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DEVELOPING CLIMATE RESILIENT VILLAGES

Managing Water & Land to Tackle Drought

Policy Brief based on an
Impact Evaluation Study and Proposed Guidelines for
Water Tank Desiltation in Maharashtra

Acknowledgments

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India is faced with a severe water crisis. More than 70 per cent of the country falls under dry zones and large parts of it experience drought – caused as much by climatic reasons as by mismanagement of water resources. Recent studies underline that there are simple, cost effective and scalable ways of dealing with drought. The Maharashtra Government has shown exemplary leadership by introducing a scheme called "Gaalmukt Dharan, Gaalyukt Shivar Yojana" – literally, silt free water reservoirs and fertile farms policy – to demonstrate how precious water from the monsoons can be saved in water tanks and be of benefit to agricultural communities. This policy brief outlines recommendations that can strengthen this scheme and help it reach its full potential by being adopted at scale across Maharashtra.

I. INTRODUCTION

A large part of India falls in arid, semi-arid and dry climatic zones, where rain brought in by the south-west monsoons is the main source of fresh water. The monsoons move over India for a short period of two or three months. However, they provide more than 80 per cent of the annual water supply for agriculture. Roughly 70 per cent of India's geographical area is classified as dry, which is prone to drought.

Studies have shown that in these regions, water scarcity and land degradation are interlinked. The increased runoff from degraded land and lack of proper rainwater harvesting initiatives leave very little water for the dry season. To make matters worse, climate change is leading to unpredictable weather patterns in India, creating uncertainty in water resource management.

Maharashtra – A severely drought prone region

The state of Maharashtra has 36 districts, of which more than 20 in the north-western, northern and central part of the state face regular droughts. More than 61 per cent of Maharashtra's population depends directly or indirectly on agriculture for its livelihood and therefore are severely impacted by lack of water availability during dry season. In 2013, all 8,700 villages in the eight districts of the Marathwada region were officially declared drought affected. In 2015, media reports said more than 3,000 farmers committed suicide in the state, and it was widely recognised that drought was a significant factor in this sad statistic. The lack of adequate water has had a cascading effect on the socio-economic and environmental conditions in the region.

There is an urgent need to improve water and land management practices to build drought resilience among communities living in these dry lands. Several decentralized water management interventions exist. One such intervention was piloted by a group of like-minded NGOs and philanthropists in Maharashtra. Together, they identified and desilted eight traditional water tanks in Beed, Jalna and Nanded districts of Marathwada region. For centuries, these water tanks have served as important water sources for local communities but years of neglect have resulted in silt accumulation which has further compromised their water storage capacity. Silt accumulation is a result of human activities in the upper catchment areas and the failure of traditional institutions to maintain these tanks. The intervention by these partners not only involved desilting the water tanks, but also applying this excavated silt on agricultural lands to test its productivity in the field. This successfully improved the water capacity of these tanks, thereby ensuring water availability during the dry season, and also improved farm productivity.

Encouraged by the success of this project, the Maharashtra Government announced a state-wide scheme called *"Gaalmukt Dharan, Gaalyukt Shivar Yojana"* (literally, silt free water reservoirs and fertile farms) in 2017 and set up a "Desilting Policy Committee", which recommended that 31,459 small dams and water tanks be desilted across the state.

The Nature Conservancy India and the Watershed Organisation Trust carried out evaluation surveys of seven such water tanks in the villages of Beed and Nanded districts to document its benefits as well as define a set of guidelines that would help this scheme reach its full potential and achieve scale across the state.

The study had the following objectives:

a) Provide a scientific basis for the evaluation of the impact of desilting along with a cost-benefit analysis.

b) Identify best practices, gaps and negative impacts.

