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Socio-economic Impact Assessment of Salinity Prevention Structure-Bardasagar Scheme in Porbandar District of Gujarat, India

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

India's vast coastline, spanning 7,516 kilometers, faces a critical challenge of seawater intrusion, resulting in salinity issues that profoundly affect agriculture, water resources, and socio-economic well-being. Among the coastal states, Gujarat, with its extensive 1,600-kilometer coastline, bears a significant burden of this phenomenon. The Barda Sagar Prevention Scheme aims to mitigate these effects by managing water resources effectively, thereby reducing salinity impact in the Porbandar area of Gujarat and ensuring the well-being of local communities. The Barda Sagar Scheme,

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situated in Rinavada village within Porbandar taluka of Gujarat, stands as a vital initiative aimed at addressing these challenges. This study meticulously evaluates the scheme's impact on agriculture, livestock, and rural livelihoods in both upstream and downstream villages. The findings underscore the scheme's substantial positive influence on various facets of rural life. Significant shifts in cropping patterns and agricultural land usage, accompanied by notable increases in crop yields, particularly in principal crops like groundnut and cumin, demonstrate the scheme's efficacy in enhancing agricultural productivity. Moreover, changes in livestock population, production, and feeding practices suggest potential improvements in livestock management and productivity, despite some fluctuations in livestock populations. Access to safe drinking water, a fundamental aspect of rural livelihoods, has witnessed considerable improvement due to the scheme's implementation. Increased reliance on the Narmada pipeline and enhanced access to potable water across surveyed villages reflect positive strides in water security and overall living standards. However, the study also identifies various challenges and factors influencing the observed changes. Soil degradation, pest incidence, and the need for sustainable water management strategies emerge as notable challenges that require ongoing attention and intervention. While positive drivers such as increased rainfall and improved market access have facilitated progress, continued monitoring, and adaptive management remain imperative for ensuring the scheme's long-term sustainability and efficacy.

Keywords: Seawater intrusion; prevention scheme; pest incidence.

1. INTRODUCTION

India has a long and varied coastline that spans 7,516 kilometers, with the mainland coastline covering about 5,400 kilometers, the Bay of the Bengal in the east, the Indian Ocean in the south, and the Arabian Sea in the west. Around 25 percent of India's total population lives in the coastal areas. Gujarat, a state in India, boasts the longest coastline at 1,600 kilometers [1].

Unfortunately, due to excessive withdrawal of groundwater and limited recharge sources, seawater has seeped in, turning available groundwater into a saline belt. This has made cultivable land unproductive and the water in wells salty and unsuitable for both irrigation and drinking [2].

India has 12.94 lakh ha of saline soil within arable lands in all the coastal districts, and Gujarat (5.28 lakh ha), West Bengal (5.08 lakh ha), and Andhra Pradesh (1.06 lakh ha) were identified as the top three affected coastal states in the country [3].

The coastal regions of Gujarat have witnessed a concerning degradation in groundwater quality due to salinity ingress. Reports indicate that each year, an average distance of 0.5 to 1.0 km from the coastline succumbs to salinity intrusion, resulting in a swath of inland areas, expanding to widths of 5 to 7.5 km by 1996, becoming saline. This relentless encroachment has led to a drastic decline in groundwater quality, with total dissolved solids (TDS) levels surpassing 2000 ppm in numerous coastal Gujarat locations. The ramifications of this phenomenon are severe, posing significant challenges for agriculture, drinking water supply, and ecosystem health. Addressing this issue necessitates comprehensive strategies that involve both immediate interventions to mitigate further intrusion and long-term measures to restore and safeguard groundwater resources in the region [4].

