

PERCEPTIVE STUDY ON POLICY INTERLINKAGE AND INSTITUTIONAL ARRANGEMENT OF AGROBIODIVERSITY WITH CLIMATE CHANGE, FOOD AND NUTRITION

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ABSTRACT

A study was conducted to find out interlink, assessing the implementation status, challenges and opportunities in mainstreaming the nexus of agro biodiversity, food and nutrition and climate change in policies and programs. An online survey tool (mwater) was used to deploy the pretested questionnaire to different professionals of Nepal. Out of 500 deployment, 54 responses were obtained. In most of the questions farmers were unable to decide the extent of interlink and implementation status, however, other professional groups perceived the linkage to be weak to moderate. Moreover, the implementation status of these policies were discerned to be less satisfactory. The opportunities and challenges are to be considered while plotting the action. For doing so, institutional setup for implementation and monitoring need to strengthen with wide consultation from policy formulation to implementation, impact assessment and review for having greater impacts on farming communities.

Keywords: Agro biodiversity, challenges, consultation, implementation, monitoring, nexus

INTRODUCTION

Nepal is rich in biodiversity and it ranks 49th in terms of world biodiversity, the 31st and the 10th in flowering plant diversity in the world and Asia respectively (Butler, 2016). Moreover, Nepal ranks the 27th position on the basis of per unit area, with 1.16 Biodiversity (BioD) index per land area where Brunei ranks 1st with an 18.68 BioD index per land area. Though the country occupies only 0.03% of the global area but harbors over 3% and 1% of the world's known flora and fauna, respectively. There are 118 types of ecosystems with 75 vegetation types, 35 forest types and 5 rangeland ecosystems (MoFSC, 2014). Among 24,300 total species in the country, 28% are agricultural genetic resources (AGRs), termed as agro biodiversity. There are 12 agro

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ecosystems supporting 1026 species under crop component, 510 under forage, 35 under livestock, 250 under the aquatic animal, 17 under aquatic plant, 3,500 under insect and 800 under microorganism. An estimated loss of agro biodiversity is 40%, however, farmers have reported up to 100% loss of AGRs in some areas for a particular species (Joshi *et al.* 2020).

Agro biodiversity is the foundation of supplying diversified and nutritious foods to people of all age groups. It is also crucially important for sustainable and resilient agriculture and food system in the context of the changing climate. Moreover, agro biodiversity is the source of food and nutrition security and livelihood of millions of smallholders worldwide. Despite its multiple benefits, inadequate substantive policy and institutional support in the face of competing market and other pressures have resulted in the rapid loss of agro biodiversity primarily through the replacement of local crop varieties and landraces by modern high-yielding varieties. This has threatened the food and nutrition security and the livelihood of small and marginal farmers (Maharjan *et al.* 2011).

Nepal is a signatory of various international conventions, treaties, and agreements related to the conservation, access, exchange, and use of agro biodiversity. With this and increased awareness and realization, the government has made some efforts to conserve and use agricultural plant genetic resources (Gauchan *et al.* 2017). Several global initiatives recognize the nexus between agriculture, biodiversity, and nutrition and the nexus between agriculture, biodiversity, and climate change and call for greater mainstreaming of agricultural biodiversity into nutrition and climate policy. For example, the latest Global Nutrition Report 2020 calls for increasing and maintaining diversity in production landscapes as a means of contributing to improved nutrition, resilience, and climate adaptation. The UN 2030 Sustainable Development Goals (SDGs) has also envisaged and incorporate the importance of these three dimensions in different SDG goals such as nutrition in Goal 2 (ending hunger and malnutrition), climate change in Goal 13 and agrobiodiversity in Goal 2.5, though specific linkages are not built in single goal. The 15 Development Plan of Nepal (2018/19-2022/23) recognizes the importance of nutrition, climate change and agrobiodiversity, though specific interlinkages are not well spelled out. Presently, limited action points and examples exist for governments to put interlinkage and specific recommendations into practice about this.

