Climate Smart Agricultural Technologies in Nepal

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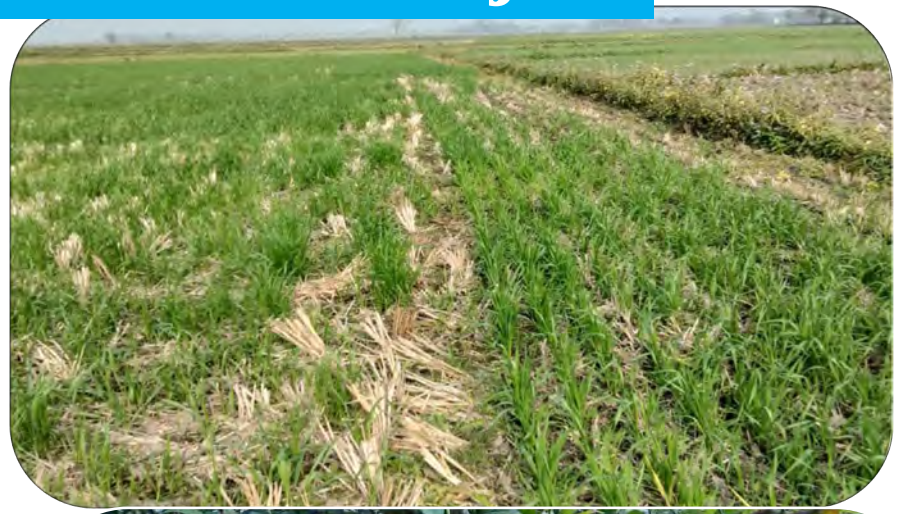
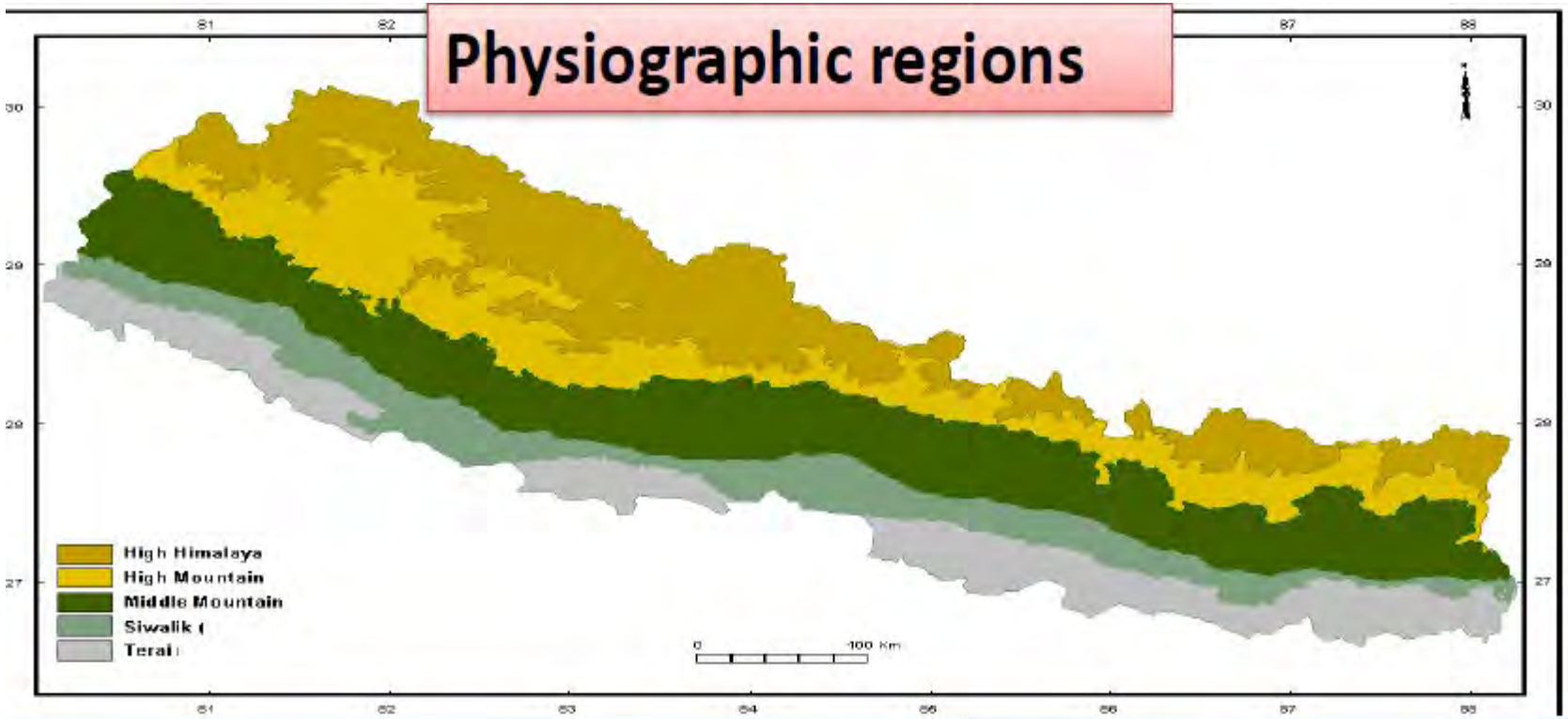
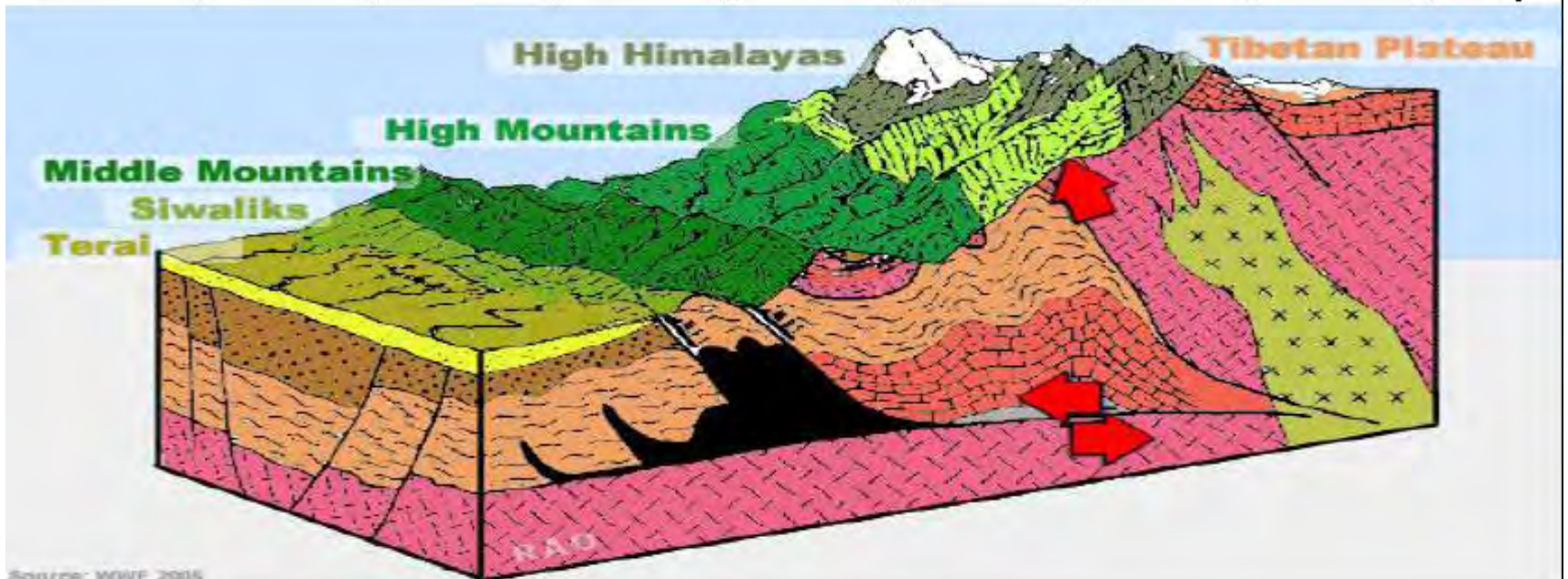
Organized by: C-SUCSeS Project