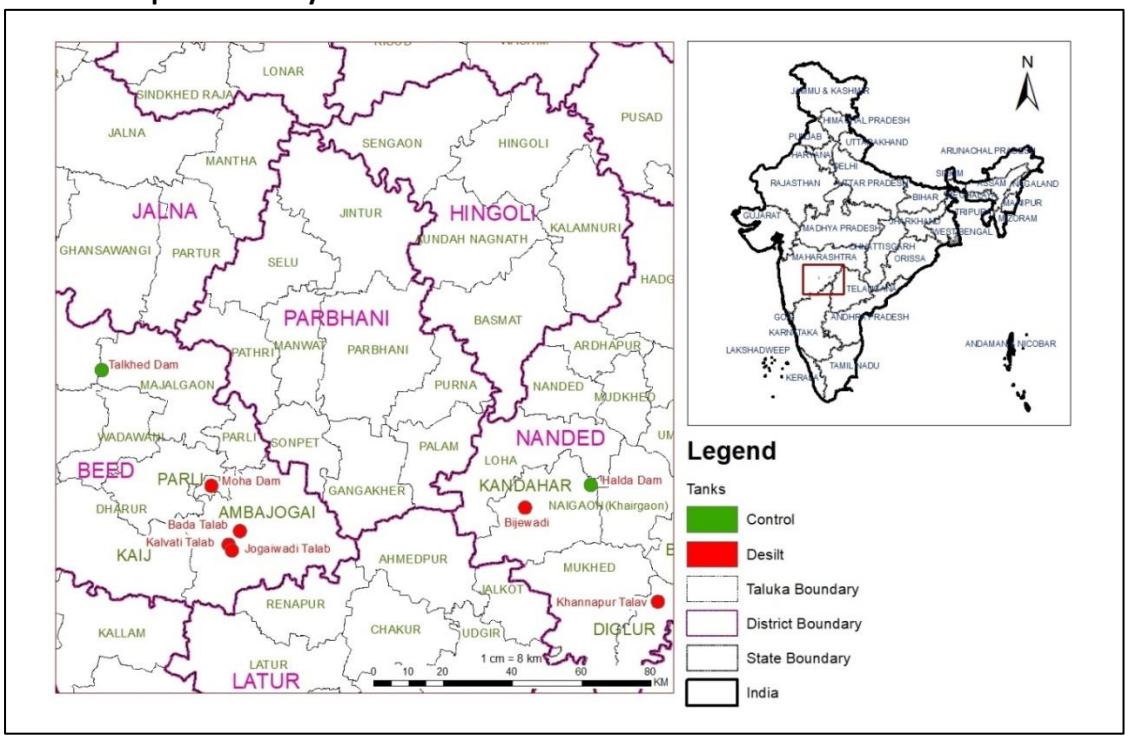
c) Develop guidelines that would help the Maharashtra Government to facilitate upscaling this work, including identifying institutions and governance structures that help engage communities in management of land and water resources.

The guidelines are aimed at helping to improve efficiency of the initiative, implement safeguards to avoid over-excavation of the reservoirs, ensure more ownership for local communities, make the process more equitable and provide science-based advice to farmers on adequate application of silt in their farms.

The study noted that the benefits of this initiative include an increase of cultivated and seasonally irrigated land area and reduction in rainfed and waste land area around the tanks. The nutrient-rich silt applied to farmland improved crop production. Some of the other benefits were reduced migration, improved livestock, increase in fisheries and improved vegetation. In short, it was noted that the desilting of these tanks had a positive impact on agriculture, improved the ecology of the area and socio-economic conditions of local communities. It was also found that the benefits of desiltation outweighed its cost.

There is, indeed, an urgent need to focus on water issues across the country, but especially so in villages where it is the main force behind livelihoods. As pressures on water mount, governments are looking at various options that they can adopt – big, medium and small – to deal with the water crisis that has been looming large.

Location map of the study sites



II. APPROACHES & FINDINGS

a) PROCESS FOLLOWED

Evaluation surveys were conducted on seven pilot tanks in Beed and Nanded districts that were desilted in 2016. Most farmers interviewed in the survey, which was carried out in December 2017, were small and marginal farmers and were scattered across income ranges. Data was collected by surveying the farmers and NGOs involved in desilting through structured questionnaires.