Coastal Gujarat, the extent and distribution of saline soil vary significantly across districts, impacting agricultural productivity and livelihoods. Jamnagar tops the list with 99,526.30 hectares of saline soil, followed by Morbi with 73,331.40 hectares. Junagadh and Rajkot also have substantial areas affected by salinity, with 57,309.10 and 43,446.00 hectares respectively. Surat faces 40,167.10 hectares of saline soil, while Bhavnagar has 30,495.00 hectares. Devbhumi Dwarka and Porbandar report 29,501.80 and 24,976.60 hectares of saline soil, respectively. Bharuch is also significantly impacted with 23,180.00 hectares. Ahmedabad and Amreli have 20,016.60 and 18,200.90 hectares of saline soil respectively, while Navsari and Valsad follow closely with 17,145.80 and 16,942.30 hectares. Kuchcha, Gir Somnath, and Vadodara have 14,490.60, 11,090.90, and 4,846.00 hectares of saline soil respectively. Anand, with 3,285.80 hectares of saline soil, has the least extent among the listed districts. This distribution highlights the pervasive issue of soil salinity across the coastal regions of Gujarat, necessitating targeted interventions and sustainable management practices to mitigate its adverse effects on agriculture and rural communities [3]. Salinity ingress affects 1.65 million hectares of land and a population of 1.33 million in Gujarat [5].

Seawater intrusion significantly impacts rural livelihoods and agriculture, with consequences varying based on the extent of intrusion, the socio-economic context of the affected region, and existing adaptation measures [6]. Salinity prevention structures, such as tidal regulators, reclamation schemes and bandharas, play a crucial role in maintaining the balance between saltwater and freshwater, thereby preventing saline water from encroaching into freshwater systems. Bandharas, in particular, are used to stop seawater ingress by creating a barrier across rivers. This barrier prevents the river's flow from merging with the sea, thereby preserving the purity of the freshwater [7]. Salinity ingress in Gujarat's coastal areas requires interventions to mitigate its impact, including freshwater management, groundwater recharge, sustainable agriculture practices, and governance transformation [8].

Barda Sagar is a solution to the problems faced in Porbandar areas. The Bardasagar scheme, located in Rinavada village within the Porbandar taluka of Gujarat, plays a pivotal role in supporting numerous upstream and downstream villages in the region. This comprehensive water management initiative encompasses a reservoir, strategically positioned to store water and facilitate its distribution to various farmers through an extensive canal network [9].

The impact of the Barda Sagar Dam, constructed in 1974, has become increasingly evident in the past 15 years due to rising awareness, affordability, and farm mechanization. This period has witnessed a surge in canal utilization, as communities harness its water resources for agricultural activities. The dam's significance has grown over time, aligning with evolving socio-economic factors and agricultural practices in the region [9].

