Removing *Prosopis juliflora* (*Baavlia*)
And other invasives from inside Smriti Van Park

Large swathes of the proposed Smriti Van Park at Beriganga are infested with *baavlia* (*Prosopis juliflora*), an invasive tree/bush from Central and South America that is noxious, invasive and undesirable.

The dominating presence of *baavlia* is clearly seen in the picture below.

This picture was taken from the first sandstone ridge, pointing southwards

Historical imagery on Google Earth tells us Forest Department plantation drives earlier this century [see image on next page] account for the establishment of another invasive exotic tree:- Israeli babool – *Acacia tortilis* – in close, parallel rows in the south-western corner of what is now the designated area of the Park. In between this plantation grid, there is now dense growth of *baavlia* trees which remain stunted on account of the unyielding nature of the rocky ground, although closer to the road *baavlia* has prospered in a narrow belt of calcareous (*mudd*) soil and grown tall.

SE portion of the proposed Park showing Acacia tortilis *planted in a grid pattern*

Kummatth (*Acacia senegal*) is also present but this is a desert native that thrives in dry, rocky situations and poses no problems for the Park. It is going to be an integral part of what we plant up the Park with. Both *Prosopis juliflora* and *Acacia tortilis*, on the other hand, are invasive aliens that compete with native plants and prosper at their expense. Their continued presence in the Park will have adverse impacts on all aspects of natural regeneration and if we want to create a beautiful, natural, sustainable landscape, these trees **must** be eradicated.

I don't believe there can be any disagreement on this. What is important to emphasise, however, is that **if the eradication of invasive species is not done 'properly', we risk causing grave harm to the ecology of this rocky area**.
This is not an exaggeration.

In this document I provide a rationale for why it is crucial to go about this task in the 'right way' and point out what we risk losing if we do not do so. I prescribe a **manual** method of removing *baavlia* that has been successfully employed inside 70 hectares of Rao Jodha Desert Rock Park in Jodhpur, and strongly recommend that we should adopt and follow this tried and tested method. Compared with using heavy earth-moving machinery to accomplish this task, a manual method is undoubtedly slow and perhaps more expensive, but the use of heavy earth-moving machinery will have disastrous effects on the vulnerable soil cover of this tract. This is NOT a price worth paying.

It is far better to eradicate *baavlia* slowly but in the right way in order to preserve the soil cover, than to try and do this quickly which will destroy a vital resource in the process.

Description of the Area

The landscape of the proposed Park – slightly less than 250 hectares in extent – is a gently sloping **rhyolite** plain interrupted by prominent outcrops of rhyolite boulders which provide relief and visual interest. Rhyolite is an extremely hard, crystalline igneous rock that was formed by ancient (pre-Cambrian) volcanic activity that took place across a substantial region of western Rajasthan known as the 'Malani Igneous Suite' some 750 million years ago.

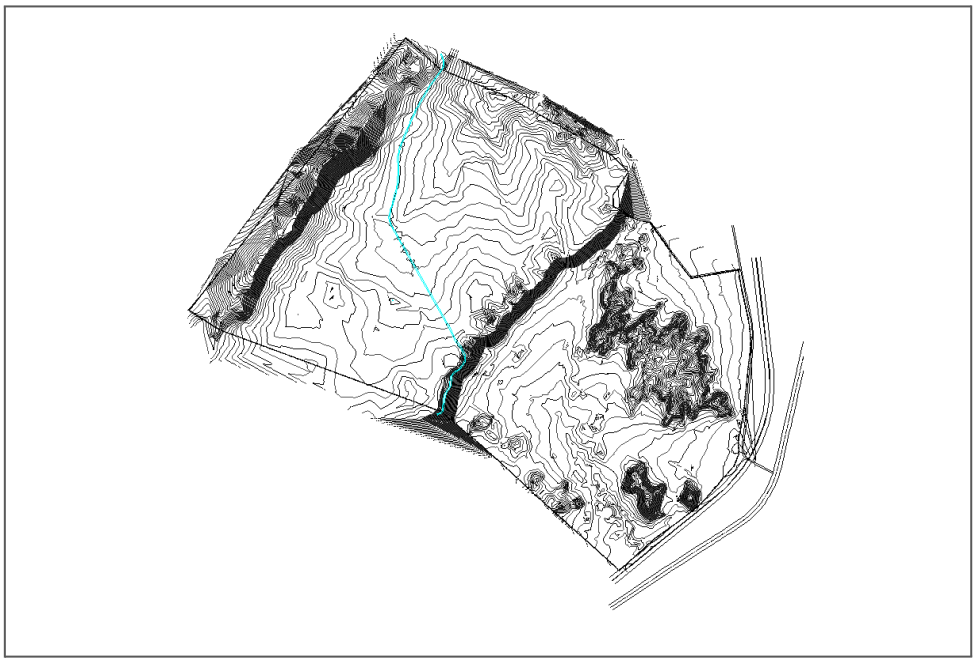
Photo taken in a SE direction from the first sandstone ridge

