



NEXUS Gains:
Realizing Multiple Benefits
Across Water, Energy, Food
and Ecosystems

Crop Diversification in Northwest India: drivers and barriers

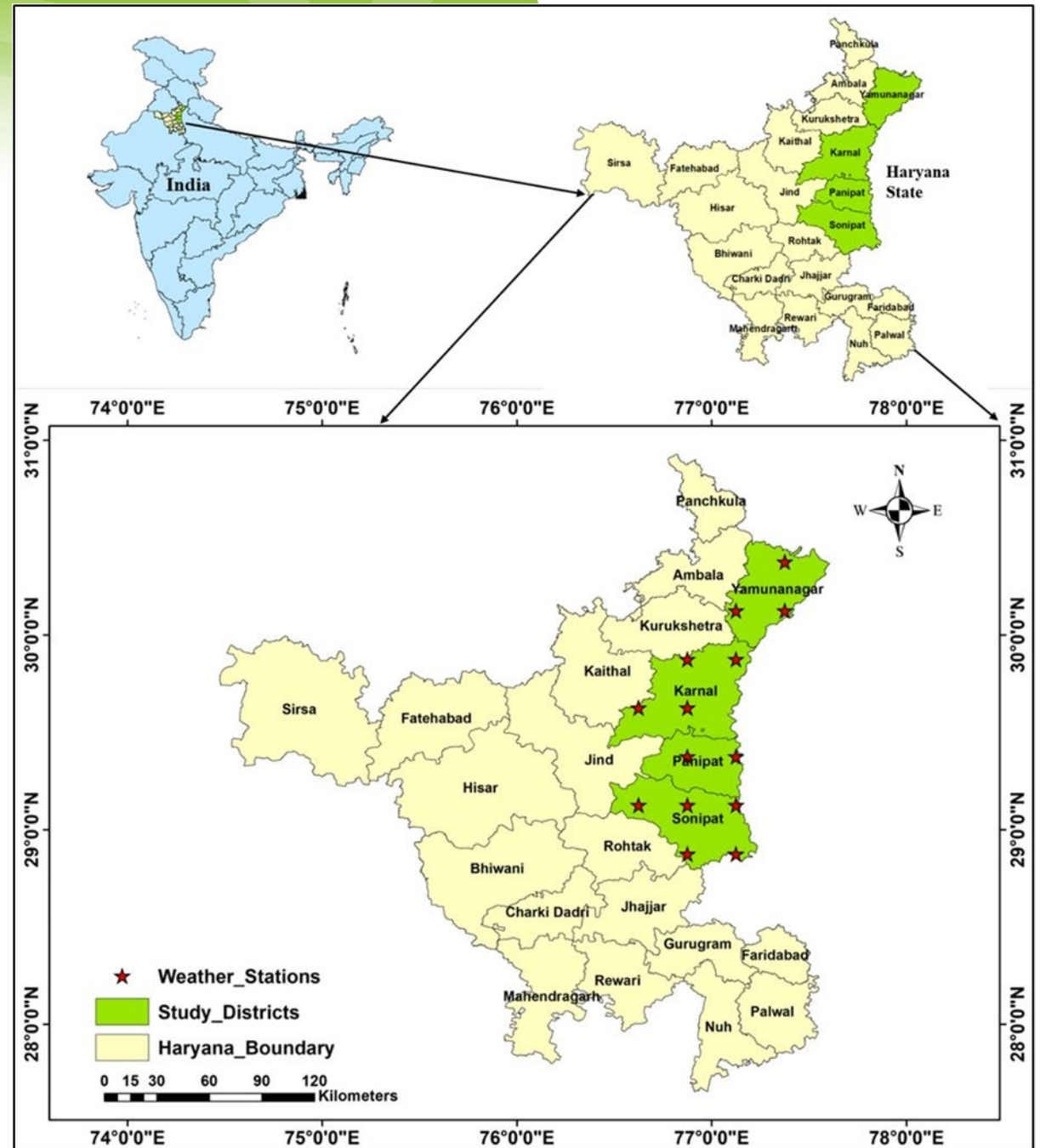
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International Rice Research Institute (IRRI)



Study Area Description

- These districts are located within the **Yamuna River basin**.
- Karnal is situated on the western bank.
- Yamuna Nagar district is located in the northeastern part of the region.
- Panipat and Sonipat, situated in the northern part of Haryana, is primarily characterized by fertile alluvial plains.