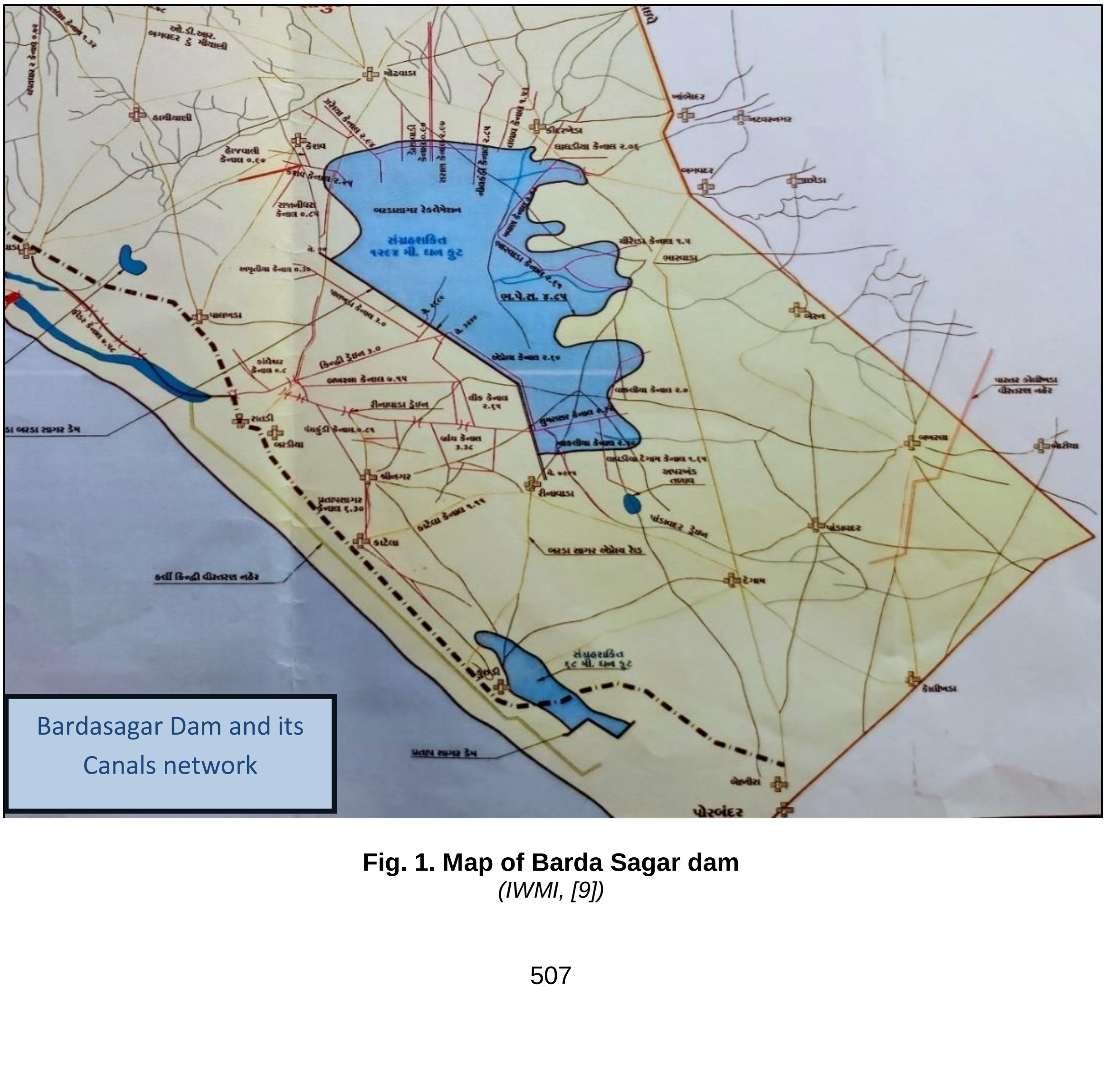

Fig. 1. Map of Barda Sagar dam
(IWMI, [9])

Derived from its proximity to the Barda hill, the scheme aptly earns its name, Bardasagar, signifying its vital importance as a lifeline for countless farmers and villagers in the area. The reservoir serves as a crucial storage facility, collecting water during periods of abundance and ensuring its availability during times of scarcity [10].

The canal system, intricately woven throughout the landscape, acts as the conduit for delivering water to agricultural lands, enabling irrigation and sustenance of crops crucial for the livelihoods of local farmers. By harnessing the resources provided by the Bardasagar scheme, communities both upstream and downstream benefit from improved access to water, enhancing agricultural productivity and supporting socio-economic development in the region [10].

1.1 The Study was Conducted with the Following Objectives:

1. Socio-economic profile of the farmers
2. To assess the impact of the Bardasagar regulator on agriculture
3. To assess the impact of scheme on livestock population, production and practices

2. METHODOLOGY

The research includes interviewing farmers and semi-structured schedule based on above mentioned objectives, then analyzing their responses with statistical tools. The study was undertaken in the benefitting villages of salinity prevention structure in the Porbandar district of Gujarat. Primary data were collected with the help of a semi-structured schedule from the farmers. Primary data changes in the last 15 years were collected. Secondary data were gathered from various literature, government publications, and web sources. The research undertaken is descriptive in nature, focusing on farmers. A nonprobability sampling method was employed, specifically utilizing convenience sampling. The sample consists of 100 farmers, with 20 farmers selected from each of the five villages within the district: Modhvada and Kinderkheda from the upstream area, Ratadi and Kantela from the downstream area, and Kuchhdi as the control area. The upstream and downstream areas are the benefited regions, while the control area is the non-benefited region. Thus, the sample size includes 40 farmers from the upstream area, 40 farmers from the downstream area, and 20 farmers from the control area. In the Porbandar area, groundwater levels range from 2 meters to 68 meters below ground level (bgl). The temperature varies between 22°C and 29°C, with pH levels ranging from 7 to 7.5 [11].