Two soil samples were collected from farms for each of the seven tanks – the first sample was taken from the farm where silt from the tank was applied and the second from a control farm with no silt application (total of 14 samples). Soil samples were also collected from three tanks. All these samples were tested for various parameters.

A GIS-based analysis was undertaken to assess changes in vegetation and water spread areas. Two indices – Normalised Difference Vegetation Index (NDVI) and Normalised Difference Wetness Index (NDWI) – were evaluated. NDVI is related to the health of a plant and estimates its photosynthetic capacity while NDWI is used to estimate plant water stress.

A cost-benefit analysis was carried out to assess the economic feasibility of tank desiltation. Expenses incurred by the NGOs for excavating silt were considered as cost. The benefits were calculated on the basis of the then current market prices of fertilisers which would have been needed to replenish the equivalent quantity of nutrients applied through the silt.

b) KEY FINDINGS OF THE STUDY

1. The quality of silt varies from tank to tank and, therefore, its impact on farm soil also varies:

The farms on which silt was applied recorded an increase in water holding capacity and improved organic carbon in the soil as compared to the soil of control farms (an adjacent farm where silt was not applied). Results on the effect of silt application on soil texture, bulk density and water holding capacity of the farm soil varied from tank to tank as the silt quality of each was different.

2. The impact of desilting and silt application on the farms was positive on agriculture:

The area under cultivation increased, seasonally irrigated area increased, rainfed areas and waste land reduced (due to increased irrigation and improved soil conditions), the gross area under water-saving technologies increased, and some amount of summer cropping was made possible.

Indicators of positive impact of desilting of tanks on agriculture in the study area

- *The area under irrigation (of 33 households) increased from 57 acres to 75.3 acres in the Kharif season for the three main crops (cotton, soybean and bajra). The same trend was observed in the Rabi season.*
- *Area under cultivation increased by 51.5 acre (3 per cent) and seasonally irrigated area increased by 33.8 acre (5 per cent).*
- *An increase in area, production and yield of Rabi crops was noted in the post-intervention period.*
- *No summer crops were reported in the period before desiltation but in the summer of 2016, about eight farmers reported cultivating groundnut, maize and bajra in 10.4 acre.*

● Perennially irrigated area showed a significant increase of 86 acre (112 per cent).
● Rainfed area and waste land reduced by 7 per cent and 11 per cent respectively.
● A corresponding increase in yield was also observed during this period.

● Fodder crops that were not being cultivated before the desiltation are now being grown by six farmers in an area of about 4.3 acre. The area under sugarcane cultivation has also increased from 13.8 acre to 55.9 acre.
● Gross area under water saving technologies increased from 29.7 acre to 76.3 acre.

3. Slight reduction in per acre cost of chemical fertilisers was observed for major crops:

The study noted a slight reduction in per acre cost of chemical fertilisers for major crops. There was, however, a marked reduction in per acre cost (by 31 per cent) of chemical fertiliser for sugarcane, a perennial crop. The fertiliser use could be much lower, but the farmers were reluctant to reduce their input as they felt they had invested significant money in silt application and feared loss of their investment in case of failed crops. Hence, they applied more fertilisers in farms where silt was applied (even though it was not needed). Farmers were of the opinion that silt application reduces weed growth and that weeding cost had reduced. There was no change observed in per acre cost of pesticides.

4. There was an increase in income from the silted farms which was used for a variety of socio-economic purposes by the farmers:

The average gross annual income from the silt applied parcel of land rose from Rs. 37,489 to Rs. 92,855. The income generated from the silted farms was used for a variety of purposes by the farmers. Some common uses were: repayment of loans, education of children, marriages, livestock purchases, investments in agriculture (repairing of farm bunds, levelling, purchase of micro irrigation sets), medical purposes and domestic uses including house repairs.

