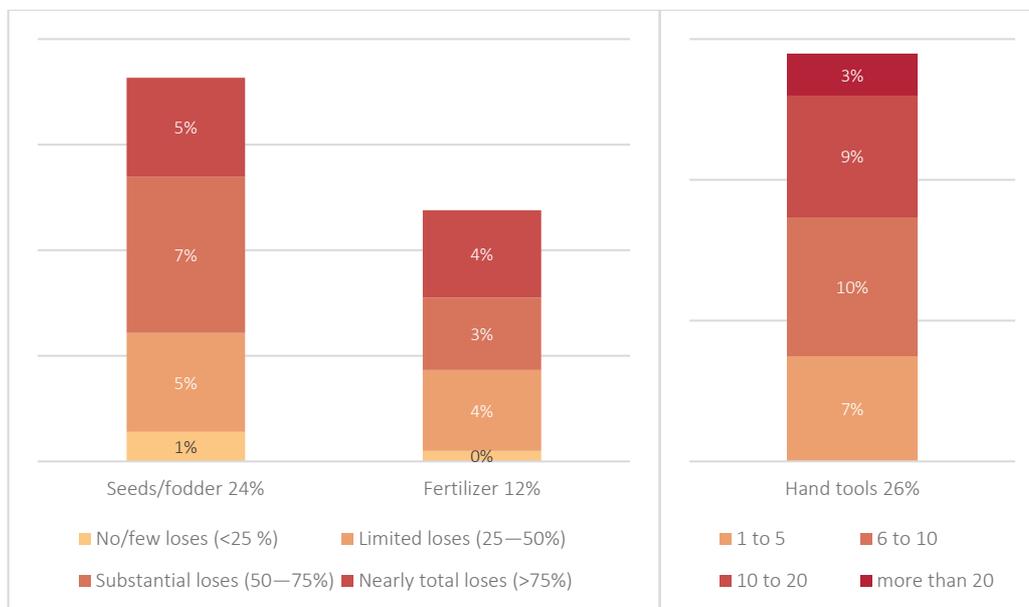
Source: FAO. 2023. Nepal: Impact of the November 2023 earthquakes — DIEM-Impact report, March 2024. In: *FAO Data in Emergencies Hub*. Rome. [Cited 15 March 2024]. <https://data-in-emergencies.fao.org>

From the standpoint of farming households, the earthquake happened at a critical moment after the maize harvest, during the rice harvest, and during the planting and germination stage of the main winter crop – wheat. Twenty-six percent reported damages to standing crops (58 percent of which was to more than half of the total land area). In most areas, the winter crops – wheat, barley, pulses and vegetables – were already planted in the field.

Key informants reported a likely decrease in the production of winter crops where crops have been damaged by debris and construction of temporary shelters in the open field. Key informants projected a decrease in production and productivity because farmers could not perform other cultural operations on time. Approximately 20 percent of respondent households stored food grains and seeds at home. Of this group, 76 percent reported losses, in particular wheat, maize and rice due to damages to the grain storage structures built out of mud and stone. Eighty-eight metric tonnes of food items were lost, resulting in a financial setback of Nr 3.8 million (DPNet, 2024b).

It is the loss of productive capital that is more concerning for the next monsoon season. About a quarter of the farmers reported seed and hand tool losses. A smaller percentage reported the loss of manure and/or fertilizer (Figure 8).

Figure 8. Frequency of assets lost (percentage of crop producers)



Source: FAO. 2023. Nepal: Impact of the November 2023 earthquakes — DIEM-Impact report, March 2024. In: *FAO Data in Emergencies Hub*. Rome. [Cited 15 March 2024]. <https://data-in-emergencies.fao.org>

Key informants reported massive seed losses in Chaur (Bheri), Kalpat (Nalagad) and Maidya villages, where food stock and tool losses were also concentrated. Thirty-two percent of households reported the loss of farming assets, more frequently ploughs (amounting to 36 percent among farming households). Approximately one fifth of the farmers lost spades and other agricultural tools.