The survey will be conducted over a period of 90 days, using a semi-structured schedule as the research instrument. Data analysis included tabular analysis and the calculation of the Weighted Average Mean to derive meaningful insights from the data.

Weighted Average calculated by,

$$\bar{x} = \frac{\sum ni{=}1 Wixi}{\sum_{i=1}^{n} w_i}$$

Where, X = Weighted Average
Wi= Weight applied to value
Xi = Data values to be averaged
n = number of terms to be averaged

The data show that 15 years ago situation of Agriculture, Livestock and the present scenario of Agriculture and livestock

3. RESULTS AND DISCUSSION

3.1 Socio-economic Profile of the Farmers

Socio-economic parameters such as age, education level, farming type, land holding, and annual income were considered. The socio-economic profile of farmers is recorded in Table 1.

The socio-economic profile of farmers surveyed revealed that the majority of farmers fell within the age group of 41 to 50 years, with the highest education level being illiterate. Most farmers were engaged in Crop + Livestock farming, and the largest landholding category was between 1 to 2 Ha. Regarding annual income, the highest proportion reported earnings between 1 to 3 Lakh annually.

3.2 To Assess the Impact of the Bardasagar Regulator on Agriculture

3.2.1 Cultivated crops of farmers over the last 15 years

The cropping season data for farmers in the upstream area, downstream area, and control area has changed over the last 15 years. In the upstream area, with a sample size of 40 farmers,

Table 1. Socio-economic profile of farmers

Sr. No.	Socio-economic parameter	Frequency (n)	Percentage (%)
1	**Age (Years)**		
A	31-40	11	11
B	41-50	39	39
C	51-60	36	36
D	Above 60	14	14
2	**Education level**		
A	Illiterate	42	42
B	Below or equivalent to SSC	23	23
C	Below or equivalent to HSC	29	29
D	Equivalent or above Graduation	6	6
3	**Landholding**		
A	< 1 Ha	27	27
B	1 to 2 Ha	52	52
C	2.1 to 4 Ha	14	14
D	> 4 Ha	7	7
4	**Annual income**		
A	Less than 1 Lakh	21	21
B	1 to 3 Lakh	34	34
C	3 to 5 Lakh	27	27
D	Above 5 Lakh	18	18

Table 2. Cultivation of kharif, rabi and summer crops

Area	Upstream area Frequency (n)		Downstream area Frequency (n)		Control Frequency (n)	
Cropping Season	**Before**	**After**	**Before**	**After**	**Before**	**After**
Kharif	38	39	34	29	17	17
Rabi	15	37	12	36	13	14
Summer	0	10	0	5	0	3

the number of farmers participating in the Kharif season increased slightly from 38 to 39. During the rabi season, the number of participating farmers saw a significant rise from 15 to 37, and in the summer season, participation increased from 0 to 10. In the downstream area, also with a sample size of 40 farmers, participation in the kharif season decreased from 34 to 29. However, during the Rabi season, the number of participating farmers increased markedly from 12 to 36, and in the summer season, it rose from 0 to 5. For the control area, with a sample size of 20 farmers, the number of participants in the Kharif season remained constant at 17. During the Rabi season, participation slightly increased from 13 to 14, and in the summer season, it rose from 0 to 3.

In the Kharif season, there was very little to no change in the number of farmers in the upstream and control areas. However, in the downstream area, the number of farmers decreased because their farms faced submersion conditions. This occurred because the water flow path is narrow, preventing proper water discharge. In the Rabi season, we observed major changes in both the upstream and downstream areas. The data show a significant increase in the number of farmers in the upstream area, indicating the positive impact of Bardasagar on the Rabi season. Additionally, the summer season also became possible because of this.