Methodology



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Extreme Events

Identify historical extreme events (based on precipitation and temperature).

SWAT Model

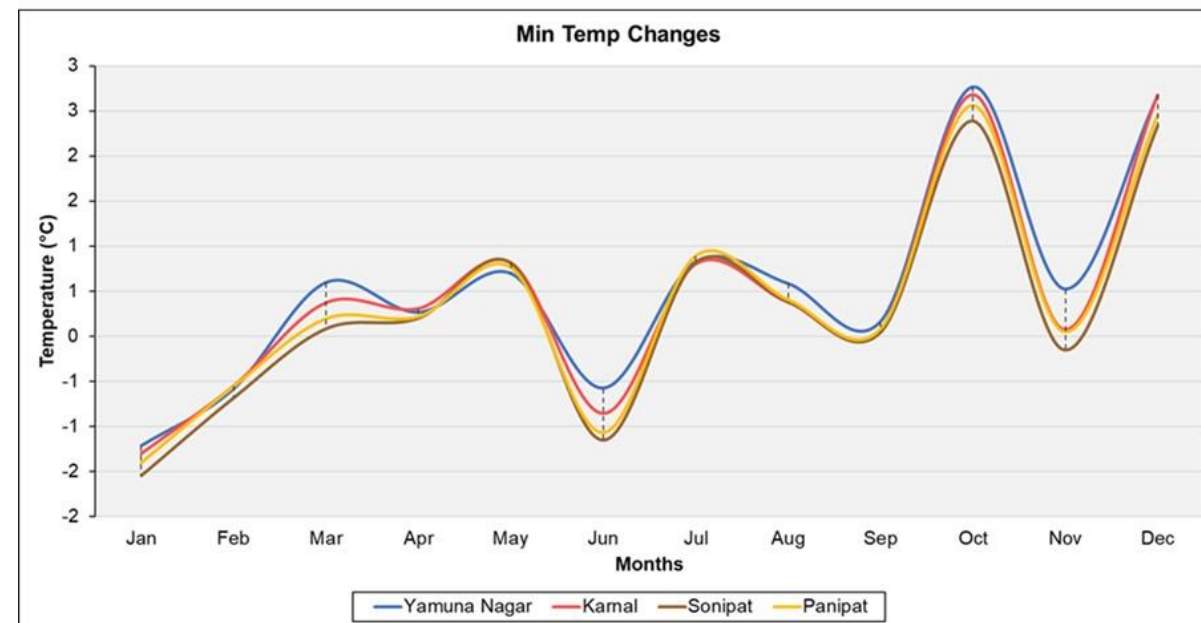
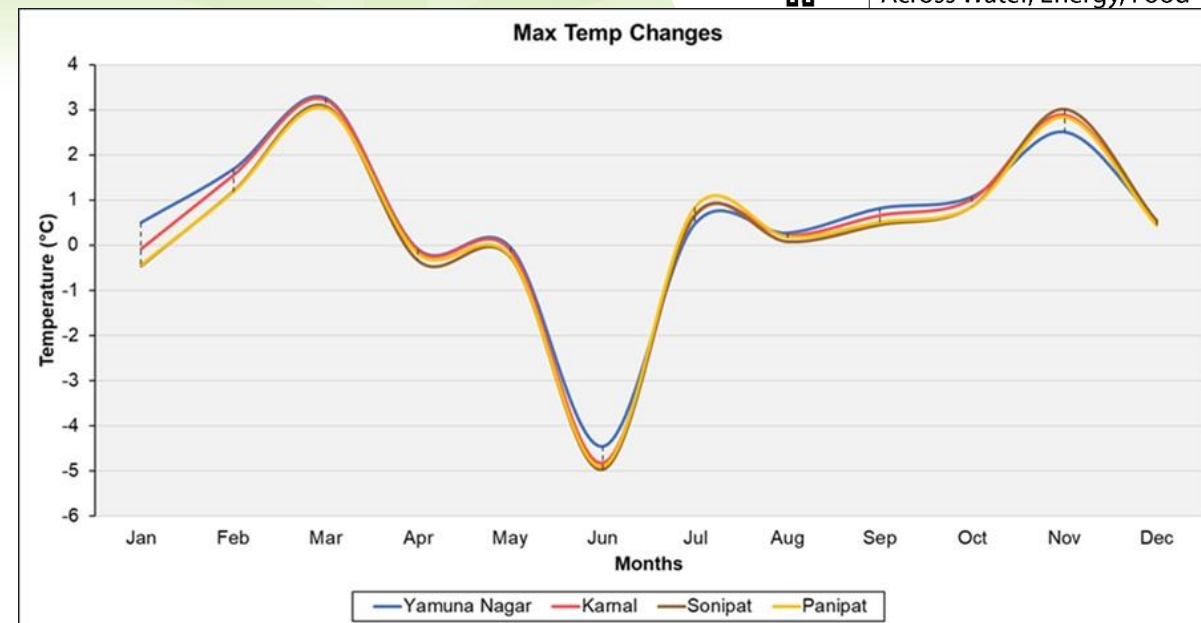
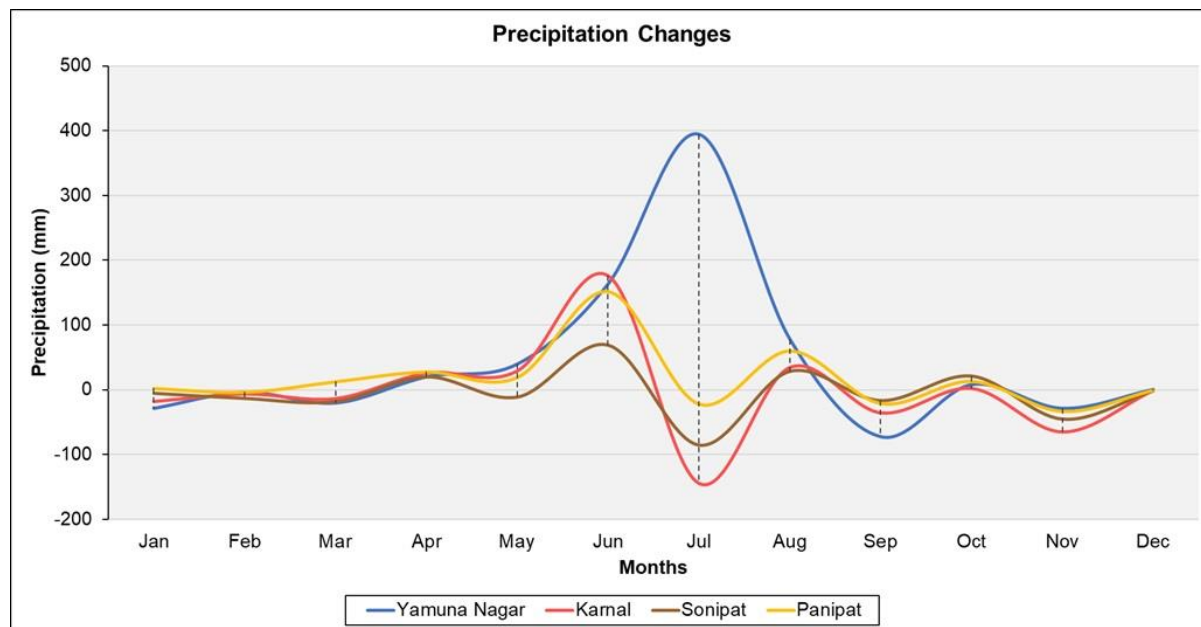
Output from the SWAT model (e.g., water yield).