There were more damages to durable capital. Twenty percent of farmers reported damages to agricultural land (62 percent of which was to more than half of the size) due to cracks, landslides and debris. Although damages to orchards were much less frequent (reported by 15 percent, particularly in the municipalities of Bheri and Sani Bheri, and mostly citrus), 21 percent of the respondents reported damages to irrigation systems (69 percent of which were substantial or fully damaged). In the villages of Kalpat (Nalagad) and Lapule (Chaurjahari), concrete dams were destroyed. In some of the villages, key informants reported that although less damages occurred, lands were unfit for cultivation, as they are hosting provisional shelters for the affected families (Figure 9). Homes have been constructed with families residing on the upper floor and livestock housed on the lower floor. The earthquake-induced displacement has compelled people to occupy 100 square metres in tents, causing damage to 192 hectares of land used for cultivating wheat and mustard. This displacement has led to a decrease in food production by 480 metric tonnes (DPNet, 2024b).

Figure 9. Provisional shelters on wheat fields, December 2023

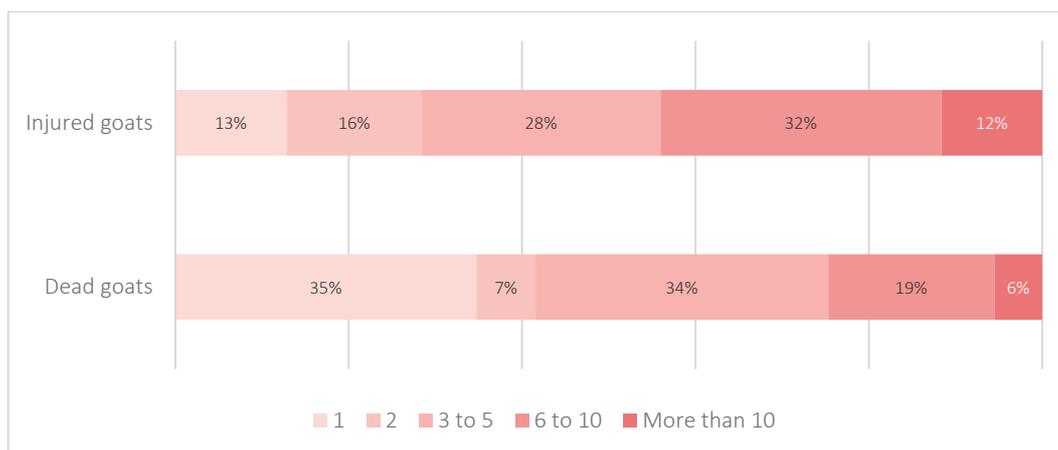


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Livestock production

Livestock losses due to the earthquake amounted to 513 livestock, resulting in a financial loss of Nr 25.2 million – the equivalent of USD 188 167 on 16 April 2024 (DPNet, 2024b). Households with livestock reported the loss of cattle and goats, in particular. Eighteen percent of cattle producers reported mortality, and 34 percent reported injuries to livestock herds as a direct consequence of the earthquake. In most cases, households only had few animals (one or two), meaning that losses to each household were mostly one cow – a large part of the entire herd. Thirty-four percent of households reported goat mortality and 37 percent reported injuries with a more complex pattern because herd sizes were larger (Figure 10).

Figure 10. Distribution of goat losses (percentage of livestock producers)