3.2.2 Changes in area under the cultivation over the last 15 years

The area of land cultivated, measured in acres, in upstream, downstream, and control regions was recorded across different cropping seasons, showing notable changes over the last 15 years. During the Kharif season, the upstream area increased from 268 to 276 acres, while the downstream area decreased from 276.6 to 238 acres due to submerged conditions. The control area remained constant at 64 acres. In the Rabi season, the upstream area saw a significant increase from 51.7 to 202.8 acres, and the downstream area rose from 60.8 to 244 acres. The control area also showed a slight increase from 35.2 to 42 acres. During the Summer season, the upstream area expanded from 0 to 13.19 acres, the downstream area increased from 0 to 10.4 acres, and the control area similarly grew from 0 to 10.4 acres. In the Rabi and Summer seasons, significant changes were observed in both upstream and downstream areas, with a notable increase in the benefited area compared to the control region.

3.2.3 Changes in yield of the principal crop in kharif season over the last 15 years

Before and after the changes, the yields of groundnut were recorded across different locations. Upstream yields increased from 773.5 to 1329 kg/acre, downstream yields increased from 902.5 to 1163 kg/acre, and control yields increased from 835.2 to 1008.8 kg/acre, indicating varied changes in all three areas. The data show that groundnut yield is highest upstream, followed by downstream, and lowest in the control area. These changes are attributed to the reclamation scheme, the use of high-yielding varieties, the increased use of fertilizers and pesticides, and an increase in rainfall.

3.2.4 Changes in yield of the principal crop in the rabi season over the last 15 year

Changes in cumin yields over the last 15 years were observed in the study area. Upstream yields increased from 260 to 400 Kg/acre, while downstream yields experienced a slight rise from 287.5 to 295 Kg/acre. Conversely, yields in the control area decreased from 255 to 233.3 Kg/acre, reflecting diverse impacts within the surveyed regions. In the upstream and downstream areas, cumin yields increased, while in the control area, yields decreased due to wilt problems. changes in wheat yields were observed near Bardasagar area. Upstream yields decreased from 1250 to 1290 Kg/acre, indicating a significant change. Downstream yields increased from 1206 to 1228 Kg/acre, while control area yields rose from 916 to 1000 Kg/acre, showcasing varied impacts within the different areas. In the upstream area. Wheat yield increased in upstream, downstream and control area yields of wheat increased. coriander yields were noted across distinct locations. Upstream yields increased from 425 to 600 Kg/acre, indicating growth in production. Downstream yields surged from 0 to 625 Kg/acre, showcasing a significant rise. Control areas maintained a yield of 0 Kg/acre before and after, suggesting consistent conditions.

Table 3. Area under the cultivation

Area	Upstream (Acre)		Downstream (Acre)		Control (Acre)	
Season	**Before**	**After**	**Before**	**After**	**Before**	**After**
Kharif	268	276	276.6	238	64	64
Rabi	51.7	202.8	60.8	244	35.2	42
Summer	0	13.19	0	10.4	0	10.7

Table 4. Yield of the kharif crop

Yield	Before (Kg/Acre)	After (Kg/Acre)
Upstream	773.5	1329
Downstream	902.5	1163
Control	835.2	1008.8

Table 5. Yield of the rabi crop

Crop	Cumin (Kg/Acre)		Wheat (Kg/Acre)		Coriander (Kg/Acre)	
Yield	**Before**	**After**	**Before**	**After**	**Before**	**After**
Upstream	260	400	1250	1290	425	600
Downstream	287.5	295	1206	1228	0	625
Control	255	233.3	916	1000	0	0

Table 6. Yield of the summer crop

Crop	Cowpea (Kg/Acre)		Green gram (Kg/Acre)		Sesamum (Kg/Acre)	
Yield	Before	After	Before	After	Before	After
Upstream	0	516.5	0	600	0	0
Downstream	0	900	0	0	0	250
Control	0	625	0	601	0	0