5. Desilting is economically viable for farmers:

The average benefit-cost ratio of three tanks for which only soil fertility was considered (and was tested) was 1.31. In other words, if a village invested one rupee, it would get benefits worth Rs. 1.31. This indicates that the desiltation activity was economically viable, even when only the fertility of silt from the tanks was considered. Additional indirect benefits of desiltation such as increased water storage capacity, improved soil texture and water holding capacity are not reflected here.

6. Farmers bear the major portion of the cost of the policy:

Farmers taking the silt bear the major portion of the cost of the scheme. This includes the cost of transporting the silt to their farms, applying it and levelling the land. The NGOs helped in organising the communities to manage desilting, along with supervising the excavation of the tanks. The average cost borne by the NGOs was Rs. 2.4 lakh per tank, whereas the average cost borne by the farmers included in the survey was Rs. 23.5 lakh per tank. Of the expense borne by the farmers, about 87 per cent was for transportation of silt.

7. Farmers faced two main challenges while carrying the silt from tank to the farms:

These challenges were (i) funds and (ii) timely availability of transportation vehicles. An estimated 300 tractor trollies of silt are required for one acre of land. Some small farmers were not able to raise capital for silt transportation in the very small window for silt application on farms before planting the next crop. Their need for immediate access to vehicles made them vulnerable to higher charges for

transportation. With the improvement in soil quality and water availability, farmers also expressed their need for training programmes on agriculture management practices.

OTHER FINDINGS:

- **Less recharge time for wells:** Average recharge time of the wells during the Rabi season (November) decreased by four hours and by two hours in the summer season (March).
- **Groundwater tables recharged:** Desiltation of tanks coupled with good rainfall helped recharge groundwater tables.
- **Increased water availability:** During group discussions, farmers said the duration of water availability from tanks had increased during summer months.
- **Reduction in migration:** The number of people migrating outward reduced due to a rise in employment opportunities within the village as a result of improved farm productivity.
- **Increase in land value:** The silt application led to an increase in land value (fixed asset) in some areas.
- **Healthier livestock:** Farmers believed that silt application helped in increasing biomass which led to more fodder for and, thereby, healthier livestock.
- **Increase in fish catch:** In the tanks where fishing was undertaken, the fish catch increased and the fishes weighed more as there was water for a longer duration.
- **Positive impact on environment:** Some people were of the opinion that the greenery surrounding the tanks also increased. In one tank (Sagroli), many birds were sighted during field visits.

The survey findings were supported with satellite data analysis. Three methods were used in GIS analysis to evaluate changes in vegetation and the water situation in a 2-km radius around the tanks.

Commercial fishing in the Sagroli tank

Two years with similar annual rainfall – 2014 (before interventions) and 2017 (after interventions) – were compared. There is no clear evidence of improvement in vegetation around the tanks – this may be because the impact was in small pockets and the area covered for the analysis was large. Also, 2014 had more wet days than 2017. On the water situation, there was clear evidence that the desilted tanks had more water in the month of February as in the years before desilting they used to dry up by that month. In the months of February and March, the areas around the desilted tanks seemed to have lower water stress than before but this was also true for the two control tanks that were considered.

III. PROPOSED GUIDELINES

Based on the surveys, interactions with farmers and analysis of the data collected, The Nature Conservancy India and Watershed Organisation Trust have developed a set of guidelines around two government resolutions (GRs) – No. 201704101302368426 dated May 6, 2017, and No. 201712061616303426 dated December 6, 2017 – by the Rural Development and Water Conservation Department, Government of Maharashtra. It is felt that these guidelines would greatly help easy implementation of the policy in the state, besides making it more oriented towards vulnerable sections of the community. Some key recommendations:

(1) Choosing farmers who get the silt: While GR No. 201704101302368426 states that farmers to be eligible for the scheme need only to be ready to bear the expenses required for transportation of silt from percolation tank to farm, it is recommended that priority be given to rainfed/degraded farms situated within the village itself and particularly to those in a 500-metre periphery of the dam to be desilted. Even among these farms, small and marginal land holders may be given preference.