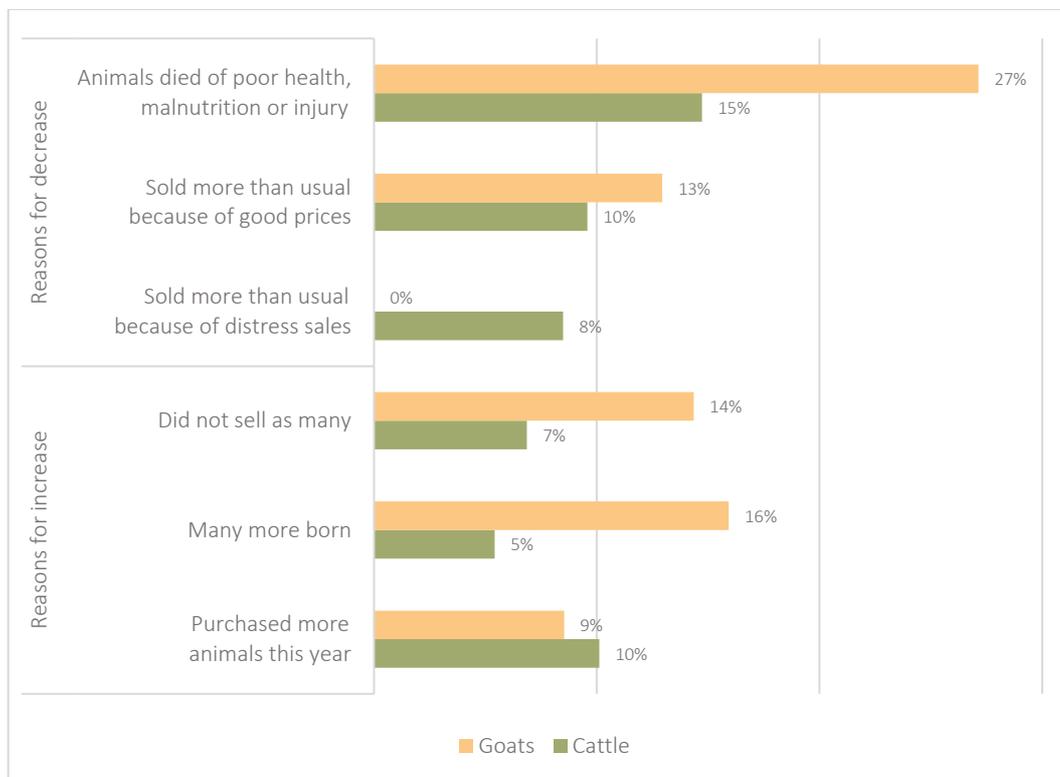


Source: FAO. 2023. Nepal: Impact of the November 2023 earthquakes — DIEM-Impact report, March 2024. In: *FAO Data in Emergencies Hub*. Rome. [Cited 15 March 2024]. <https://data-in-emergencies.fao.org>

In comparison, sheep losses were much less frequent, as 4 percent reported sheep mortality and 12 percent reported injuries. Key informants cited livestock mortality, up to 25 percent, and mostly in Bheri and Sani Bheri municipalities.

Data indicate that the earthquake was not the only reason for the decrease in herd size, as many engaged in both commercial and distress sales (Figure 11), but it was the main reason for mortality, as association tests with pasture conditions (which are mostly communal) and, with animal diseases were not significant. In the September 2022 FAO/WFP joint survey, 28 percent of households whose main animals were goats and 9 percent whose main animals were cattle in Karnali reported a decrease in herd size. After the earthquake, in the two districts, this decrease reached, substantially, 50 and 42 percent (FAO & WFP, 2022).

Figure 11. Reasons for changes in herd size (percentage of livestock producers)