Climate change, biodiversity loss and multiple forms of malnutrition are hitting hard to human race and the challenges posed is well known. EAT-Lancet Commission states that the food is the single strongest lever to optimize human health and environmental sustainability on Earth, but is currently threatening both people and planet (EAT, 2019). Half of the world's habitable land surface is occupied by crops and livestock which consume about three quarters of fresh water resources. Moreover, deforestation rate is running at 4 million hectares per year and 3/4 shares

of it goes to agriculture in clearing forest for planting crops or raising livestock. Thus agriculture is one of the greater driver of biodiversity loss and contributor to climate change. Moreover, the healthy diets are being replaced by processed and junk foods (FAO, 2019). So, there is a dearth need of adopting an agri-food-systems perspective by identifying the key policies and actions needed to address the challenges of climate change, biodiversity loss and nutrition (HLPE, 2017). Raising awareness of the importance of the agrobiodiversity and its interlinkages with climate change and nutrition amongst all sectors of society, including the public and policy makers and private sectors, and operationalizing the nexus between the three areas into practice is the need of the hour. However, there are limited information and evidence of their interlinkages in Nepal.

The study was carried out to find out the perception of stakeholders on the provisions of the interlink between the major policies related to agrobiodiversity, climate change and food and nutrition along with their implementation status, and pointing out the challenges and opportunities in mainstreaming the nexus in policies and programs.

METHODOLOGY

Different policies related to agrobiodiversity/agriculture were listed out for recording the perception of different stakeholders about the implementation status of these policies and interlink with climate change, food and nutrition and small holder farmers along with institutional arrangements, opportunities and challenges. For doing so, questionnaire was prepared, discussed with key persons and uploaded in an online survey tool, i.e. mWater portal (<https://portal.mwater.co/#/>). The questionnaire was divided into consent form, respondent profile, perception on implementation status of policies and interlink with climate change and food & nutrition on five point likert scale. Moreover, perception about institutional arrangements were observed as adequate, average, inadequate and can't say. A pre-test was conducted and then the questionnaire were revised. The online survey was requested from 500 relevant persons (farmers, experts, academicians, students, researchers, policymakers, focal persons of the relevant department and ministries). A request was also posted on the Facebook page and other social platform. However, only 54 completed responses were obtained.

The information collected from mWater portal was exported to MS-EXCEL which was then loaded to Statistical Package for Social Science version 21. Descriptive and inferential analysis were done. As responses expected count was less than 5, Fisher exact test was done for observing level of significance for responses at $P=0.05$ instead of Chi square. The analyzed data were processed and presented in tables, bar diagrams, and pie charts as and where needed. For ranking of gaps, opportunities, and challenges index was calculated based on a percentage of response

for a particular category. Moreover, Cronbach’s alpha value was calculated and assessed to check the reliability and internal consistency of results obtained from survey. The value of Cronbach’s alpha between 0.755 to 0.966 showed the reliability of results. Consultation workshop was done with experts to validate the results.

RESULTS AND DISCUSSIONS

PROFILE OF RESPONDENT STAKEHOLDERS

Out of 54 respondents , 6% were farmers, 26% were scientists/researchers, 18% each were policy advocates and academicians, 10% were students of masters level (agriculture) and 22 % were extension workers (figure 1).

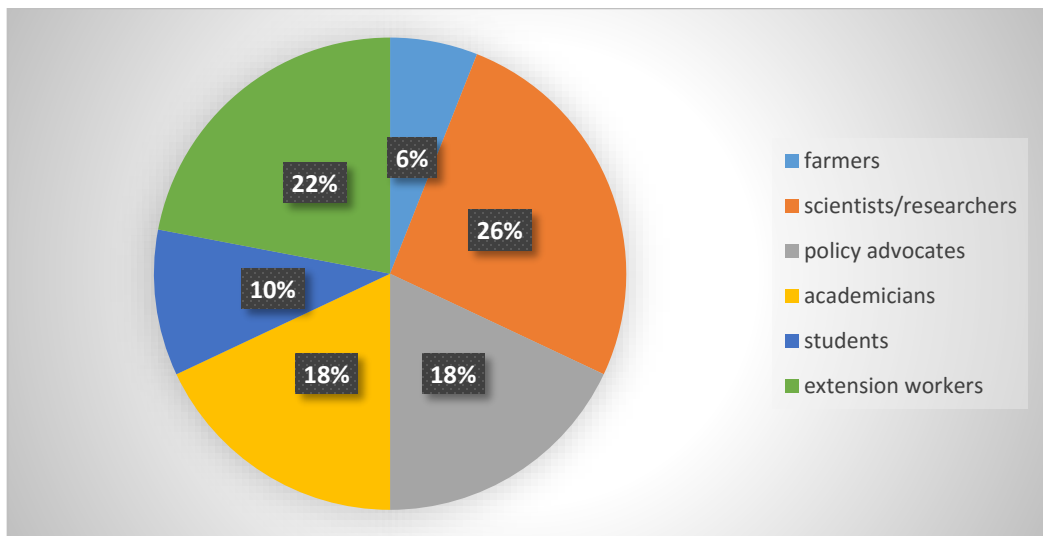


Figure 1. Profession of respondents

Similarly, the engagement of respondents in agriculture/agrobiodiversity, food and nutrition activities, climate related activities, education level and gender is shown in table 1.