It also recommended that grant support (partial/full) may be provided to small and marginal farmers for transportation of silt. The support could be from government schemes such as MGNREGS or JYSY.

A special loan with 'no/minimal' interest rate may be offered to other farmers for transportation of the silt as the study found that they are often constrained as funds are not immediately available.

Visible change in soil structure after and before mixing with the tank silt

(2) Monitoring and Evaluation: It is recommended that a Village-level Monitoring Committee (VMC) and a representative of the Tahsildar monitor the desiltation work while an external/third party evaluate the activity. GR No. 201704101302368426 had suggested an external/third party do both monitoring and evaluation.

(3) Choice of tanks: While GR No. 201704101302368426 gives priority to percolation tanks which are more than 5 years old and have command area of less than 250 hectares, the following amendments and additions are suggested:

(a) The definition of big and small dams may be based on the catchment area of a dam rather than the command area. The catchment area implies the land that provides water to the tank and command area implies the land to which water from the dam is supplied.
(b) Priority should be given to the oldest and most silted tank in the village.
(c) A tank may be desilted only if the siltation has reduced the height of original water storage by at least 50 per cent so that the work is economically viable.
(d) Sample pits should be dug in selected tanks to assess depth of silt and its suitability for application on croplands. Farmers should be made aware of the parameters of suitability and care must be taken that the soil of farmland is not degraded by application of poor quality silt.
(c) Sand excavation may be "prohibited" rather than "not permitted" as in GR No. 201704101302368426. Only that quantity of silt should be excavated which would help in restoring the original water storage capacity of the dam. The designed storage capacity of the tank should not be increased.

(4) Key guidelines related to the implementation process of projects/schemes:

(a) Role of Gram Panchayat: It is recommended that the Gram Panchayat be the nodal agency for implementing the project through its VMC under close supervision of the Sub-Divisional Officer of the Revenue Department (SDO-Prant) rather than the SDO, Tahsildar or Talathi driving the project as laid out in GR No. 201704101302368426. The study by The Nature Conservancy India and Watershed Organisation Trust proposes specific steps that are to be taken by the Gram Panchayat in the implementation process. The VMC should monitor the desiltation process and the work continuously. The Talathi is responsible for monitoring and for giving the final sign-off.

The Gram Panchayat is to give prior notice to the designated officer regarding the tank/s to be desilted and an individual or NGO approaches the respective Gram Panchayat expressing their interest in tank desiltation/silt. The Gram Panchayat then prepares the proposal after assessing with help of the government engineer and the VMC the suitability of the tank for desiltation and how much silt would be available for application on farmland. A list of farmers surrounding the tank is prepared, their interest and the quantity of silt they require are recorded and this list is displayed in a public place to ensure transparency.

(b) Transportation: While GR No. 201704101302368426 says farmers would be responsible for making all the necessary arrangements required for the transportation of silt including approach roads, it is recommended that the approach road from the tank to the existing public road must be demarcated by the VMC with the help of the Talathi/Tahsildar. The VMC along with GP and the community forms the guidelines to make temporary roads, if required, through the existing farms without major damage to the farmland. The guidelines also suggest ways and means to compensate the farmers affected by such roads which should be demolished after the desiltation is completed and the farmland restored. This would avoid the silt-taking farmers from being charged for the roads at an individual level. Silt transportation charges are to be fixed in the Gram Sabha after discussions with the vehicle owners/drivers based on the distance for transporting the silt.

(c) Composition of VMCs: It is recommended that besides the members listed by GR No. 201712061616303426, the structure of the VMC should include women representatives to maintain gender equality and members from SC/ST/Minority communities to make them more inclusive. It should also include representatives of societies/banks to facilitate loan possibilities and owners of

transport vehicles (tractors, tipper, *hiwa*) as they play an important role in the timely and smooth operation of desilting schemes.