3.2.5 Changes in yield of the principal crops in summer season over the last 15 years

Changes in cowpea yields were observed over the last 15 years, in the upstream area, the yield increased from 0 to 516.5 Kg/acre. Downstream areas saw a significant rise in yield from 0 to 900 Kg/acre. Meanwhile, in the control area, the yield also increased from 0 to 625 Kg/acre. Similarly, changes in green gram yields were observed in the upstream region, the yield increased from 0 to 600 Kg/acre. However, there was no change in yield in the downstream area, which remained at 0 Kg/acre both before and after. In the control area, there was a slight increase in yield from 0 to 601 Kg/acre. Additionally, changes in Sesamum yields were observed in the upstream region, there was no yield recorded both before and after the observed period. However, in the downstream area, the yield increased from 0 to 250 Kg/acre. Conversely, there was no change in yield in the control area, which remained at 0 Kg/acre both before and after. The data show that in the upstream area, three new crops were introduced, in the downstream area, two new crops were introduced, and in the control area, only one new crop was introduced. This indicates that both the upstream and downstream areas are performing better than the control area.

3.2.6 Change in source of irrigation over the last 15 years

The data on irrigation sources and their usage across different seasons reveal notable changes before over the last 15 years. During the Kharif season, the number of respondents relying on wells dropped from 30 to 14 upstream and from 31 to 15 downstream, with control figures remaining constant at 17. Those using both wells and canals increased from 2 to 14 upstream and from 1 to 8 downstream. Canal usage rose from 4 to 11 upstream and from 1 to 6 downstream. Rainfed irrigation dropped to zero in both upstream and downstream from initial figures of 2 and 1, respectively. The number of non-respondents decreased slightly from 2 to 1 upstream, but increased from 6 to 11 downstream, with control figures stable at 23. The total number of respondents remained constant at 40 for upstream, downstream, and control. In the Rabi season, well usage increased from 7 to 10 upstream and from 10 to 13 downstream, with a slight increase from 12 to 13 in control. The usage of both wells and canals rose from 2 to 8 upstream and from 2 to 13 downstream. Canal usage saw a significant increase from 6 to 19 upstream and from 0 to 10 downstream. The number of non-respondents decreased dramatically from 25 to 3 upstream and from 28 to 4 downstream, with a minor decrease in control from 28 to 27. The total number of respondents remained constant at 40 across all categories. In the Summer season, well usage increased from 0 to 10 upstream, from 0 to 5 downstream, and from 0 to 3 in control. The number of non-respondents decreased from 40 to 30 upstream, from 40 to 35 downstream, and from 40 to 37 in control. The total number of respondents remained consistent at 40 across upstream, downstream, and control. Over the past 15 years, there has been an increase in the number of canal users, primarily due to heightened awareness, improved affordability, and advancements in farm mechanization.

3.3 To Assess the Impact of Scheme on Livestock Population, Production and Practices

3.3.1 Changes in livestock population in the last 15 years

In the upstream area, the number of buffaloes increased from 70 to 95 and cows increased from 24 to 30, while the number of bullocks decreased from 10 to 6. In the downstream area, the number of buffaloes decreased from 115 to 98, cows decreased from 43 to 37, and bullocks decreased from 20 to 4. In the control area, the number of buffaloes decreased from 34 to 29, the number of cows remained constant at 8, and the number of bullocks decreased from 3 to 1. These changes indicate an increase in the number of buffaloes and cows in the upstream area, while the downstream and control areas experienced a reduction in the number of animals. In the Downstream area decline in livestock population is primarily due to a lack of interest in livestock farming, a shift towards agricultural farming, and the reduction of available grazing land, leading to fewer resources and opportunities for maintaining livestock herds.

3.3.2 Changes in milk production in the last 15 years

Changes in milk production were observed across different regions. In the upstream area, milk production increased from 588 to 946 litres per day. In the downstream area, milk production decreased from 1176 to 1008 litres per day due to a reduction in the number of animals, which directly impacted milk production. In the control area, milk production increased from 258 to 310 litres per day. These changes indicate a shift in milk production, with significant increases in the upstream and control areas, while the downstream area experienced a reduction in daily milk output.