Physiographic regions





Agro Eco zone

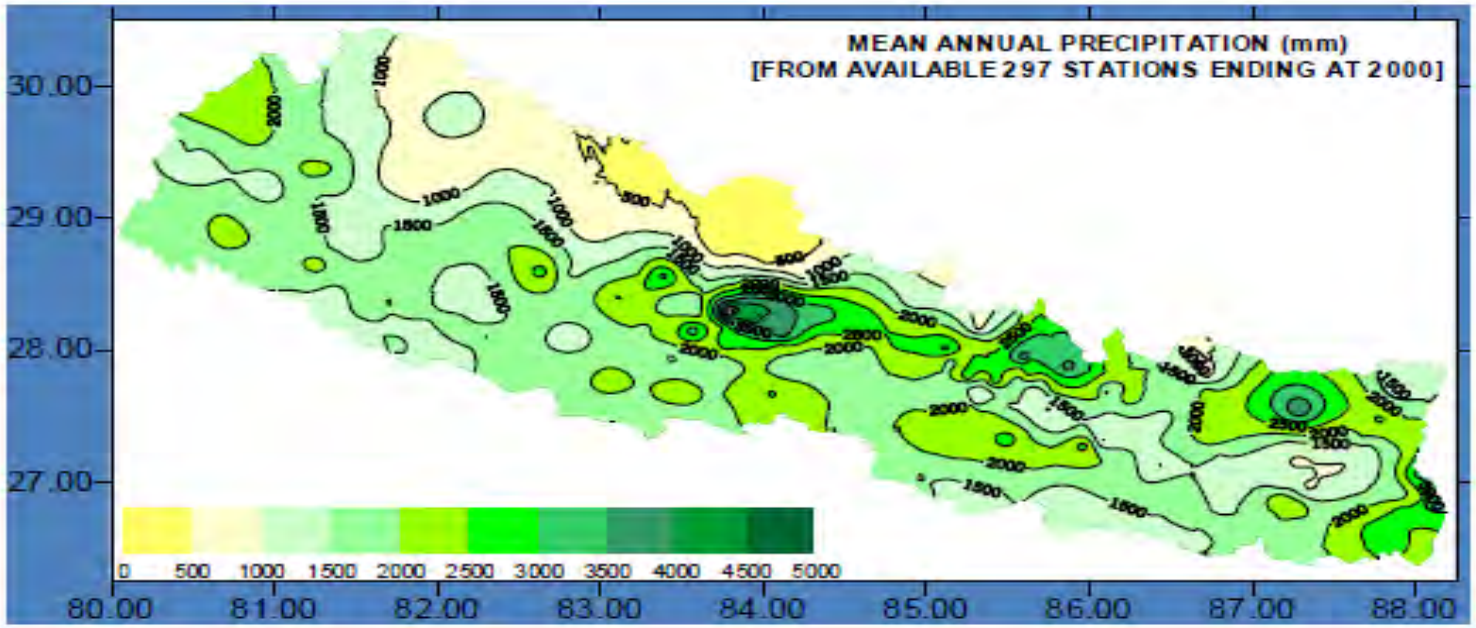
Mountain (35%)
Sub Alpine

Hill (42%)
Cool Temperate

Terai (23%)
Sub Tropical

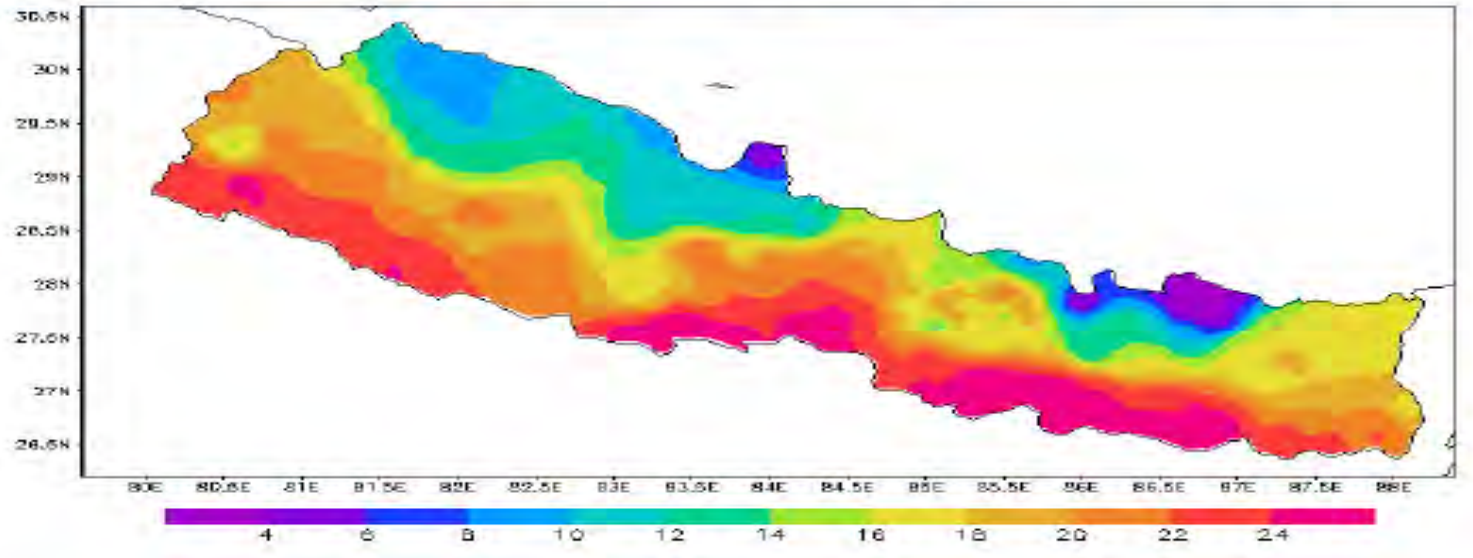
Climate

- Warm sub-tropical to cool temperate climate based on altitude.
- 80% rainfall - monsoon (June- Sept.)