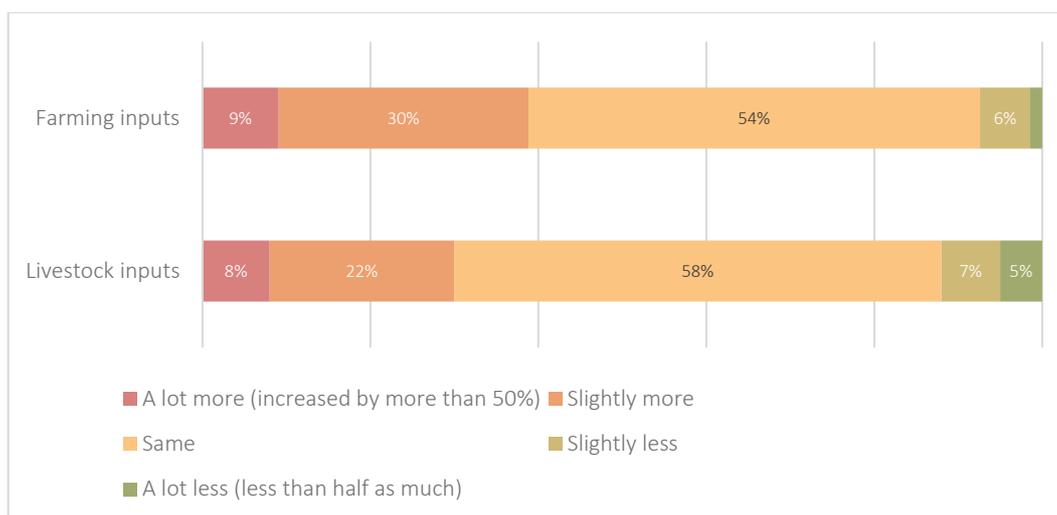


Source: FAO. 2023. Nepal: Impact of the November 2023 earthquakes — DIEM-Impact report, March 2024. In: *FAO Data in Emergencies Hub*. Rome. [Cited 15 March 2024]. <https://data-in-emergencies.fao.org>

Markets

Access roads were partially destroyed in almost all villages visited during the assessment resulting in a possible impact on markets. Twenty-eight percent of the farmers reported that their usual agricultural input market (for both crop and livestock) was no longer functional after the earthquake, and crop and livestock inputs prices were, in some areas, rising (Figure 12).

Figure 12. Change in agricultural input price (percentage of households)



Source: FAO. 2023. Nepal: Impact of the November 2023 earthquakes — DIEM-Impact report, March 2024. In: *FAO Data in Emergencies Hub*. Rome. [Cited 15 March 2024]. <https://data-in-emergencies.fao.org>

Food security

The evaluation of food security analysis is based on the premise that if food availability, access, utilization and stability are inadequate, a household's consumption is also likely to be inadequate. The severity of the inadequacy of food consumption is dependent on how inadequate one or more elements are, and to what extent households' resort to unsustainable livelihood changes to decrease food gaps. Food consumption gaps have been mitigated by unsustainable coping strategies. If households have difficulties securing enough food, they may engage in unsustainable coping strategies, such as selling productive assets like land and livestock, decreasing expenditures on education and health, and consuming stored seeds.

Livelihood changes were carefully contextualized before conducting the survey. In cases like this – after an earthquake – the loss of a household's livelihood capital is not driven by food insecurity but by the disaster itself. This is still considered evidence of outcome level changes, or the incapacity of a household to sustain its typical livelihood activities.

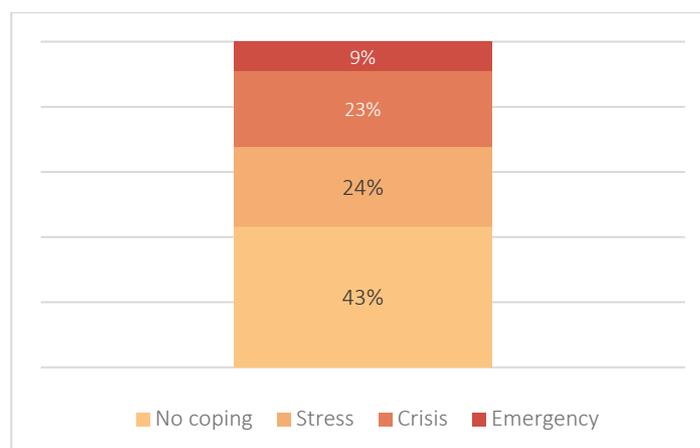
To assess food security outcomes, different indicators were collected. The household dietary diversity score (HDDS), a proxy for dietary diversity, indicated that, especially for a post-harvest period, the quality of the diet was particularly poor. Fifty-two percent of the population had poor dietary diversity (score of one and two); 37 percent had medium dietary diversity (score of three to five); and only 10 percent had high dietary diversity (scores of 6 and above).

The reduced coping strategy index (rCSI) was partially consistent with the HDDS. Sixteen percent were engaged in high coping (rCSI of 19 or higher), a high share consistent with HDDS. Eighteen percent were classified to have medium coping (rCSI between 5 and 18); and two-thirds had low coping, while 55 percent adopted no coping mechanism at all. This can be explained by the association of the rCSI indicator with the food assistance received. The use of these two indicators reflects different aspects of food consumption. The rCSI is a stronger proxy of caloric intake, while HDDS is a stronger measure of diet quality.