(d) Information dissemination: Over and above the responsibilities of the VMC listed in GR No. 201712061616303426, it is recommended that the committee should undertake an awareness campaign in the village. Information about the plan and execution of the desilting activity must be displayed and updated daily in public places, so that people are well informed.

IV. CONCLUSION

The findings of the scientific study of the seven pilot tanks that were desilted in Beed and Nanded districts indicate that the Maharashtra Government's *"Gaal Yukt Shivar"* policy has the potential to change the lives of farmers across the state. It leads to an increased storage and holding capacity of water in the tanks, which helps the villagers in manifold ways, but especially in farming with the additional benefits of the application of nutrient-rich silt on farmland. Schemes under the policy have been found to be economically viable, they yield immediate results and have the support of sections of farmers.

Analysis of soil tests from the tanks and the silt-applied farms showed silt from the tanks was richer with nutrients and carbon and had better water retention. When applied to the farms and mixed with top soil, it helped improve crop yields and cut down input expenses for the farmers. Desilting also helped improve the water situation in the villages.

Benefits of Tank Desiltation

- Water storage level improved
- Farm soil improved
- Greater participation of community
- Gave boost to women, landless, SCs, STs, others
- Generated employment, such as tractor services
- Improvement in socio-economic conditions
- Reduced outward migration
- Improved livestock health
- More greenery and birds

Surface water was now available for a longer time in the dry period and the groundwater was recharged. This had a positive impact on crop production. Some farmers ventured into growing summer crops and fodder. Overall, there was an improvement in the socio-economic conditions in the region. There were other indirect benefits, such as reduced migration, improved livestock health, more greenery and more bird sightings. Even when only the fertility of the silt was considered, a cost-benefit analysis showed the economic viability of desilting. The economic gains will be higher if other direct and indirect benefits are considered.

But, as the study underlines, the policy needs some amendments and additions for effective and rapid upscaling and these are suggested in the guidelines.

The government policy needs to be urgently implemented across the state. Lives are changing in the villages because of access to water – and its cascading effects. The policy implemented elsewhere in the state, with the proposed changes, can transform a million lives.

The Nature Conservancy India

www.tncindia.in

The Nature Conservancy is the largest conservation non-profit in the world that works to protect ecologically important lands and waters for nature and people. We are a science-led organisation that partners with governments, businesses and other NGOs to find solutions to the greatest challenges facing the planet.

The Nature Conservancy's India programme has been advancing projects in India since 2015 and aims to work closely with the Indian Government, NGOs, research institutions and citizens to create science-based solutions that support India's efforts at development while conserving the lands and rivers on which all life depends.

We bring strong science, an ability to pilot and scale up on-the-ground programmes, a focus on collaborating with stakeholders and a history of global conservation successes. We are supporting the Indian Government's priorities, particularly the National Mission for Clean Ganga, Namami Devi Narmade, wetland conservation initiatives, air pollution in northwest India, renewable energy goals and the Smart Cities Mission. We envision a vibrant and healthy India that is guided by sound science to manage its natural resources.

Watershed Organisation Trust

www.wotr.org

Established in 1993, the Watershed Organisation Trust (WOTR) is a non-profit that engages at the intersection of practice, knowledge and policy across scales and in collaboration with stakeholders from across sectors.

WOTR assists rural communities to assess their vulnerabilities to climate and non-climatic risks. It organises them in a socially and gender inclusive manner to help themselves out of poverty by regenerating their ecosystems in a holistic and integrated manner, conserving and optimising resource use, especially water, and undertaking climate smart sustainable livelihoods.

WOTR as a learning organisation has set up the Centre for Resilience Studies (W-CReS) in Pune with a focus on applied research. It closely engages with institutional and governance actors so that insights and good practices derived from the ground experience contribute towards shaping policies and enabling effective programmes.