3.3.3 Changes in feeding practices and feed composition in last 15 years in the upstream area

In feeding practices change over the last 15 years for different areas provide insightful. In the

Table 7. Source of irrigation

Sr. No.	Irrigation source	Upstream		Downstream		Control	
		Before	After	Before	After	Before	After
1.	Kharif season (No. of Farmers)						
	Well	30	14	31	15	17	17
	Well and Canal	2	14	1	8	0	0
	Canal	4	11	1	6	0	0
	Rainfed	2	0	1	0	0	0
	No respondents	2	1	6	11	3	3
	Total	40	40	40	40	20	20
2.	Rabi season (No. of Farmers)						
	Well	7	10	10	13	12	13
	Well and Canal	2	8	2	13	0	0
	Canal	6	19	0	10	0	0
	No respondents	25	3	28	4	8	7
	Total	40	40	40	40	20	20
3.	Summer season (No. of Farmers)						
	Well	0	10	0	5	0	3
	No respondents	40	30	40	35	20	17
	Total	40	40	40	40	20	20

Table 8. Livestock population

Area	Upstream Frequency (n)		Downstream Frequency (n)		Control Frequency (n)	
Animals	Before	After	Before	After	Before	After
Buffalo	70	95	115	98	34	29
Cow	24	30	43	37	8	8
Bullock	10	6	20	4	3	1

Table 9. Milk production

Area	Before Litres/Day	After Litres/Day
Up Stream	588	946
Down Stream	1176	1008
Control	258	310

Table 10. Feed practices and feed composition

Area	Upstream Frequency (n)		Downstream Frequency (n)		Control Frequency (n)	
Feeding Practice	**Before**	**After**	**Before**	**After**	**Before**	**After**
Open grazing + stall feeding	13	1	11	1	6	0
Open grazing + Stall feeding + Concentrate feed	3	0	8	0	3	0
Stall feeding	12	0	4	0	5	0
Stall feeding + Concentrate feed	5	34	12	35	2	16
No response	7	5	5	4	4	4
Total	40	40	40	40	20	20
Feed Composition						
Dry fodder, Green fodder	22	1	15	1	11	0
Dry fodder, Green fodder, Concentrated feed	11	34	20	35	5	16
No response	7	5	5	4	4	4
Total	40	40	40	40	20	20

Table 11. Changes in milk productivity and fat percentages

Milk productivity and fat percentage have been increased	Frequency (n)	Percentage (%)
Yes	53	53
No	27	27
No response	20	20
Total	100	100

Table 12. Reason for increasing milk productivity and fat percentage

Reason for increasing milk productivity and fat percentage	WAM score	Rank
Accessibility to concentrate feed	4.22	1
Availability of good quality water	4.03	2
Better raising practices	3.91	3
Availability of fodder crop	3.18	4
Improved healthcare facilities	2.37	5

upstream area, the number of respondents practicing open grazing combined with stall feeding decreased significantly from 13 to 1 farmer. The practice of combining open grazing, stall feeding, and concentrate feed also dropped from 3 to 0. The number of those solely using stall feeding fell from 12 to 0. However, the use of stall feeding combined with concentrate feed saw a significant increase from 5 to 34 farmers. In the downstream area, respondents practicing open grazing combined with stall feeding decreased from 11 to 1, and those combining open grazing, stall feeding, and concentrate feed decreased from 8 to 0. Stall feeding alone dropped from 4 to 0. Conversely, the practice of stall feeding with concentrate feed increased from 12 to 35 farmers. In the control area, open grazing combined with stall feeding dropped from 6 to 0, while open grazing with stall feeding and concentrate feed decreased from 3 to 0. Here concentrated feed impacts both the production and productivity of milk. Due to the increase in concentrated feeding, milk production has also increased.

3.3.4 Milk Productivity and fat percentages have been increased

Increase in milk productivity and fat percentage, indicating positive growth in milk production. However, 27% said they did not see an increase, while 20% did not respond, suggesting uncertainty or a lack of information.