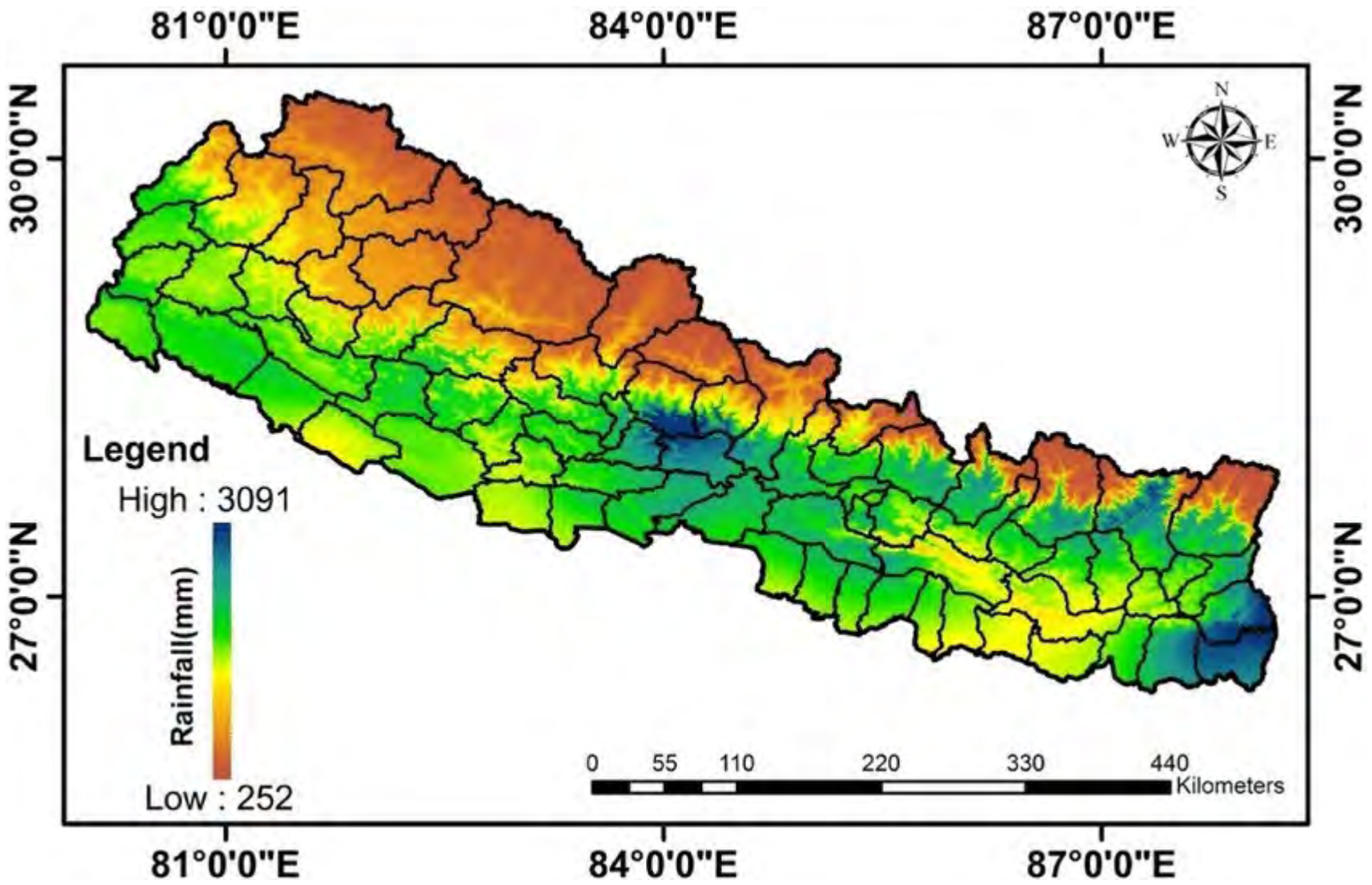


Season

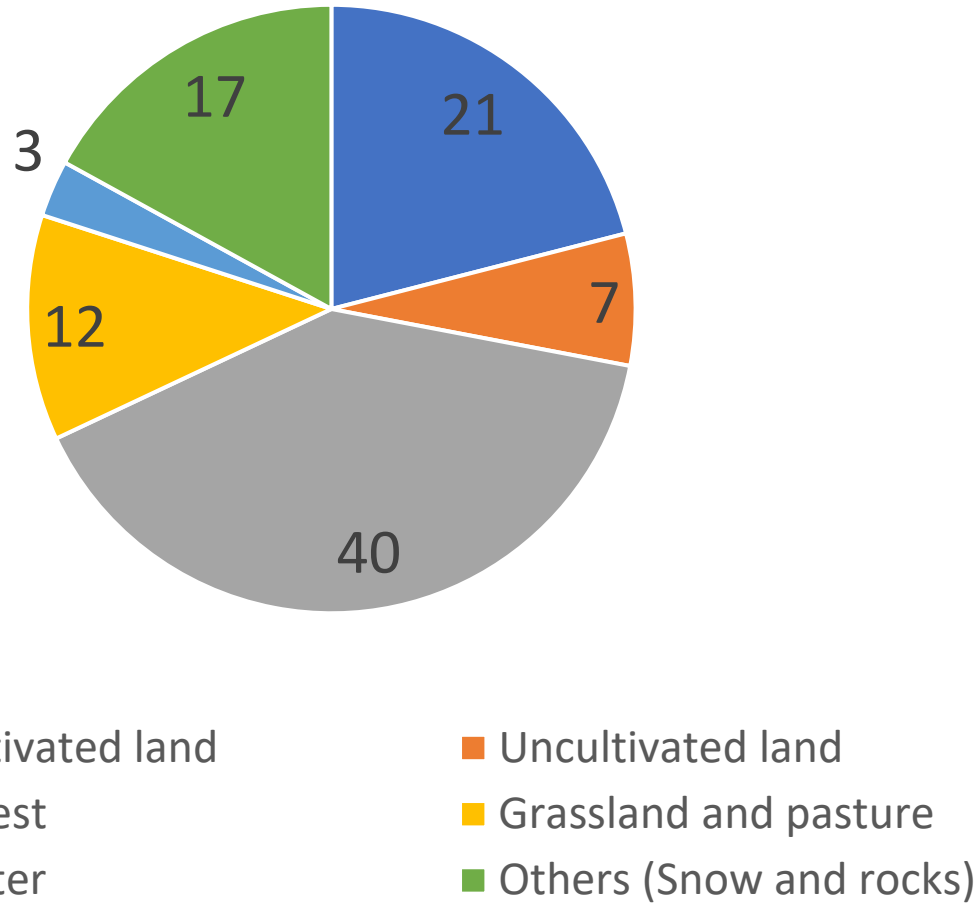
- Spring (Mar, Apr, May)
- Summer (Jun, July, Aug),
- Autumn (Sep, Oct, Nov),
- Winter (Dec, Jan, Feb)



Annual Mean Rainfall Map of Nepal



Agriculture at a glance



- Cultivated land: 2.6 million ha
- Livestock sector contributes 13 and 27 percent to GDP and AGDP, respectively (DLS, 2020).
- In urban areas 29% and in rural areas 38% of households are food insecure.
- Biodiversity: 1026 crop species, 510 forages, 35 livestock, 250 aquatic animal, 17 aquatic plant, 3,500 insect and 800 microorganism.

Poor agricultural productivity:

- Poor irrigation facilities (28% year round irrigation)
- Degrading Soil Fertility Status – Composting, imbalance fertilizer use, site specific nutrient management, intensive tillage
- Less mechanization
- Poor yielding genotypes/breeds
- Inadequate farming system research- barren land, dryland and rainfed farming
- Weeds problem
- **Climate Change-drought, flood, sowing time and crop maturity……..**
- **Inadequate R&D on Climate Smart Agricultural (CSA) Technologies**

CONSEQUENCES OF CLIMATE CHANGE

- Drought : lower crop yields, higher food prices, and detrimental effects on rural communities' livelihoods (WBG, 2022).
- Unseasonal heavy rains in October, 2021 brought floods and landslides damaged rice paddy crops worth >US$50 million. Roads, bridges, and other physical infrastructure were also damaged.
- The direct economic cost of climate vulnerability in the agriculture sector in 2020 was 1.5-2 percent of GDP.
- An estimated loss of agrobiodiversity is 40% (CC + other factors) –ref?

