GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

LOK SABHA
UNSTARRED QUESTION NO. 2935
TO BE ANSWERED ON 12.03.2021

Global Warming

2935. SHRI RAJIV PRATAP RUDY:

Will the Minister of ENVIRONMENT, FOREST AND CLIMATE CHANGE be pleased to state:

(a) whether the Government has conducted orproposes to conduct a detailed study on global warmingand depleting source of water as a result thereof;
(b) if so, the details thereof and the technologiesproposed to be used to address the issue;
(c) the details of the average ground water levels forthe last three years, State/UT-wise; and
(d) whether the Government has any study on theimpact of global warming on marine flora and fauna andif so, the details thereof?

ANSWER
MINISTER OF STATE IN THE MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE
(SHRI BABUL SUPRIYO)

(a) and (b): The National Action Plan on Climate Change (NAPCC) launched by the Government of India identified the approach to be adopted to meet the challenges of impact of climate change through institutionalization of 8 national missions which *inter-alia* includes a 'National Water Mission'. As per the information received from the Central Water Commission, eight research studies on the impact of climate change on water resources are being taken up by the National Water Mission, Ministry of Jal Shakti (MoJS). Details of these studies are at Annexure I.The Department of Science and Technology (DST) has supported research projects to Wadia Institute of Himalayan Geology (WIHG); NationalInstitute of Hydrology (NIH);G.B. Pant National Institute of Himalayan Environment; Kashmir University and Indian Institute of Technology Madras to carry out studies on the impact of climate change on water resources.

The MoJShas been implementing various programs and schemes on the conservation of water resources in the country.The Jal Shakti Abhiyan with a mission mode approachis intended to improve water availability, including groundwater conditions in the water-stressed blocks of 256 districts in India. The National Hydrology Project is being implemented to improve the extent, quality and accessibility of water resources information and to strengthen the capacity of water resources management institutions in India. This ensuresthe availability of reliable, real-time and continuous data for informed decision-making. For this purpose, modern technologies like LiDARMapping, Real Time Data Acquisition System through telemetry, Supervisory Control and Data AcquisitionSystem (SCADA) for water resources management and advanced information technology based information system is being used.

(c): The Central Ground Water Board, MoJS is periodically monitoring the groundwater levels across the country, through a network of monitoring wells. The groundwater level for the years 2017, 2018 and 2019 is given in the Annexure- II, III and IV.

(d): The Government of India is implementing a National Network Project, 'National Innovations in Climate Resilient Agriculture'(NICRA), which is aimed at assessing the impact of climate change and to enhance the resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. The research on adaptation and mitigation covers crops, livestock, fisheries and natural resource management. The Central Marine Fisheries Research Institute (CMFRI)has carried out focused studies on climate change impacts on marine flora and fauna, besides implementation of adaptation options in a time-bound manner.

The effects of climate change in aquatic ecosystems can be direct, through rise in sea surface temperature (SST), changes in rainfall, and associated changes in the phenology of the organisms, or indirect *ie.*, through ocean acidification, through shifts in ocean currents and rise in sea level. The rate of change in SST in the Indian Seas revealed that the impact is more in the west coast than the east coast. The Northern Indian Ocean has been identified as one of the 17 climate change hotspots among world oceans. These areas will warm faster than 90% of the world oceans. Studies on the effects of climatic parameters on phenology of various marine fishes indicate that SST, chlorophyll-a, current speed, wind and rainfall do have influence on the diet, spawning, maturity, mean length, fecundity, distribution and catch of various species of marine fishes. The distributional shifts of several marine species will have implications on the fish catch. The distributional boundaries of oil sardine and Indian mackerel have extended, and could be attributed to the habitat modifications induced by climatic parameter variations. The Indian mackerel was found to descent into deeper water strata under the influence of induced habitat modification. The distribution of Zoanthids and the dynamic changes exhibited by the Zoanthids in relation to various environmental parameters was identified with quantitative information. Significant changes in chlorophyll-a has also been identified by scientific analysis, which also has implications for ecosystem productivity. During the monsoon period, increasing trend of chlorophyll-a was also observed. In long-term,the climate change is likely to impact the marine environment and its capacity to sustain fish stocks and exacerbate stress on the marine fish stocks.