3.3.5 Reason for increasing milk productivity and fat percentage

The reasons for increasing milk productivity and fat percentage can be ranked based on their Weighted Average Mean (WAM) scores from a sample of respondents. The highest-ranked reason is the accessibility to countertrade feed, with a WAM score of 4.22, indicating that a majority of respondents strongly agree that this factor significantly enhances milk productivity. Following closely is the implementation of better raising practices, which holds a WAM score of 4.03, reflecting its importance in maintaining the health and productivity of dairy animals. The availability of good quality water ranks third with a WAM score of 3.91, emphasizing its crucial role in sustaining the well-being and milk production of the livestock. Next is the availability of fodder crops, scoring 3.18, indicating its moderate. Finally, improved healthcare facilities for livestock, with a WAM score of 2.37, are considered the least influential among the factors.

4. CONCLUSION

In conclusion, the Barda Sagar Scheme has demonstrated significant potential to enhance agricultural productivity, improve water security, and uplift socio-economic conditions in the region. By addressing key challenges and leveraging opportunities for sustainable development, the scheme can serve as a valuable model for informing future development strategies and interventions aimed at improving livelihoods and fostering resilience in rural communities.

Over the past 15 years, Bardasagar has implemented significant changes. There's been a noticeable expansion in both cultivated area and yield in both upstream and downstream regions. The introduction of new crops, primarily impacting the rabi season, has brought about slight adjustments in the kharif season as well, both upstream and downstream. Additionally, new crops have been successfully integrated into the summer season. In contrast, the control village has seen minimal changes in cultivated area, but there has been a marked increase in yield.

In the upstream area, livestock population and production have seen an increase due to improved raising practices and concentrated feeding. Conversely, in the downstream region, there has been a decrease in the number of livestock over the past 15 years. Furthermore, there have been no significant changes observed in the control village.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Mukhopadhyay R, Karisiddaiah SM. The Indian coastline: Processes and landforms. Landscapes and landforms of India. 2014;91-101.
2. Gururaja Rao G, Kanani AD, Purohit D, Waghela, D. Coastal saline soils of Gujarat (India): problems, reclamation measures and management strategies. Research Developments in Saline Agriculture. 2019;629-651
3. Mandal UK, Nayak DB, Ghosh A, Bhardwaj AK, Lama TD, Mahajan GR, Burman D. Delineation of saline soils in coastal India using satellite remote sensing. Current science. 2023;125(12): 1339.
4. Sathyapalan J. Economic valuation of ecosystem changes due to salinity ingress and ground water depletion: A Study of Coastal Gujarat, India; 2020.
5. Siddha S, Sahu P. Status of seawater intrusion in coastal aquifer of Gujarat, India: a review. SN Applied Sciences. 2020;2(10):1726
6. Costal salinity prevention cell. Socio economic impact of costal salinity prevention structure; 2014. Available:https://cspc.org.in/studies-reports/
7. Costal salinity prevention cell. Socio economic impact assessment study of the salinity prevention structure in Saurashtra region; 2009. Available:https://cspc.org.in/studies-reports/
8. Karthiayani P, Viswanathan Pathak, Jharna, Bandi, Madhusudan. Enhancing agriculture livelihoods in Coastal Areas in Gujarat: A Study of the Impacts of KVY Interventions; 2016.
9. International Water Management Institute; 2024.

Available:https://www.iwmi.cgiar.org/about/who-we-are/

10. Narmada, Water Resources, Water Supply and Kalpsar Department; 2024. Available:https://gujnwrws.gujarat.gov.in/showpage.aspx?contentid=4083&query=Bardasagar%20reclamation%20scheme&lang=english

11. Kanani Twinkal, Malek A. Prakash, Indra, Mehmood Khalid. Ground Water Vulnerability Assessment of Coastal Area of Porbandar, Gujarat, India. International Journal for Scientific Research & Development (IJSRD). 2017;5: 796-799.

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