Extreme climate indices trend in Nepal

Extreme Climate Indices	Trend pattern/regions
Number of rainy days	Increasing significantly, mainly in the northwestern districts and trend are insignificant in other districts
Very wet days	Decreasing significantly mainly in the mountains
Consecutive wet days	Increasing significantly in the northern districts of Karnali Province, central part of Gandaki and Lumbini, however the trend is insignificant.
Consecutive dry days	Decreasing significantly, mainly in the Karnali Province insignificant in other provinces.
Warm days	Increasing significantly
Warm nights	Increasing significantly
Warm spell duration	Increasing significantly
Cool days	Decreasing
Cool nights	Increasing in the northwestern significantly and decreasing in the southeast significantly
Cold spell duration	Increasing significantly only in the FW districts and trends are insignificant in other districts

Initiatives to cope with the climate change effects in Nepal

- National Climate Change Poilcy, 2019
- Local Adaptation Plan for Action Framework, 2012
- Climate Change Budget Code, 2013
- Reducing Emission from Deforestation and Forests Degradation (REED) Strategy, 2016
- Nationally Determined Contribution (NDC), 2016
- National Adaptation Plan (on the process)
- Agriculture Development Strategy (ADS), 2015-2035
- The Fourteenth Plan (2016/17-2018/19)
- The Fifteenth Plan (2019/20-2023/24)

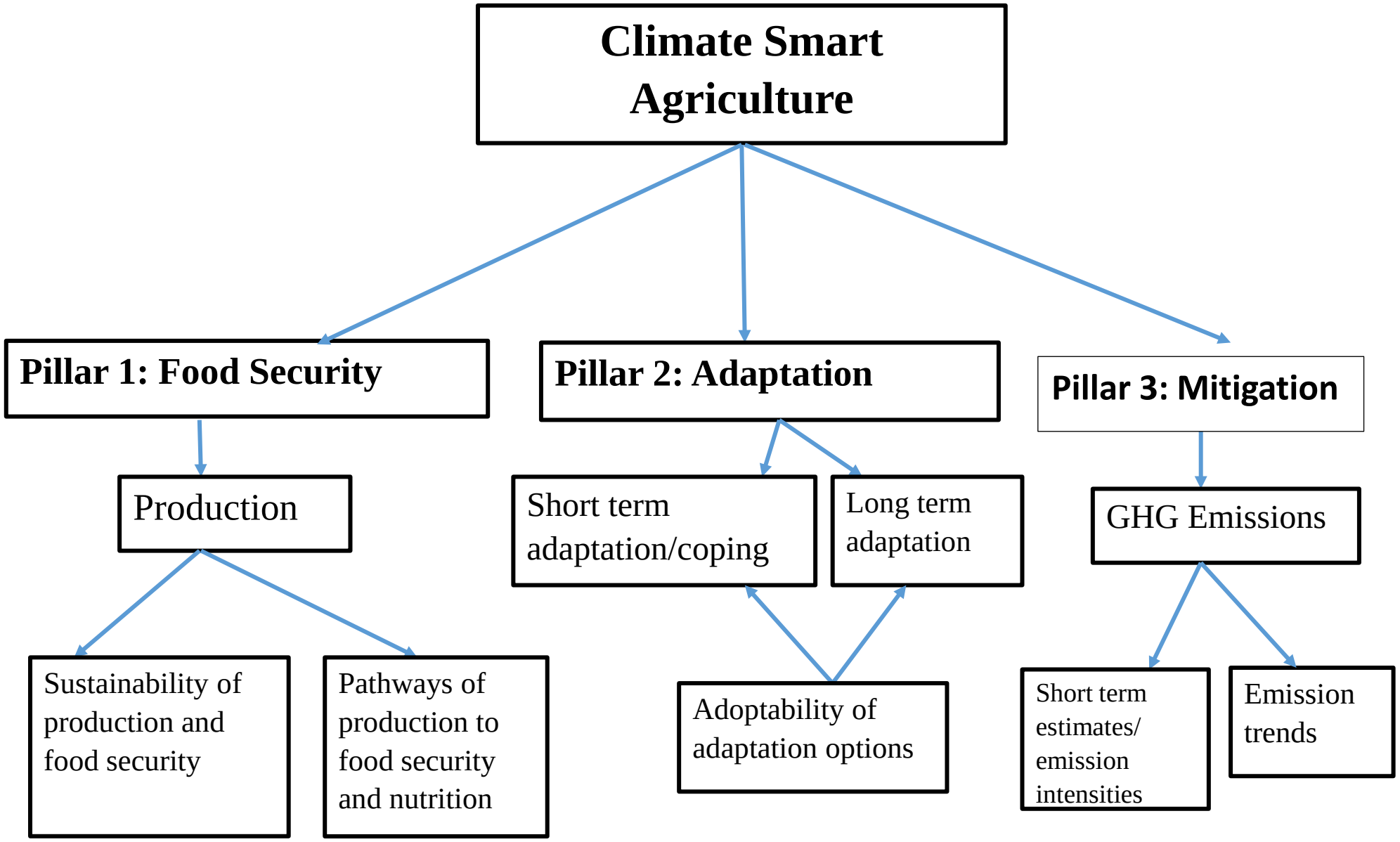


Figure. Pillars of climate smart agriculture

Prioritized CSA technologies for Terai crop production system

(Adapted from WB, 2021 CSAIP Nepal)

S. N.	Key Climate-Smart Criteria
1	System of Rice Intensification (SRI) with alternative wet and dry irrigation system
2	Alternative wet and dry irrigation system
3	Good irrigation practices (gravitational and pressurized irrigation)
4	Laser land-leveling
5	Relay cropping of pulses and oilseeds
6	Zero tillage of wheat and direct sowing of rice (DSR)
7	Land pooling and terrace improvement
8	Precision use of chemical fertilizers and management of farmyard manure, green manures, and crop residues for mulching
9	Promotion of boro (winter) rice and winter maize
10	Drought and flood tolerant varieties of crops
11	Varietal improvement of niche products such as mustard, soybean, and aromatic rice