FGDs on Crop Diversification

Farming practices, drivers and barriers of diversification, and perceived benefits.



Monthly precipitation and temperature changes between 1981–2000 and 2001–2020



Yearly changes in precipitation and temperature



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Table: Yearly changes in precipitation and temperature indices (1981–2000 and 2001–2020) of Sonipat, Panipat, Yamuna Nagar and Karnal

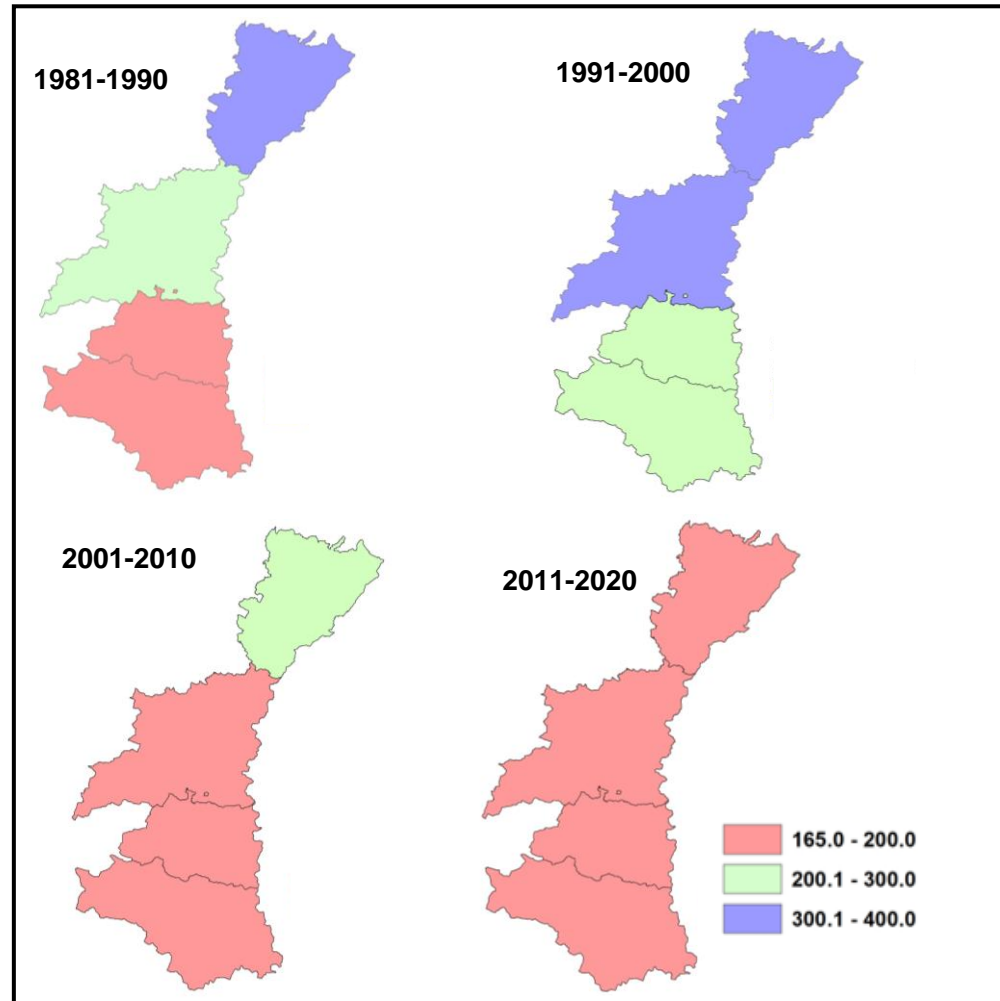
	DTR	PCPTOT	r10mm	r20mm	r25mm	rx1day	rx3day	rx5day	su	tmm	tn10p
Sonipat	-0.30	-109.50	-3.20	-2.18	-1.90	-4.39	-7.57	-10.30	0.35	0.30	-7.84
Panipat	-0.33	-176.65	-5.70	-3.65	-2.90	-7.40	-13.32	-18.86	0.45	0.31	-8.76
Yamuna Nagar	-0.26	-39.98	-1.18	-1.33	-0.95	-1.67	0.24	-1.02	0.58	0.36	-8.85
Karnal	-0.30	-78.79	-2.33	-1.58	-1.15	-3.57	-6.83	-9.87	0.38	0.35	-8.75
	tn90p	tnm	tnn	tnx	tr	tx10p	tx90p	txgt50p	txm	txn	txx
Sonipat	4.68	0.45	0.52	0.40	0.61	-2.65	-0.31	5.80	0.15	0.16	0.08
Panipat	4.79	0.48	0.58	0.41	0.58	-2.86	-0.17	6.36	0.15	0.15	0.06
Yamuna Nagar	5.66	0.49	0.67	0.42	0.62	-2.74	1.27	8.35	0.23	0.36	0.20
Karnal	4.86	0.50	0.63	0.39	0.68	-2.78	0.42	7.51	0.20	0.28	0.12