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Annexure I

Research Studies on Climate Change and Water Resources

Title	State/institution
Impact Assessment of Climate Change on Hydro-meteorological processes and Water Resources of Mahanadi River Basin	IISC Bangalore (Lead Instt.)
	IIT Bhubaneshwar
Climate change impact studies for Rajasthan Area of inland drainage and Mahi basin	MNIT Jaipur (Lead Instt.)
	CU Ajmer Rajasthan
	IIT Delhi
Impact of Climate Change on Water Resources of Tapi Basin	SVNIT Surat (Lead Jnst/.)
	MNIT Jaipur
	MANIT Bhopal
Effects ofClimate Change and land use/land cover changes on spatial and temporal water availability In Subarnarekha Basin	IIT Kharagpur
Impact of Climate Change on Water Resources of Sabarmati Basin	IIT Gandhinagar (Lead Instt.)
	SVNIT Surat
Impact of Climate Change on Water Resources in River Basins from Tadri to Kanyakumari	IIT Mumbai (Lead Instt.)
	NIT Surathkal
	CWRDM Kozhikode
Statistical Downscaling for Hydro-climatic Projections with CMIP5 Simulations to Assess Impact of Climate Change	IIT Mumbai (Lead Instt.)
	IIT Guwahati
	IISc Bangalore
	IIT Gandhinagar
	IIT Kanpur
Dynamic Downscaling to study Climate Change Impact on Water Resources in India	IIT Delhi (Lead Instt.)
	11T Madras
	Anna University
	BHU Varanasi

Annexure-II

State-wise Depth to water Level and Distribution of Percentage of Wells for the Period of Premonsoon, 2017

S. No.	Name of State	No. of wells Analysed	Depth to Water Level (mbgl)		Number & Percentage of Wells Showing Depth to Water Level (mbgl) in the Range of											
					0-2		2-5		5-10		10-20		20-40		> 40	
			Min	Max	No	%	No	%	No	%	No	%	No	%	No	%
1	Andaman & Nicobar Island	81	0.12	9.5	38	47	38	47	5	6.2	0	0.0	0	0	0	0
2	Andhra Pradesh	751	0.00	49.30	46	6.13	278	37.02	305	40.6	115	15.31	4	0.53	3	0.40
3	Arunachal Pradesh	12	1.10	10.82	3	25.00	5	41.67	2	16.67	2	16.67	0	0.00	0	0.00
4	Assam	165	0.02	14.75	22	13.33	99	60.00	42	25.45	2	1.21	0	0.00	0	0.00
5	Bihar	660	0.50	14.73	19	2.88	305	46.21	309	46.82	27	4.09	0	0.00	0	0.00
6	Chandigarh	10	2.75	62.54	0	0.00	2	20.00	3	30.00	2	20.00	2	20.00	1	10.00