Prioritized CSA technologies for hill and mountain crop production system

1	Key Climate-Smart Criteria
2	SRI in river basin lowlands
3	Good irrigation practices, rainwater and snow harvesting, drip and solar based irrigation.
4	Soil and irrigation management through increased soil organic matters
5	Laser land-leveling in terraced areas to reduce soil erosion
6	Sloping agriculture land technology (SALT) with integrating cereal crops
7	Cover crop plantation, legume integration in maize crop, strip crop plantation using shade-loving plants such as ginger and turmeric in maize field
8	Mulching to reduce evapo-transpiration and weed infestations
9	Zero/minimum till and strip tillage, Dry Direct Seeded Rice and Puddled DSR
10	Protection from flash floods and soil erosion through bioengineering and transplantation of tree saplings and forage plants, and protecting stream banks through gabion wire, check dam, plantation
11	Drought-tolerant varieties of crops and deep rooted crop species to increase resilience

Institutional engagement for CSA development and promotion in Nepal

S. N.	Institutions/project	Activities
1	MoALD/PMAMP	Policy formulation and implementation, Promotion of CSA options
2	NARC in collaboration with PPCR, AFASI, UNEP/GEF, SDC/Helvetas, IRRI, CIMMYT	Agro-met advisory services, IPM and Organic farming, Traditional crop diversification, Gender sensitive and climate adaptive technology, Mechanization on rice-lentil system, Heat stress resilient maize and climate resilient wheat and rice, Conservation Agriculture
3	Agriculture Ministry of Lumbini and Gandaki Province	Climate Smart Village (CSV)
4	CGIAR on Climate Change, Agriculture and Food Security (CCAFS), New Delhi, India Local Initiatives for Biodiversity, Research and Development (LI-BIRD)	CSA project through which they identified champion CSA practices for three AEZs and developed CSA scale-up strategies
5	Practical Action	Industrial crop through private sector engagement
6	ICIMOD) and CEAPRED)	Piloting a Resilient Mountain Village concept with strong emphasis on CSA for hill systems.
7	Developing Climate Resilient Livelihoods in the Vulnerable Watershed in Nepal (DCRL), UNDP	Developing and promoting climate resilient water resource conservation and utilization practices and conservation farming in Drought Declared Districts of Okhaldhunga and Khotang.

Major CSA technologies practiced in Nepal

S. N.	CSA technologies	Smartness
1	Climate resilient crop varieties	Weather/knowledge smart
2	Weather based crop insurance	Weather smart
3	Protected cultivation for vegetable production	Weather smart
4	Climate smart housing for livestock	Weather smart
5	Stress tolerant breed	Weather smart
6	Laser land leveler (LLL)	Water smart
7	Direct seeded rice	Water smart
8	System of rice intensification	Water smart
9	Drip irrigation	Water smart
10	Sprinkler irrigation	Water smart
11	Alternate wetting and drying irrigation in rice field	Water smart
12	Rainwater harvesting	Water smart
13	Pond water depth for fish farming	Water smart and energy smart

Major CSA technologies practiced in Nepal

S. N.	CSA technologies	Smartness
14	Use of mulching	water and weather smart
15	Raised bed planting	Water smart
16	Cover crops method	Water smart
17	Conservation furrow	Water smart
18	Sloping agriculture land technology (SALT) with integrating cereal crops	Water/nutrient/carbon smart
19	Laser land leveling	Water smart
20	Irrigation scheduling/management	Water smart
21	Conservation furrow	Water smart
22	Furrow irrigation	Water smart
23	Zero tillage	Energy smart
24	Minimum tillage	Energy smart
25	Solar pump	Energy smart

Major CSA technologies practiced in Nepal

S. N.	CSA technologies	Smartness
26	Solar dryer	Energy smart
27	Zero-energy storage	Energy smart
28	Use of leaf colour chart (LCC)	Nutrient smart
29	Site specific nutrient management	Nutrient smart
30	Improved compost	Nutrient smart
31	Improvement of farmyard manure	Nutrient smart
32	Crop diversification	Nutrient smart
33	Conservation agriculture	Nutrient smart/carbon smart
34	Biochar	Nutrient smart
35	Permanent bed planting	Nutrient smart
36	Jhol mal (plant/urine based liquid form of fertilizer)	Nutrient smart

Major CSA technologies practiced in Nepal

S. N.	CSA technologies	Smartness
37	Integrated nutrient management	Nutrient smart
38	Green manuring	Nutrient smart
39	Sowing/planting time adjustment	Knowledge smart
40	Home garden	Knowledge smart
41	Integrated fish farming	Knowledge smart
42	Rice cum duck farming	Knowledge smart
43	Contingent crop planning	Knowledge smart
44	Agro-met advisory	Knowledge smart
45	Livestock and fishery as diversification strategy	Knowledge smart
46	Integrated pest management	Knowledge smart
47	Concentrate feeding for livestock	Carbon smart
48	Fodder management	Carbon smart
50	Agro-forestry	Carbon smart
51	Management of grazing land	Carbon smart