Decadal Change of Runoff

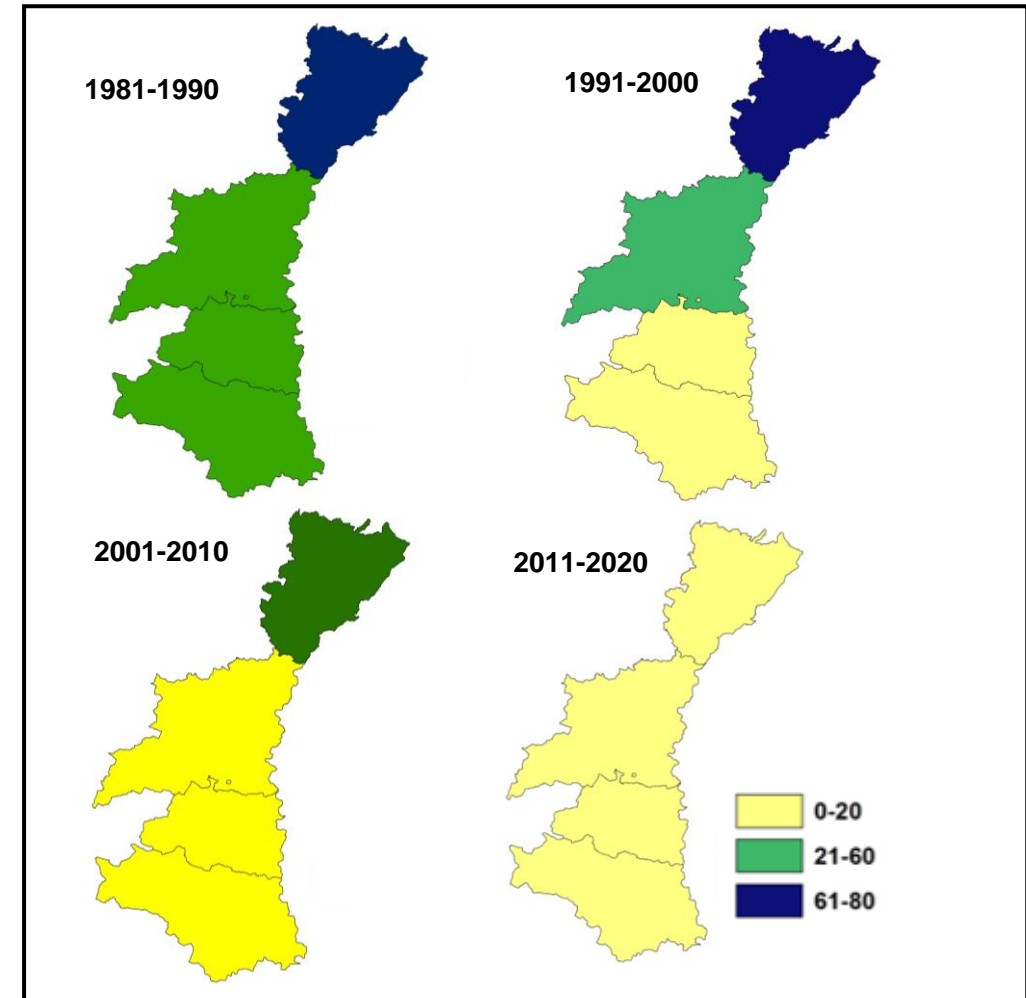


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Surface runoff



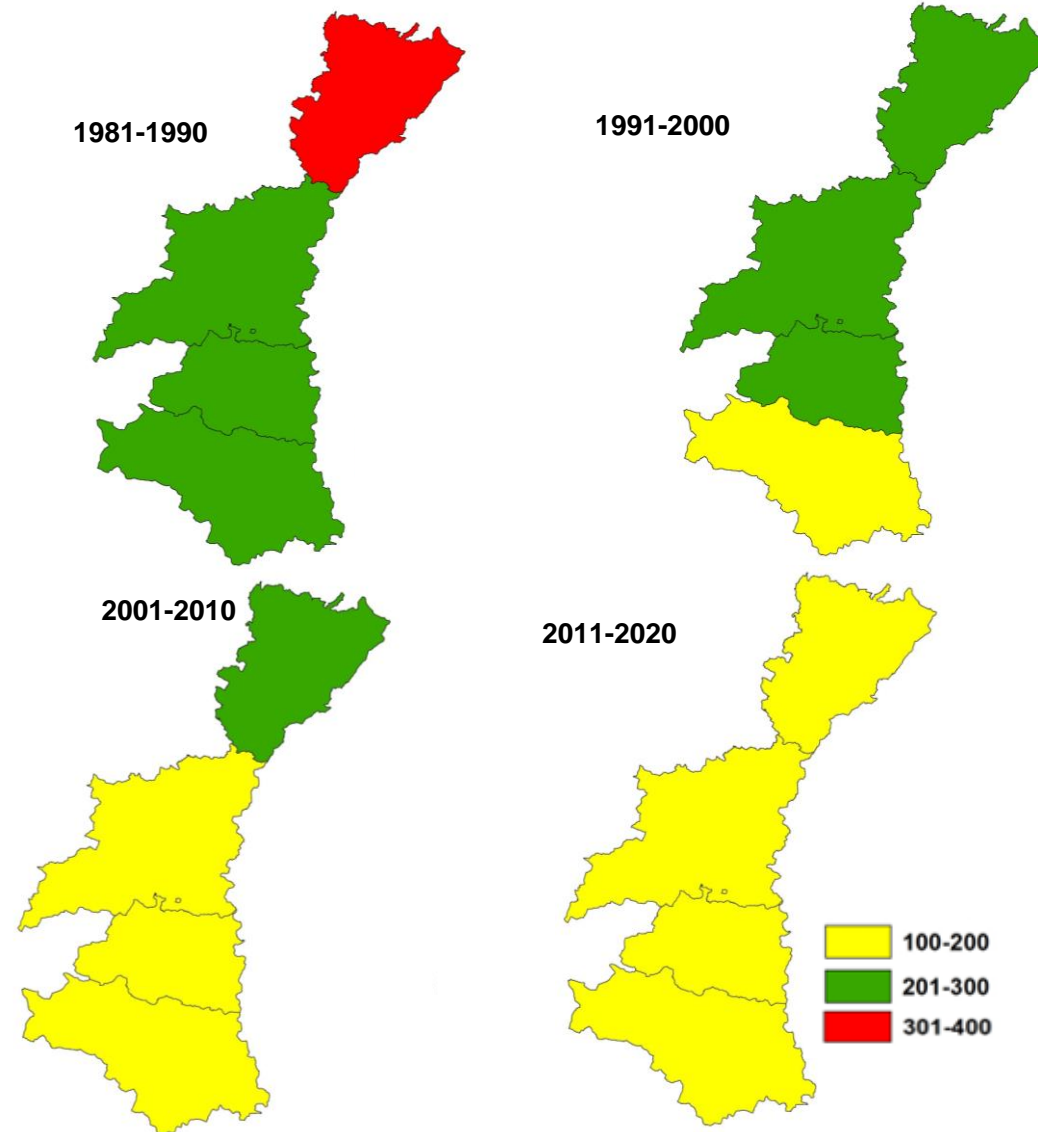
Groundwater runoff



Decadal Change of Water Yield



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Crop diversification and its challenges



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From farmers' perspective

- To what extent farmers are aware about crop diversification?
- What challenges do farmers face when trying to diversify their cropping system, and
 - what support would help you overcome these challenges?
- How do they perceive about impact of crop diversification on farm productivity and income, during changing climate conditions?
- What are their deciding factors while adopting new crops or diversifying current crop mix?



What do farmers and experts think?



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A series of workshops from June 7 to June 14, 2024, in the four districts.

In these workshops, **50 farmers** and **20 KVK SMS** participated and provided input.

During these sessions, three interventions were emphasized to reduce water use in agriculture:

- Adopting short-duration rice varieties,
- Dividing farms into smaller plots, diversifying from rice to other crops.

	Rice	Wheat	Maize	Jowar	Barley	Bajra	Arhar/Tur	Potato	Sweet potato	Gram	Groundnut	Sunflower	Masoor	Green Gram	Peas & beans	Sugarcane	Coriander	Cotton(lint)	Dry chillies	Garlic	Guar seed	Horse-gram	Moth	Onion	Rapeseed & Mustard	Sannhamp	Sesamum	Turmeric
Rice						2										4									5			
Wheat																												
Maize																												
Jowar																												
Barley																												
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Green Gram																												
Peas & beans																												
Sugarcane																												
Coriander																												
Cotton(lint)																												
Dry chillies																												
Garlic																												
Guar seed																												
Horse-gram																												
Moth																												
Onion																												
Rapeseed & Mustard																												
Sannhamp																												
Sesamum																												
Turmeric																												