Table 1. Characteristics of respondents involved in survey

Characteristics	Farmer (%)	Scientists/researchers (%)	Policy advocates (%)	Academician (%)	Students (%)	Extension workers (%)
Engagement in agrobiodiversity /agriculture	100	76.9	44.4	100	100	54.6

Characteristics	Farmers (%)	Scientists/researchers (%)	Policy advocates (%)	Academicians (%)	Students (%)	Extension workers (%)
Engagement in food and nutrition activities	100	15.4	33.3	75	0	36.4
Engagement in climate related activities	0	7.7	22.3	50	0	9
Education level						
Bachelors	66.7	7.7	44.4	0	100	45.5
Masters and above	33.3	92.3	55.6	100	0	54.5
Gender						
Male	100	92.3	33.3	55.5	80	72.7
Female	0	7.7	66.7	44.5	20	27.3

POLICY INTERLINKAGES OF AGROBIODIVERSITY AND CLIMATE CHANGE

About 68.8% of respondents said Agrobiodiversity policy 1st amendment 2014 and 58.3% said National Biodiversity Strategy and Action Plan 2014-20 are moderately linked with climate change. Apart from these two policies, the majority of respondents felt that there is no linkage between the agrobiodiversity-related policies with climate change (table 2).

Table 2. Response (%) on interlink of agrobiodiversity related policies with climate change

Policy	Strong	Moderate	Weak	No link	Can't say/don't know
Seed Act 1988	2.1	14.6	16.7	60.4	6.3
Agro biodiversity policy 1 st amendment 2014	25	68.8	4.2	-	2.1
Agriculture Development Strategy 2015	4.2	8.3	35.4	45.8	6.3
National Seed Policy 1999	3.8	21.2	32.7	30.8	11.5
National Seed Vision 2013-25	4.2	22.9	29.2	35.4	8.3
National Biodiversity Strategy and Action Plan 2014-20	31.3	58.3	8.3	-	2.1
IMISAP 2017	8.3	37.5	22.9	-	31.3
CSB Program Implementation Guideline 2008	29.2	43.8	18.8	-	8.3

Policy	Strong	Moderate	Weak	No link	Can't say/don't know
CSB Establishment Operational Guideline 2015	30.6	51	10.2	-	8.2

Statistical difference was noted in the response of professionals stating about the interlink of Seed Act 1988 ($P < 0.05$), Agricultural Development Strategy 2015 ($P < 0.05$) and National Seed Policy 1999 ($P < 0.05$) with climate change aspects. Farmers and extension workers believe that there's no linkage of Seed Act 1988 with climate change. Scientists/researchers and policy advocates found weak linkage whereas academicians and students feel moderate linkage in this regard. Similarly for Agriculture Development Strategy 2015, farmers were unable to say, extension workers felt no linkage whereas other groups stated moderate linkage with climate change. Moreover for National Seed Policy 1999, farmers said no linkage existed with climate change, policy advocates and extension workers found weak linkage whereas other groups found moderate linkage. Detail is shown in table 3.

Table 3. Response of different professionals stating the linkage of agrobiodiversity related policies with climate change

Policy	Farmer	Scientists/researchers	Policy advocate	Academicians	Students	Extension workers	Fisher exact test
Seed Act 1988	1	2	2	3	3	1	11.26*
Agro biodiversity policy 1 st amendment 2014	0	2	3	3	2	3	2.49ns
Agriculture Development Strategy 2015	0	2	2	2	2	1	12.79*
National Seed Policy 1999	1	3	2	3	3	2	12.38*
National Seed Vision 2013-25	0	3	4	3	4	2	8.21ns
National Biodiversity Strategy and Action Plan 2014-20	2	4	3	1	4	3	8.20ns
IMISAP 2017	0	4	4	4	0	4	6.23ns
CSB Program Implementation Guideline 2008	1	2	2	3	3	1	9.38ns
CSB Establishment Operational Guideline 2015	1	2	2	3	3	1	2.01ns