Major CSA technologies practiced in Nepal

1. Weather smart CSA technologies: Agrometeorology Advisory Bulletin	
1) Climate resilient crop varieties	
1.1	Drought tolerant rice varieties : Sukha Dhan1, 2,3,4,5, and 6, Ghaiya -3
1.2	Submerged/flood tolerant rice varieties: Sworna Sub1, Sambha Masuri sub1, Ciherang sub1, Gangasagar-1 and Gangasagar-2
1.3	Drought and submergence tolerant rice varieties: Bahuguni dhan-1 and Bahuguni dhan-2
1.4	Cold tolerant rice varieties: Lekali dhan-1 and Lekali dhan-3, Chandannath-1 and Chandannath-3, Machhapuchhre-3
1.5	Heat tolerant wheat varieties: Gautam, Vijaya, Bhrikuti, Bandganga, Borlaug 2020
1.6	Heat tolerant maize varieties: Rampur Hybrid-8, Ramour Hybrid-10 and Rampur Hybrid-12
1.7	Lentil genotypes for submergence tolerance: Sagun
1.8	Drought tolerant potato genotypes: PRP 35861.13, L 235.4, 397077.16 and 394034.65
2) Weather based crop insurance	
3) Protected cultivation for vegetable production	
4) Climate smart housing for livestock	
5) Stress tolerant breed- indigenous species (eg. Lulu Cattle)	
6) In Nepal, 18,765 accessions of AGRs have been conserved in GENEBANK.	

Major CSA technologies practiced in Nepal

2. Water smart CSA technologies	
1) Laser Land Leveler (LLL)	
2) Low water input based (water efficient) rice production techniques	
1)	Direct seeded rice (DSR)
2)	System of rice intensification (SRI)
3)Water efficient irrigation system	
1)	Alternate wetting and drying irrigation system for rice
2)	Drip irrigation
3)	Sprinkler irrigation
4) Rain water harvesting	
5) Pond water depth for fish farming	
6) Sloping agriculture land technology (SALT)	

Major CSA technologies practiced in Nepal

4. Energy smart CSA technologies	
1)	Zero tillage
Zero tillage wheat	
Zero tillage lentil	
Zero tillage rice	
Zero tillage maize	
Zero tillage garlic	

5. Nutrient smart CSA technologies
1) Integrated nutrient management
2) Site specific nutrient management
3) Improved composting
4) Improvement of farmyard manure
5) Crop diversification: Maize based inter cropping
Rice based inter/relay cropping
Wheat and maize based intercropping
Mixed cropping of oilseed crop and legumes
6) Conservation agriculture: Maize based cropping system Rice-wheat cropping system, Agroforestry, Agro-Horti system
7) Biochar

Major CSA technologies practiced in Nepal

6. Knowledge smart CSA technologies
1) Sowing/planting time adjustment
2) Integrated pest management (IPM)
3) Home garden
4) Agro-met advisory bulletin
5. Carbon smart CSA technologies
1) Agro-forestry
2) Fodder management
3) Management of grazing land
4) Cover crop

Native breeds

Cattle (7) : ***Lulu, Siri, Acchami, Pahadi, Terai, Khaila, Yak***

Buffalo (4): ***Gaddi, Lime, Parkote, Terai***

Goat (4): ***Terai, Khari, Sinhal, Chyangra***

Sheep (4) : ***Lampuchhre, Kage, Baruwal, Bhyanglung***

Pig (3) : **Chwanche, Hurrah, *Bampudke, Bandel (wild)***

Chicken (3): ***Sakini, Ghanti Khuile, Pwankh Ulte***

Some of the glimpses of CSA in Nepal

Water harvesting practices in Nepal

Recharge pond

Water harvesting pond

Water management practices in Nepal

Greywater Collection

Solar lifting Irrigation

Pani pipe for AWD in rice

Improved composting and manuring in Nepal

Improved Cattle Shed

Improved Composting

Land leveled with Laser Land Leveler

Tillage and residue effect on soil organic matter, Rampur

Drought & Submergence tolerant rice varieties at NARC

Sukhhadhan-2

Sukhhadhan-3

Bahuguni dhan-1

Sukkhadhan-4

Sukkhadhan-5

Bahuguni dhan-2

Submergence/flood tolerant rice varieties

Swarna sub-1

Gangasagar-1

Gangasagar-2

Cold tolerant rice varieties

Heat tolerant wheat varieties

Heat & drought tolerant maize varieties:

- NMRP in collaboration with CIMMYT has developed heat tolerant maize varieties:

Rampur Hybrid 8

Rampur Hybrid 10

Rampur hybrid-12

CAH 1511

CAH 1817

CAH 193

Climate resilient landraces

Proso millet: Dudhae Chino (Humla

Fox tail millet: Bariyo Kaguno (Lamjung)

जुम्ला लाल मार्से

Fox tail millet: Bariyo Kaguno (Lamjung)

Finger millet: Rato Kodo (Jumla)

