Dear Anagha,

Please see below some comments from my esteemed colleague, Dr Peter Dillon. Dr Dillon was involved in the MARVI project since its beginning and was key to the success of whatever we could achieve in MARVI. He is a pioneer of the managed aquifer recharge in Australia and internationally, and he too is pleased with your efforts to advance the planning and community participation in groundwater recharge activities in India.

Best wishes,

Basant Maheshwari

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WESTERN SYDNEY UNIVERSITY

From: Peter Dillon <pdillon500@gmail.com>

Sent: Monday, 7 June 2021 10:51 PM

To: Basant Maheshwari <B.Maheshwari@westernsydney.edu.au>

Subject: RE: A 10th Grader's work on "increasing community participation in groundwater recharging"

Dear Basant,

This work is remarkable for someone who has not yet had a university education. Anagha should be encouraged.

I love that she understands that the participatory process is essential, and she has well advanced ideas for locating suitable sites for managed aquifer recharge.

A third weakness I see in the Artificial Recharge Master Plan is that it is based on very arbitrary mean annual flows and doesn't address sharing arrangements for surface water within catchments. This means that upstream rechargers can deny those downstream of streamflow and of water that they could otherwise use or recharge.

A strength of Anagha's approach is in engaging with potential rechargers, via an app and amassed data on physical aspects of the geology and hydrology. With some thought this could be

brought to bear on how water sharing arrangements in a catchment could be embedded. Bringing in that extra dimension would be very valuable.

A simple example, probably too simple, is to include a maximum value for recharge in any square km of a catchment based on the estimated available water for recharge divided by the entire catchment area down to its outlet.

This would constrain surface water over-exploitation for recharge upstream but not prevent it. The reason for this remaining problem is that in low flow years upstream recharge takes a much higher proportion of flow than in the average year.

Again a simple way around that may be to only allocate some percentage (say 25%) of the average excess flow for recharge across the whole catchment.

Another could be to enforce recharge structures to bypass low flows eg via pipes through the streambed structure (and maintain these) or by making offstream infiltration basins with diversion at high flows.

Perhaps the app could in this way be developed to also help inform farmers about their impacts on flows downstream, and used across whole catchments to set realistic targets for recharge, and test alternative strategies.

There is a swag of material on mapping aquifer suitability for MAR (artificial recharge) and more at the IAH-MAR web site: https://recharge.iah.org/ (especially in the Resources pages, and there is a Working Group on this topic). Prof Catalin Stefan, beside being a co-chair of this commission is a global leader on mapping aquifer suitability, and also in use of web based tools and models: 'Stefan, Catalin' catalin.stefan@tu-dresden.de

I would suggest Anagha email him to show him her draft and also to seek relevant references.

I hope this information is helpful for Anagha. I would like to hear how this progresses in due course.

I wish her well.

With best regards,

Peter

Peter Dillon

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CSIRO, NCGRT

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Dear Anagha,

I am impressed with your write-up!! You have showed a great maturity in writing the article. Same as Basant, I too will be interested in assisting you in developing your write-up into a publishable article.

Regards

Dharma

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Co-ordinator – Australia-India Water Centre (http://iitg.ac.in/aiwc/) Member of MARVI team: http://www.marvi.org.in/

Dear Anagha,

I had a look at your research and it is very interesting and impressive work for someone of your age. However I don't think there is enough here for it to be publishable. Even for our undergraduate students it is very rare for them to publish their work. However please don't let that discourage you from continuing to do your own research as it will put you in a good position for publishing later on when you have more experience.

Best wishes, Emma

Dr Emma Tebbs

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Dear Anagha,

Thanks for sharing your remarkable piece of work with me. I am indeed surprised that at so young age, you have created such an exquisite piece of research. Thanks also for the flawless writing. I think you are on the right track and should work on the mobile application. While improving on it, you should pay attention to whether your application outperforms traditional, unlettered barefoot hydrologists who looked at the lay of the land and identify ideal location for a recharge pond. You must also bear in mind the demand side of the picture. Your app may find best recharge sites in the middle of nowhere where there is no demand for groundwater. Even a somewhat less efficient site may be more useful than the best if it is located where demand for groundwater is high.

I would like to commend you to continue such excellent work and develop your ideas further. Regards,

TUSHAAR SHAH

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********** my cold email **********

Greetings,

Hope you are staying safe.

My name is Anagha Raghunandan and I'm a 15 year old girl from Karnataka, India. I have finished my preschool and middle school years in California, United States. In middle school, we were taught to conduct small researches not only in Science, but also in Language Arts (as in writing research essays). I grew very fond of researching from then on, and now after I moved back to India, I would still like to continue this habit. Currently I am in 10th grade, studying at Canara High School, Urva, Mangalore.

During this pandemic, I have started working on a project related to groundwater recharging. Here is the brief explanation of my project:

The effective implementation of artificial recharge schemes depends on the identification of appropriate locations and structures. Several research works have integrated Geographic Information System (GIS) & remote sensing techniques to identify potential groundwater zones. I have made an attempt to extend this technology to recommend suitable structures based on the site conditions and build a Mobile technology platform to further involve consumers of groundwater in its management.

With this app, the technology will be accessible to the communities.

Here is the link to the initial paper I have prepared based on my research: https://tinyurl.com/29xm953a

At present, I am working with a Senior Scientist from the Central Ground Water Board, India and an Esri ArcGIS team to create a proof of concept app.

I have gone through your paper and research work done that highlights the importance of community participation in groundwater recharging, and I have cited them in my work. I have tried to incorporate a technology aspect to increase community participation in this work.

I would really appreciate it if you could go through the paper and suggest your feedback!

1. I would like to know if I can discuss with you how this technology adaptation can be used for increased community participation in

2. Would you be able to guide me on how to take this work forward, and publish it?

Thanks, Anagha