Note: the numbers in the table signifies median values where 0=can't say/don't know, 1=no linkage, 2=weak linkage, 3=moderate linkage, 4= high linkage, ns= not significant, *=P<0.05

About 51% of respondents said National climate change policy 2019 to be moderately linked with agrobiodiversity which was 45.8% for the National Adaptation Plan of Action 2010. Moreover, 50% perceived weak linkage of National Environment policy 2019 with agrobiodiversity and 47.9% voted the interlinkage of Environment protection act 2019 to be weak in this regard (figure 2).

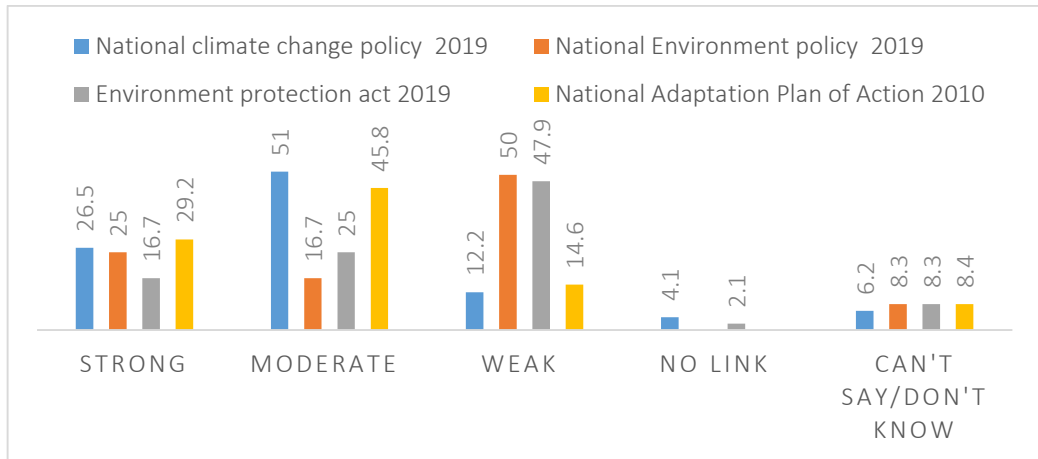


Figure 1. Response (%) on interlink of climate change-related policies with agrobiodiversity

POLICY INTERLINK OF AGROBIODIVERSITY RELATED POLICIES WITH FOOD AND NUTRITION

Talking about the interlinkage of agrobiodiversity-related policies with food and nutrition, most of the respondents felt that there is a moderate linkage between these sectors as shown in table 4.

Table 4. Response (%) on interlink of agrobiodiversity related policies with food and nutrition

Policy	Strong	Moderate	Weak	No link	Can't say/don't know
Seed Act 1988	29.2	54.2	12.5		4.1
Agro biodiversity policy 1 st amendment 2014	27.1	62.5	6.3		4.1
Agriculture Development Strategy 2015	40.8	44.9	10.2	2	2.1
National Seed Policy 1999	29.2	50	16.7		4.1

Policy	Strong	Moderate	Weak	No link	Can't say/don't know
National Seed Vision 2013-25	28.6	51	16.3		4.1
National Biodiversity Strategy and Action Plan 2014-20	14.6	68.8	6.3	2.1	8.2
IMISAP 2017	4.2	60.4	14.6		20.8
CSB Program Implementation Guideline 2008	33.2	58.3	2.1	2.1	4.2
CSB Establishment Operational Guideline 2015	34.7	55.1	4.1		6.1

Significant difference was observed while recording the response on interlinkage of agrobiodiversity related policies with food and nutrition with respect to National Biodiversity Strategy and Action Plan 2014-20 ($P < 0.05$), CSB Program Implementation Guideline 2008 ($P < 0.05$) and CSB Establishment Operational Guideline 2015 ($P < 0.05$). Farmers were unable to decide about the extent of interlinkage with these policies. Scientists/researchers and policy advocates felt high linkage, academicians felt no linkage, students were undecided for National Biodiversity Strategy and Action Plan 2014-20 and felt weak linkage for CSB Program Implementation Guideline 2008 and CSB Establishment Operational Guideline 2015. Similarly, extension workers said that these policies are moderately linked with food and nutrition (table 5).