7	Chhattisgarh	634	0.78	43.70	12	1.89	122	19.24	349	55.05	126	19.87	22	3.47	3	0.47
8	Dadra & Nagar Haveli	18	2.82	13.18	0	0.00	3	16.67	9	50.00	6	33.33	0	0.00	0	0.00
9	Daman & Diu	12	3.28	11.80	0	0.00	2	16.67	9	75.00	1	8.33	0	0.00	0	0.00
10	Delhi	94	1.13	99.00	2	2.13	17	18.09	21	22.34	24	25.53	17	18.09	13	13.83
11	Goa	65	1.10	16.08	10	15.38	29	44.62	21	32.31	5	7.69	0	0.00	0	0.00
12	Gujarat	802	0.00	60.69	22	2.74	122	15.21	270	33.67	288	35.91	93	11.60	7	0.87
13	Haryana	304	0.87	78.43	12	3.95	65	21.38	82	26.97	77	25.33	57	18.75	11	3.62
14	Himachal Pradesh	90	0.40	28.59	7	7.78	32	35.56	30	33.33	16	17.78	5	5.56	0	0.00
15	Jammu & Kashmir	230	0.36	31.90	20	8.70	122	53.04	57	24.78	21	9.13	10	4.35	0	0.00
16	Jharkhand	227	1.35	19.80	2	0.88	22	9.69	159	70.04	44	19.38	0	0.00	0	0.00
17	Karnataka	1439	0.34	30.70	66	4.59	273	18.97	620	43.09	454	31.55	26	1.81	0	0.00
18	Kerala	1396	0.20	56.20	80	5.73	394	28.22	592	42.41	301	21.56	27	1.93	2	0.14
19	Madhya Pradesh	1355	0.85	49.20	6	0.44	164	12.10	667	49.23	452	33.36	65	4.80	1	0.07
20	Maharashtra	1663	0.01	60.00	57	3.43	265	15.94	782	47.02	500	30.07	57	3.43	2	0.12
21	Meghalaya	21	0.15	5.32	4	19.05	15	71.43	2	9.52	0	0.00	0	0.00	0	0.00
22	Nagaland	3	3.04	6.40	0	0.00	2	66.67	1	33.33	0	0.00	0	0.00	0	0.00
23	Odisha	1317	0.25	17.42	98	7.44	454	34.47	711	53.99	54	4.10	0	0.00	0	0.00
24	Pondicherry	5	2.33	7.70	0	0.00	4	80.00	1	20.00	0	0.00	0	0.00	0	0.00
25	Punjab	236	1.31	45.74	8	3.39	34	14.41	63	26.69	67	28.39	61	25.85	3	1.27
26	Rajasthan	903	0.19	134.22	15	1.66	108	11.96	216	23.92	224	24.81	166	18.38	174	19.27
27	Tamil Nadu	540	0.57	65.75	12	2.22	98	18.15	210	38.89	179	33.15	33	6.11	8	1.48
28	Telangana	596	0.63	69.40	10	1.68	106	17.79	251	42.11	174	29.19	44	7.38	11	1.85
29	Tripura	28	1.05	6.37	7	25.00	12	42.86	9	32.14	0	0.00	0	0.00	0	0.00
30	Uttar Pradesh	659	0.73	43.40	13	1.97	178	27.01	299	45.37	144	21.85	24	3.64	1	0.15
31	Uttaranchal	47	0.15	34.40	2	4.26	11	23.40	20	42.55	12	25.53	2	4.26	0	0.00
32	West Bengal	715	0.02	32.75	33	4.62	211	29.51	306	42.80	140	19.58	25	3.50	0	0.00
Total		**15078**			**626**	**4.15**	**3592**	**23.82**	**6423**	**42.60**	**3457**	**22.93**	**740**	**4.91**	**240**	**1.6**