aces

Climate resilient common fruit crops in Nepal


Walnut


Almond


Pomegranate


Grapes


Sun kagati

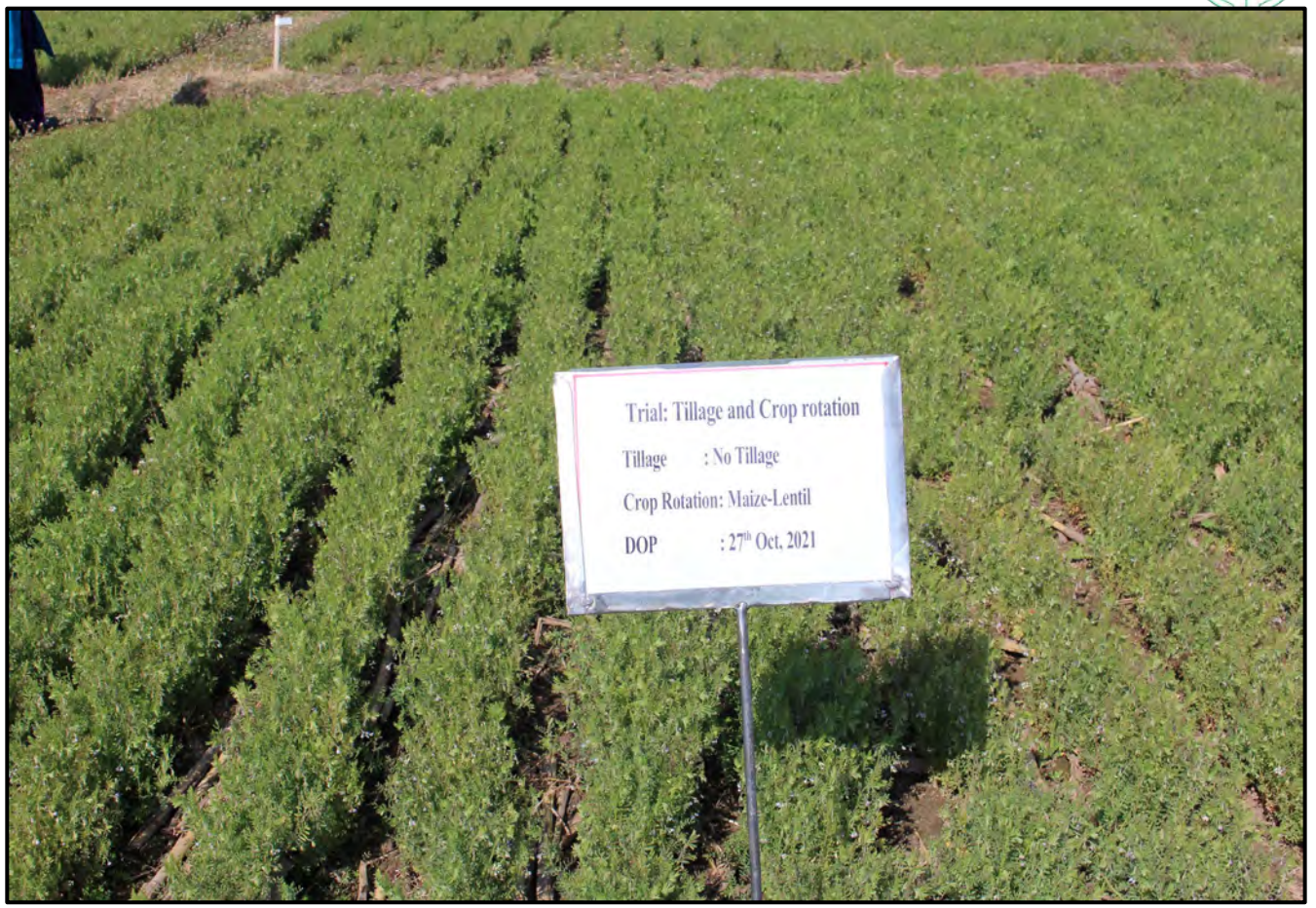

Dragon fruits

Conservation Agricultural Technologies

Zero till wheat under maize-wheat system, midhill, Agronomy Farm, Lalitpur, 2022

Zero till lentil under maize-legumes system, midhill,2022 Agronomy Farm, Lalitpur, 2022

Zero till under rice-maize system, Terai, RARS, Sunsari, Terai, 2018



Zero till lentil under maize-legumes system, midhill, 2022 Agronomy Farm, Lalitpur, 2022

Dry DSR, 2021 at Agronomy Farm, Lalitpur

DSR with drum seeder, 2021, Agronomy Farm,

ZT maize with plastic mulch at Rampur, 2016

ZT maize under maize-maize system at Rampur, 2016

On-station Demonstration and Seed Production by Dry DSR, 2021 at Agronomy Farm, Lalitpur

On-station Demonstration and Seed Production by ZT-Wheat, 2021 at Agronomy Farm, Lalitpur

On-farm Demonstration of zero till wheat, OR site, 2022

On-farm Demonstration of DSR and PTR, Chitwan

Zero till garlic after rice, Bardiya

Plastic mulching in Lalitpur

Banana intercropped with legumes

Mulching in citrus

Agroforestry in Nepal

Agro-met Advisory Bulletin (AAB)-Weather smart technology

Agricultural meteorology branch

-Weather information of the previous week

- ❑ **Weekly total rainfall**
- ❑ **Weekly average temperature**
- ❑ **Weekly relative humidity**
- ❑ **Wind speed & direction**

Situation of crop and livestock (Offices under NARC, Agriculture and livestock services)

Meteorological forecasting division

-Weather condition for the next seven days

- ❑ **Rainfall**
- ❑ **Temperature**
- ❑ **Weather condition**
- ❑ **Important weather systems**

Expert team of Agro-met Advisory Bulletin

Extension/diffusion

Farming community/Agricultural entrepreneur

Challenges/barriers for CSA in Nepal

- Complex bio-physical and socio-economic settings
- Inadequate evidence-based knowledge/information on CSA, its consequences and technological options- Poor in CSA technological R&D
- No data on CSA technologies adoption acreage
- Government policies are not CSA friendly
- Institutional/individual capacity and collaboration among the concerned agencies (public-private) - poor
- Poor access of resources and financing

The way-forward

- Evidence base- On-Station & On-farm Research
- Policy-Enabling
- Capacity-at all levels
- Collaboration with CG centers, Regional and Global initiatives and I/NGOs
- Financing
- Implementation-public-private partnership

Acknowledgement

- Consortium for Scaling-up Climate Smart Agriculture in South Asia (C-SUCSeS) Project
- Government of Nepal, MoALD
- Nepal Agricultural Research Council, NARC
- Dept. of Hydrology and Meteorology, Nepal
- Dept. of forestry and Environment
- CG Centres
- Institutions involved in CSA R&D in Nepal
- Funding agencies

Thank You !