Table 5. Response of different professionals stating the linkage of agrobiodiversity related policies with food and nutrition

Policy	Farmer	Scientists/researchers	Policy advocate	Academicians	Students	Extension workers	Fisher exact test
Seed Act 1988	0	4	3	4	1	2	5.49ns
Agro biodiversity policy 1 st amendment 2014	0	2	4	3	3	3	5.92ns
Agriculture Development Strategy 2015	0	3	4	4	3	4	9.14ns
National Seed Policy 1999	0	4	3	4	3	1	5.27ns
National Seed Vision 2013-25	0	4	4	3	2	2	4.20ns
National Biodiversity Strategy and Action Plan 2014-20	0	4	4	1	0	2	11.07*
IMISAP 2017	0	3	3	1	3	1	5.03ns
CSB Program Implementation	0	4	4	1	2	2	12.67*

Policy	Farmer	Scientists/researchers	Policy advocate	Academicians	Students	Extension workers	Fisher exact test
Guideline 2008 CSB Establishment Operational Guideline 2015	0	4	4	1	2	2	12.82*

Note: the numbers in the table signifies median values where 0=can't say/don't know, 1=no linkage, 2=weak linkage, 3=moderate linkage, 4= high linkage, ns= not significant, *=P<0.05
As shown in **table 06**, the majority of respondents felt that the policies related to food and nutrition are moderately linked to agrobiodiversity.

Table 6. Response (%) on interlink of policies and legislation related to food and nutritional security with agrobiodiversity

Policy	Strong	Moderate	Weak	No linkage	Can't say/don't know
Multi sectorial nutritional plan II (2018-22)	23.4	46.8	17	4.3	8.5
National nutritional policy and strategy 2004	23.4	55.3	14.9	2.1	4.3
Zero hunger challenge national action plan (2016-25)	19.1	51.1	17	6.4	6.4
Food and nutritional security plan of action 2013	21.3	53.2	17	2.1	6.4
The right to food and food sovereignty act 2018	27.7	46.8	19.1		6.4

While observing the response of different professional groups stating the interlinkage of food and nutrition related policies with agrobiodiversity, significant difference was not observed in any of the cases. Detail is shown in table 07.

Table 07. Response of different professionals stating the linkage of food and nutrition related policies with agrobiodiversity

Policy	Farmer	Scientists/researchers	Policy advocate	Academicians	Students	Extension workers	Fisher exact test
Multi sectorial nutritional plan II (2018-22)	0	4	3	1	1	4	1.59ns
National nutritional policy and strategy	0	3	3	2	0	4	4.26ns

Policy	Farmer	Scientists/researchers	Policy advocate	Academicians	Students	Extension workers	Fisher exact test
2004							
Zero hunger challenge national action plan (2016-25)	0	3	2	1	1	4	4.33ns
Food and nutritional security plan of action 2013	0	3	3	3	0	4	3.33ns
The right to food and food sovereignty act 2018	0	3	4	3	0	4	5.60ns

Note: the numbers in the table signifies median values where 0=can't say/don't know, 1=no linkage, 2=weak linkage, 3=moderate linkage, 4= high linkage, ns= not significant, *=P<0.05

INSTITUTIONAL ARRANGEMENT RELATED TO AGROBIODIVERSITY

With regards to the institutional arrangements related to agrobiodiversity, the majority of respondents felt the inadequacy in geographical coverage and number (48%), staffs strength and capacity (70%), and impacts produced (76%) (figure 3). While coverage of content and subjects as well as a collaboration was said to be average by 58% and 52% of respondents respectively.