Annexure-III

State-wise Depth to water Level and Distribution of Percentage of Wells for the Period of Pre-monsoon, 2018

S. No.	Name of State	No. of wells Analysed	Depth to Water Level (mbgl)		Number & Percentage of Wells Showing Depth to Water Level (mbgl) in the Range of											
					0-2		2-5		5-10		10-20		20-40		> 40	
			Min	Max	No	%	No	%	No	%	No	%	No	%	No	%
1	Andaman & Nicobar Island	104	0.06	7.3	84	81	18	17	2	1.9	0	0.0	0	0	0	0
2	Andhra Pradesh	718	0.09	49.30	59	8.22	319	44.43	250	34.8	83	11.56	5	0.70	2	0.28
3	Arunachal Pradesh	8	2.27	11.58	0	0.00	5	62.50	1	12.50	2	25.00	0	0.00	0	0.00
4	Assam	155	0.18	18.83	35	22.58	91	58.71	25	16.13	4	2.58	0	0.00	0	0.00
5	Bihar	642	0.53	15.80	12	1.87	257	40.03	335	52.18	38	5.92	0	0.00	0	0.00
6	Chandigarh	9	4.29	42.38	0	0.00	1	11.11	2	22.22	3	33.33	2	22.22	1	11.11
7	Chhattisgarh	490	1.30	34.10	8	1.63	89	18.16	302	61.63	83	16.94	8	1.63	0	0.00
8	Dadra & Nagar Haveli	17	3.02	15.91	0	0.00	5	29.41	8	47.06	4	23.53	0	0.00	0	0.00
9	Daman & Diu	10	3.24	11.80	0	0.00	2	20.00	7	70.00	1	10.00	0	0.00	0	0.00
10	Delhi	82	0.71	65.00	1	1.22	16	19.51	16	19.51	24	29.27	16	19.51	9	10.98
11	Goa	70	0.86	14.95	6	8.57	29	41.43	26	37.14	9	12.86	0	0.00	0	0.00
12	Gujarat	758	0.54	62.20	15	1.98	127	16.75	254	33.51	264	34.83	92	12.14	6	0.79
13	Haryana	284	1.28	81.83	8	2.82	54	19.01	77	27.11	78	27.46	57	20.07	10	3.52
14	Himachal Pradesh	86	0.56	28.56	6	6.98	33	38.37	27	31.40	17	19.77	3	3.49	0	0.00
15	Jammu & Kashmir	252	0.75	35.50	18	7.14	112	44.44	84	33.33	28	11.11	10	3.97	0	0.00
16	Jharkhand	260	0.74	18.92	4	1.54	41	15.77	179	68.85	36	13.85	0	0.00	0	0.00
17	Karnataka	1343	0.22	30.70	140	10.42	353	26.28	540	40.21	294	21.89	16	1.19	0	0.00
18	Kerala	1441	0.09	65.40	96	6.66	424	29.42	627	43.51	267	18.53	24	1.67	3	0.21
19	Madhya Pradesh	1330	0.90	40.25	16	1.20	144	10.83	587	44.14	525	39.47	57	4.29	1	0.08
20	Maharashtra	1646	0.01	55.10	73	4.43	282	17.13	768	46.66	463	28.13	57	3.46	3	0.18
21	Meghalaya	22	0.20	5.06	2	9.09	18	81.82	2	9.09	0	0.00	0	0.00	0	0.00
22	Odisha	1261	0.12	15.73	142	11.26	540	42.82	540	42.82	39	3.09	0	0.00	0	0.00
23	Pondicherry	5	2.35	3.08	0	0.00	5	100.00	0	0.00	0	0.00	0	0.00	0	0.00
24	Punjab	225	0.45	42.18	9	4.00	34	15.11	50	22.22	61	27.11	68	30.22	3	1.33
25	Rajasthan	994	0.27	114.00	21	2.11	104	10.46	224	22.54	257	25.86	187	18.81	201	20.22
26	Tamil Nadu	529	0.00	82.60	28	5.29	138	26.09	213	40.26	118	22.31	19	3.59	13	2.46
27	Telangana	575	0.11	69.50	22	3.83	105	18.26	228	39.65	173	30.09	41	7.13	6	1.04
28	Tripura	25	0.17	6.75	7	28.00	12	48.00	6	24.00	0	0.00	0	0.00	0	0.00
29	Uttar Pradesh	567	0.74	39.35	6	1.06	147	25.93	258	45.50	131	23.10	25	4.41	0	0.00
30	Uttaranchal	31	2.86	72.58	0	0.00	9	29.03	11	35.48	7	22.58	2	6.45	2	6.45
31	West Bengal	652	0.40	27.12	54	8.28	232	35.58	237	36.35	106	16.26	23	3.53	0	0.00
Total		**14591**			**872**	**5.98**	**3746**	**25.67**	**5886**	**40.34**	**3115**	**21.35**	**712**	**4.88**	**260**	**1.8**

Annexure-IV

State-wise Depth to water Level and Distribution of Percentage of Wells for the Period of Pre-monsoon, 2019