The livelihood coping strategy index (LCSI) demonstrates the effect of the earthquake on household capital, as 32 percent depleted their productive assets (Figure 13). Households were classified based on the most severe coping strategy adopted, with the following typology:

- Stress coping strategy, such as borrowing money or spending savings, are those which indicate a reduced ability to deal with future shocks due to a current reduction in resources or an increase in debts. Twenty-four percent of the population adopted stress strategies.
- Crisis coping strategy, such as selling productive assets, directly reduce future productivity, including human capital formation. Twenty-three percent of households engaged in crisis strategies.
- Emergency strategies, such as selling one's land, affect future productivity, but are more difficult to reverse or more dramatic in nature. Nine percent adopted these more drastic measures.
- Forty-three percent of households have not engaged in coping strategies.

Figure 13. LCSI (percentage of households)



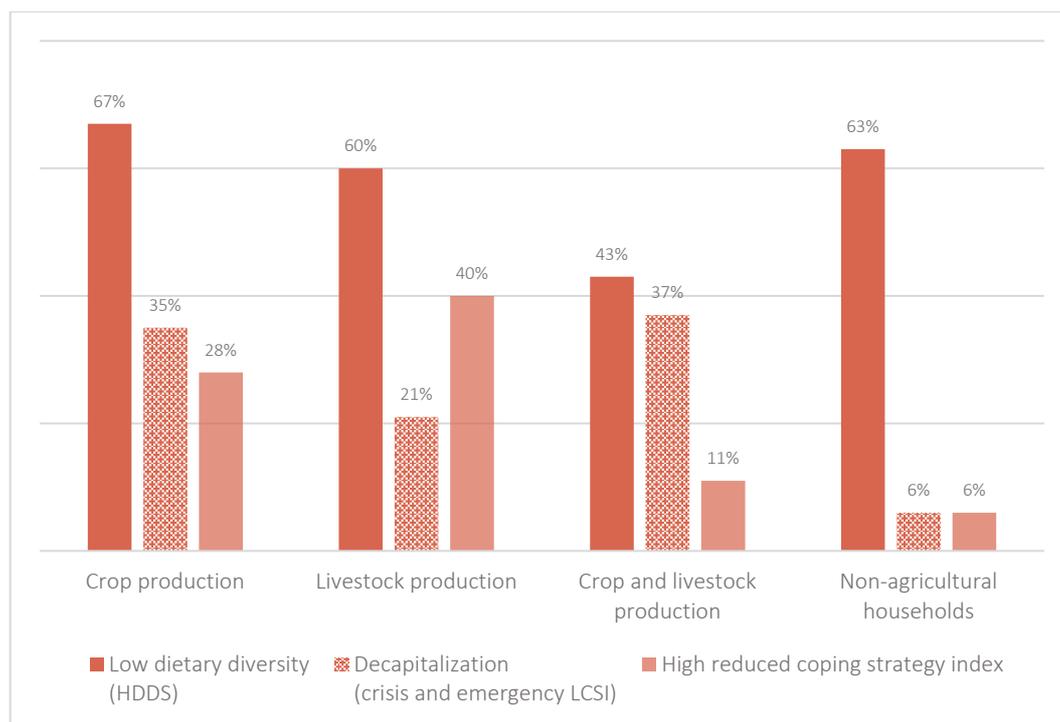
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The food security indicators consistently identify food consumption gaps or that households have only been able to mitigate large food consumption gaps by employing crisis or emergency livelihood strategies and asset liquidation. Beyond the indicators, it is important to identify the drivers of food insecurity for better targeting. Pearson’s Chi-squared tests reveal that these are:

- The severity of destruction due to the earthquake: all indicators showed the worst outcomes when the households had to evacuate their house or suffered major material damages.
- Food assistance: 43 percent benefited from some form of food assistance which was associated with low or no coping – less severe classes of rCSI and LCSi.
- Shocks: the worst outcomes were strongly – as measured by Phi coefficients – associated with animal and plant diseases.
- Goat deaths, as a direct consequence of the earthquake, were particularly associated with the most severe class of rCSI (19 or above).