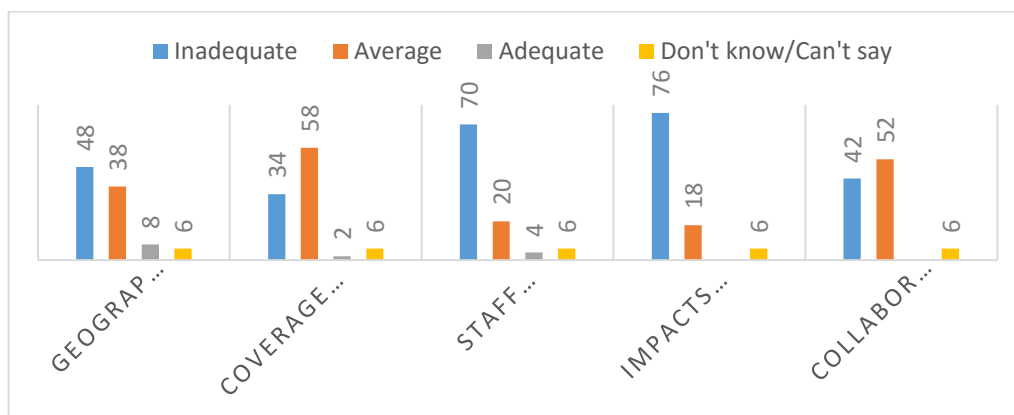


Figure 3. Response (%) on status of institutional arrangements related to agrobiodiversity

While observing the response on institutional arrangement related to agrobiodiversity across different professional groups significant difference was seen only for impacts produced so far (P<0.05). Farmers and students were undecided, policy advocates and extension workers felt the impacts were inadequate, moreover, scientists/researchers and academicians felt the impacts produced from current institutional arrangement were average. Detail is shown in table 08.

Table 8. Response of different professional groups on status of institutional arrangements related to agrobiodiversity

Profession	Farmers	Scientist/researcher	policy advocate	Academicians	Students	extension workers	Fisher exact test
Geographical coverage and number	3	3	1	3	2	3	8.64ns
Coverage of the contents and subjects	0	1	0	0	0	0	3.67ns
Staff strength and capacity	0	2	1	3	3	3	8.42ns
Impacts produced so far	0	2	1	2	0	1	13.03*
Collaboration with other related institutions	0	1	1	0	0	1	8.01ns

Note: the numbers in the table signifies median values where 0=can't say/don't know, 1=inadequate, 2=average, 3=adequate, ns=not significant, *=P<0.05

IMPLEMENTATION STATUS

As per the respondents the implementation status of policies regarding agrobiodiversity is not in the direction as anticipated. Most of the policies are perceived to be slightly effective (**table 09**).

Table 9. Response (%) on implementation status of agrobiodiversity related policies

Policy	Highly effective	Moderately effective	Slightly effective	Ineffective	Can't say/don't know
Seed Act 1988	4.2	20.8	47.9	20.8	6.2
Agro biodiversity policy 1 st amendment 2014		18	60	8	14
Agriculture Development Strategy 2015		16	52	26	6
National Seed Policy 1999	2	24	50	16	8
National Seed Vision 2013-25	2	14	58	18	8
National Biodiversity Strategy and Action Plan 2014-20		18	56	12	14
IMISAP 2017		10	40	6	44
CSB Program Implementation Guideline 2008	4	26	46	6	18

Policy	Highly effective	Moderately effective	Slightly effective	Ineffective	Can't say/don't know
CSB Establishment Operational Guideline 2015	2	24	46	6	22

While observing the response on implementation status of agrobiodiversity related policies, significant difference was observed with Agriculture Development Strategy 2015 ($P < 0.05$) and National Seed Vision 2013-25 ($P < 0.05$). Detail is shown in table 10.

Table 10. Response of different professional groups about the implementation of agrobiodiversity, related policies

Policy	Farmer	Scientists/researchers	Policy advocate	Academics	Students	Extension workers	Fisher exact test
Seed Act 1988	0	4	0	3	2	2	2.17ns
Agro biodiversity policy 1 st amendment 2014	0	3	0	3	0	3	3.62ns
Agriculture Development Strategy 2015	0	1	2	1	2	1	12.68*
National Seed Policy 1999	0	4	1	2	2	2	4.27ns
National Seed Vision 2013-25	0	3	2	2	2	2	10.63*
National Biodiversity Strategy and Action Plan 2014-20	0	2	2	3	3	1	8.46ns
IMISAP 2017	0	2	1	1	0	1	5.21ns
CSB Program Implementation Guideline 2008	0	3	2	4	3	3	4.32ns
CSB Establishment Operational Guideline 2015	0	4	2	3	1	2	3.39ns

Note: the number represents the median value where 0 = “Can’t say/don’t know”, 1 = ineffective, 2 = slightly effective, 3 = moderately effective and 4 = highly effective

POLICY CONSTRAINTS, CHALLENGES, AND OPPORTUNITIES

The major opportunities as perceived by respondents for increasing policy interlinkage for improving climate resiliency were adaptation and mitigation strategies to combat climate change, linking climate change with income generation, and enhanced livelihood opportunities. However, certain challenges are hindering cash in these opportunities. The major challenges perceived in this regard were

uneven impacts seen across regions and population groups, adaptation and mitigation strategies being site-specific and fewer priorities given to marginal communities (table 11).