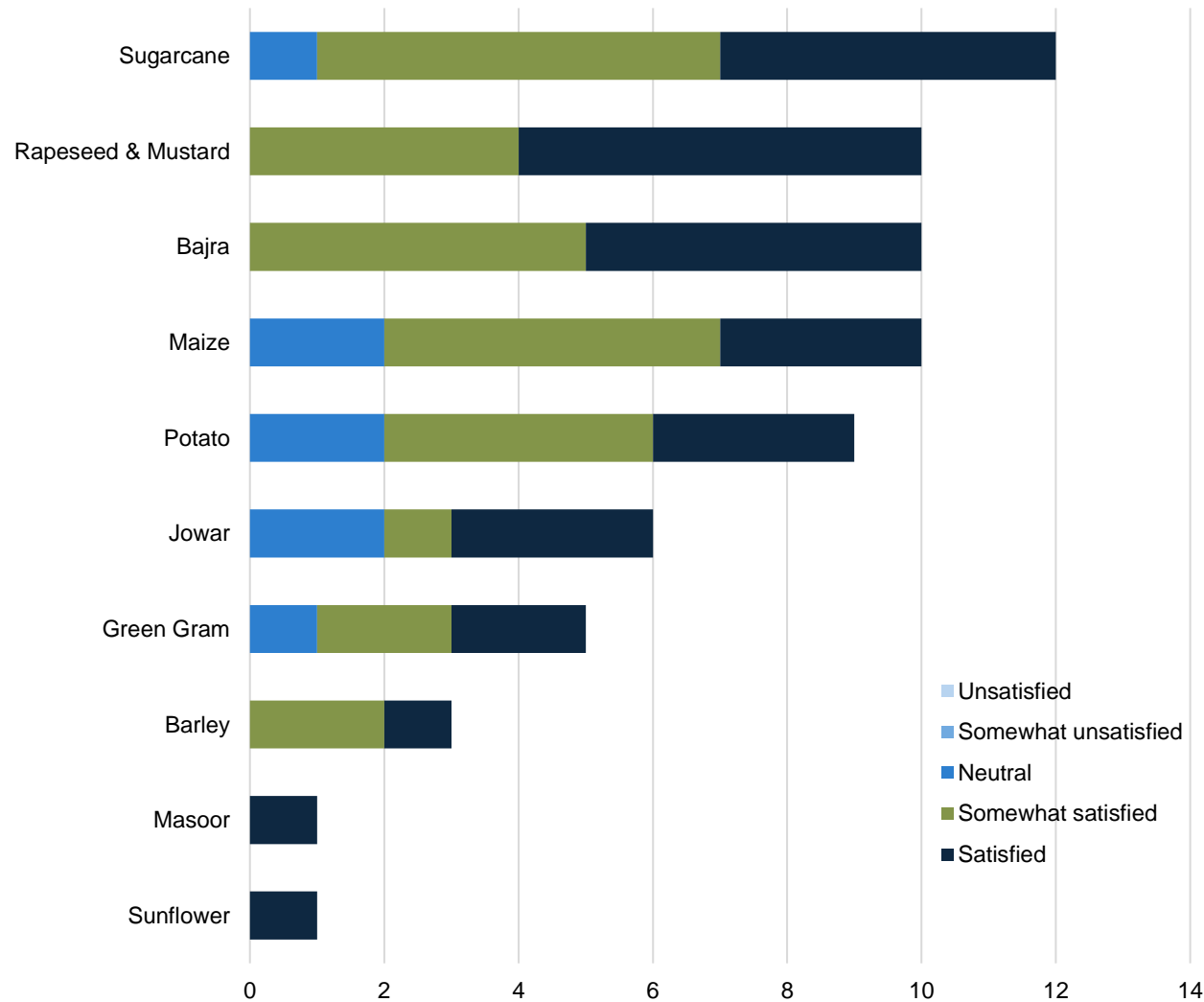
Figure: Expert-based score matrix applied in the case study analysis

Factors driving the ranking



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Farmers' choice of crops for diversification



Factors affecting Crop Diversification

- Economic Factors
 - Market Access and Prices
 - Profit Margins
 - Cost of Inputs
- Knowledge and Technical Expertise
- Climate Uncertainty
- Infrastructure and Resource Constraints
- Government Policies and Support
- Access to Technology and Innovations
- Lack of Adaptive Research

Conclusions



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- Extreme weather events significantly threaten **agricultural productivity** and increase farm vulnerability.
- Crop diversification is essential for **mitigating** these impacts, and to increase farm benefits.
- Adoption of crop diversification is hindered by factors such as **lack of knowledge, financial constraints, and inadequate support**.
- It is vital to develop farm capacities for **precision agriculture, develop resilient value chains, and empower institutions** to utilize crop diversification for developing sustainable livelihoods.

Acknowledgment



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CGIAR NEXUS Gains

All the Farmers



Chaudhary Charan Singh Haryana Agricultural University (KVK Yamuna Nagar, Karnal, Panipat and Sonipat)



Central Soil Salinity Research Institute



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Thank You

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