S. No.	Name of State	No. of wells Analysed	Depth to Water Level (mbgl)		Number & Percentage of Wells Showing Depth to Water Level (mbgl) in the Range of											
					0-2		2-5		5-10		10-20		20-40		> 40	
			Min	Max	No	%	No	%	No	%	No	%	No	%	No	%
1	Andaman & Nicobar Island	106	0.04	10	80	75	19	18	7	6.6	0	0.0	0	0	0	0
2	Andhra Pradesh	718	0.09	49.30	59	8.22	319	44.43	250	34.8	83	11.56	5	0.70	2	0.28
3	Arunachal Pradesh	18	0.00	12.69	10	55.56	3	16.67	4	22.22	1	5.56	0	0.00	0	0.00
4	Assam	219	0.14	17.39	42	19.18	130	59.36	39	17.81	8	3.65	0	0.00	0	0.00
5	Bihar	621	0.74	16.11	10	1.61	215	34.62	348	56.04	48	7.73	0	0.00	0	0.00
6	Chandigarh	13	3.02	47.64	0	0.00	3	23.08	1	7.69	3	23.08	4	30.77	2	15.38
7	Chhattisgarh	650	0.60	40.00	7	1.08	126	19.38	401	61.69	109	16.77	7	1.08	0	0.00
8	Dadra & Nagar Haveli	18	3.80	19.90	0	0.00	3	16.67	6	33.33	9	50.00	0	0.00	0	0.00
9	Daman & Diu	11	1.83	9.05	1	9.09	3	27.27	7	63.64	0	0.00	0	0.00	0	0.00
10	Delhi	73	1.07	62.64	4	5.48	12	16.44	18	24.66	20	27.40	13	17.81	6	8.22
11	Goa	64	1.75	14.95	3	4.69	28	43.75	24	37.50	9	14.06	0	0.00	0	0.00
12	Gujarat	669	0.00	59.90	9	1.35	99	14.80	231	34.53	234	34.98	90	13.45	6	0.90
13	Haryana	288	0.48	87.11	11	3.82	64	22.22	67	23.26	75	26.04	59	20.49	12	4.17
14	Himachal Pradesh	101	0.62	28.70	15	14.85	39	38.61	21	20.79	20	19.80	6	5.94	0	0.00
15	Jammu & Kashmir	204	0.85	38.70	28	13.73	102	50.00	51	25.00	15	7.35	8	3.92	0	0.00
16	Jharkhand	278	0.00	16.25	5	1.80	35	12.59	179	64.39	59	21.22	0	0.00	0	0.00
17	Karnataka	1102	1.15	27.30	33	2.99	235	21.32	510	46.28	318	28.86	6	0.54	0	0.00
18	Kerala	1441	0.31	55.23	88	6.11	411	28.52	633	43.93	283	19.64	25	1.73	1	0.07
19	Madhya Pradesh	1099	0.00	49.62	15	1.36	125	11.37	490	44.59	412	37.49	53	4.82	4	0.36
20	Maharashtra	1680	0.01	51.00	40	2.38	176	10.48	751	44.70	617	36.73	88	5.24	8	0.48
21	Meghalaya	56	0.51	31.90	8	14.29	29	51.79	15	26.79	1	1.79	2	3.57	1	1.79
22	Nagaland	5	1.15	11.62	1	20.00	2	40.00	0	0.00	2	40.00	0	0.00	0	0.00
23	Odisha	1067	0.00	13.55	140	13.12	467	43.77	437	40.96	23	2.16	0	0.00	0	0.00
24	Pondicherry	6	2.51	6.90	0	0.00	5	83.33	1	16.67	0	0.00	0	0.00	0	0.00
25	Punjab	251	0.70	43.43	6	2.39	45	17.93	56	22.31	76	30.28	64	25.50	4	1.59
26	Rajasthan	922	0.52	128.15	13	1.41	75	8.13	201	21.80	263	28.52	195	21.15	175	18.98
27	Tamil Nadu	630	0.60	103.40	26	4.13	119	18.89	267	42.38	177	28.10	32	5.08	9	1.43
28	Telangana	560	0.85	99.50	7	1.25	83	14.82	202	36.07	189	33.75	66	11.79	13	2.32
29	Tripura	96	0.45	27.25	20	20.83	50	52.08	18	18.75	5	5.21	3	3.13	0	0.00
30	Uttar Pradesh	582	0.29	44.20	9	1.55	170	29.21	265	45.53	113	19.42	23	3.95	2	0.34
31	Uttarakhand	44	1.98	71.90	1	2.27	13	29.55	11	25.00	16	36.36	1	2.27	2	4.55
32	West Bengal	374	0.41	32.29	20	5.35	101	27.01	183	48.93	64	17.11	6	1.60	0	0.00
Total		**13966**	**0.00**	**128.15**	**711**	**5.09**	**3306**	**23.67**	**5694**	**40.77**	**3252**	**23.29**	**756**	**5.41**	**247**	**1.8**