Table 11. Opportunities and challenges of increasing policy interlinkage for improving climate resiliency

Opportunities	Index	Rank	Challenges	Index	Rank
Awareness raising	0.16	4 th	Less priority to marginal communities Adaptation and mitigation strategies are site specific	0.23	3 rd
Enhanced livelihood opportunities	0.20	3 rd		0.27	2 nd
Adaptation and mitigation strategies followed	0.27	1 st	Uneven impacts across regions and population groups	0.30	1 st
Link climate change adaptation with income generation	0.23	2 nd	Lack of well defined support in terms of knowledge and technology transfer	0.19	4 th
Ensure participation of local communities	0.14	5 th			

The major opportunities as perceived by respondents for increasing policy interlinkage for improving food and nutritional security were mainstreaming neglected underutilized species in food and nutrition plan, value addition of minor crops, and importance to food sovereignty by the constitution of Nepal. The major challenges perceived to hinder cashing opportunities were difficult geography and poor infrastructure, change in land use pattern, and loss of biodiversity (table 12).

Table 12. Opportunities and challenges of increasing policy interlinkage for improving food and nutritional security

Opportunities	Index	Rank	Challenges	Index	Rank
Mainstreaming NUS	0.22	1 st	Out migration of youth	0.16	3 rd
Increased awareness	0.18	3 rd	Change in dietary pattern	0.13	5 th
Enhanced livelihood opportunities	0.17	5 th	Difficult geography and poor infrastructure	0.22	1 st
Achieve food sovereignty	0.18	3 rd	Change in land use pattern	0.19	2 nd
Value addition of	0.22	1 st	Loss of biodiversity	0.16	3 rd

Opportunities	Index	Rank	Challenges	Index	Rank
minor crops					
Community based local participation	0.01	6 th	Climate change	0.11	6 th
Integration of crops, livestock and fisheries	0.01	6 th	Armed conflicts in the past	0.01	7 th
One health program	0.01	6 th	Social dispute and disintegration	0.01	7 th

The major opportunities for increasing policy interlinkage so as to improve the conditions of small holder farmers were perceived that the small holders are better placed to manage agrobiodiversity, agrobiodiversity provides livelihood security to small holders and resource endowed farmers maintain agrobiodiversity. The major challenges perceived to hinder cashing opportunities were low initial demand of neglected underutilized species, the high transitional cost for small holders to bear, and limited access to technical knowledge (table 13).

Table 13. Opportunities and challenges of increasing policy interlinkage for improving condition of small holder farmers

Opportunities	Index	Rank	Challenges	Index	Rank
Smallholder supply great part of food stuffs consumed	0.2	4 th	Low initial demand of NUS	0.28	1 st
Small holders are closely placed to manage agro biodiversity	0.3	1 st	High transitional cost	0.24	2 nd
Resource endowed farmers maintain agrobiodiversity	0.23	3 rd	Limited capital resource	0.22	4 th
Agrobiodiversity provides livelihood security to small holders	0.25	2 nd	Limited access to technical knowledge	0.24	2 nd
Sustainable management of resources at community level	0.01	5 th	Small scale production and poor government support	0.01	5 th

CONCLUSIONS

Awareness on policies related to agriculture is quite poor across the country. The majority of these policies do not recognize the agrobiodiversity at the core having linkage with climate change and nutrition in the sense that conservation of agrobiodiversity has positive impact on climate change adaptation and nutritional outcomes. Moreover, the level of effectiveness and implementation status is either

mostly less effective, ineffective and few of the policies are moderately effective. The contribution of such policies to smallholders is very negligible. Interlinkages among these policies should be inbuilt targeting conditional beneficiaries and specific locations. Institutional setup for implementation and monitoring need to strengthen. Wide consultation during policy formulation and implementation, regular impact assessment, and review are necessary to get the greater impact of these policies on farming and consumer communities. Policies should be effectively developed and implemented so that a system-based approach could be in place for conservation and utilization of agrobiodiversity, food and nutrition security, and mitigation of climate changes targeting smallholder farmers.

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