Food security outcomes differ by the activities households were engaged in (Figure 14). A minority of non-agricultural households have a similar pattern of HDDS to agricultural households, but they have not decapitalized their assets as much. Households engaged in both crop and livestock production less frequently showed the most serious rCSI and HDDS outcomes, but households engaged in more crisis and emergency strategies. Livestock producers, on the other hand, decapitalized less frequently and with a high prevalence of high rCSI (19 or above), engaged in food-related coping behaviour more frequently and severely.

Figure 14. Food security indicators by agricultural activity (percentage of households)



Source: FAO. 2023. Nepal: Impact of the November 2023 earthquakes — DIEM-Impact report, March 2024. In: *FAO Data in Emergencies Hub*. Rome. [Cited 15 March 2024]. <https://data-in-emergencies.fao.org>

Conclusion

Besides the earthquake, Jajarkot and Rukum West districts experienced other shocks, leading to a decrease of agricultural incomes (except for livestock) more frequently compared to the year preceding the survey. For farming households, the earthquake happened at a critical moment after the maize harvest, during the rice harvest, and with the main winter crop – wheat – in the field. Twenty-six percent of households reported damages to standing crops – 58 percent of which was to more than half of the land which will likely result in a decrease in production.

It is the loss of productive assets that is most concerning for the next crop cycle. Twenty percent of farmers reported damages to agricultural land (62 percent of which was to more than half the size), and 21 percent reported damages to irrigation systems (69 percent of which was substantial or total). About a quarter of the respondent farmers reported seed and hand tool losses. Key informants related concerns that during the monsoon seasons, these cracked lands would percolate water down, loosening soil structures, and, therefore, leading to higher chances of landslides.

Livestock mortality due to the earthquake was high for cattle and goats. Before the earthquake in September 2022, 28 percent of households with goats and 9 percent of households with cattle in Karnali province reported a decrease in their herd size (FAO & WFP, 2022). In the two districts, this percentage was, after the earthquake, respectively, 50 and 42 percent.

Similar to crop production, what is worrying is the destruction and loss of livestock productive capital as 35 percent of households reported the destruction of animal shelters and 18 percent reported the loss of stocked fodder.

Food security indicators show consumption gaps and a particularly poor diet demonstrating that consumption is achieved with severe coping and asset depletion (either sold or destroyed by the earthquake) for a third of the population. Although 43 percent reportedly benefited from some form of food assistance, which was associated with better food security outcomes, the loss of productive assets will likely impede the ability of households to return to normal livelihoods.

Recommendations

- > Land rehabilitation: although some cropland is still occupied by temporary shelters, much has been damaged by debris and, more concerning, by cracks. If these are not filled, there is a risk of landslides during the next monsoon season. A specific assessment to target where land rehabilitation is most urgent and corresponding interventions should be coupled with soil and water conservation techniques to control soil erosion.
- > As the immediate response is ongoing, including insurance payments, vaccination, food assistance, hermetic bags for seed and other storage, and reconstruction grants, there is the need to bridge humanitarian action with livelihood support, starting with seeds and tools. The loss of seed stock was not only cited by a quarter of farmers, but, given the lack of access to market and the increasing price, it was a need expressed by 80 percent of farming households. The need for agricultural tools, for the same reasons, was expressed by 67 percent of farmers and 31 percent of livestock producers. Animal restocking is also recommended, particularly cattle and goats, as well as the rehabilitation or reconstruction of animal sheds.
- > Beyond land rehabilitation and food assistance, the most frequent needs were the rebuilding of the productive capacity of farming households, such as seeds, fertilizer, tools and irrigation for farmers, and tools and animal restocking for livestock producers.

These livelihood support activities should be coupled with the extension of better practices to revive agricultural production and protect the livelihoods of the affected households. These include the support of nutritional home gardens, and training and extension services to affected smallholder farmers on climate resilient and organic agricultural production. The rehabilitation of irrigation infrastructure is also necessary, particularly communal structures. In this framework, it is also recommended to support the income diversification of the area, the beekeeping sector for example.

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Contact

FAO Representation in Nepal
FAO-NP@fao.org | <https://www.fao.org/nepal>
Kathmandu, Nepal

Office of Emergencies and Resilience
data-in-emergencies@fao.org | <https://data-in-emergencies.fao.org>
Rome, Italy

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