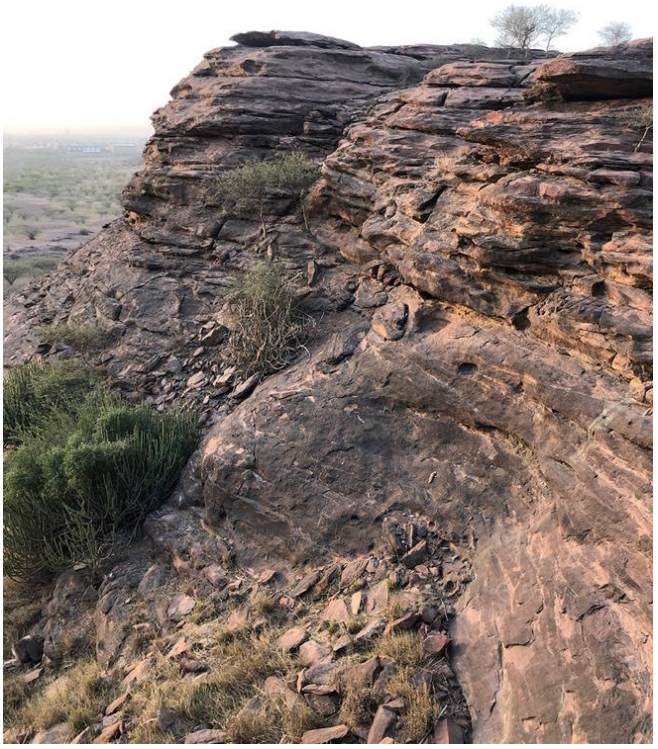
As one travels in a north-westerly direction towards the 'back' of the designated Park, one encounters 2 prominent **sandstone** ridges, the further one forming a boundary to a slightly more elevated plain that is also dominated by rhyolite. These sandstone ridges are a part of the Soorsagar sandstone formation that yields 'Jodhpur sandstone' which is extensively quarried as a building stone.

This sedimentary rock was formed in shallow marine basins some 600 million years ago – roughly 100 million years after the rhyolite poured out of volcanoes. Originally, the whole of

this region would have been covered by the sandstone. Being relatively soft, the mantle of the sandstone has mostly been eroded away.

You can easily see the two ridges shown as dense contours in the image below.





Together, these volcanic and sedimentary rock formations make up an extensive rocky landscape stretching in a SSW-NNE alignment that dominates the Jodhpur-Mandore region and provides a unique and attractive setting for a Public Park.

We believe that we must aim to make the most of these natural features.

To achieve this, we will need to do everything we possibly can to avoid **damaging or degrading the natural ecosystem** and to increase the opportunities for a full panoply of the Thar's native rock-loving plants to prosper here.

Rockgrass

Anyone who visits the Beriganga site will not fail to notice that most of the rocky ground is overlain by a thin layer of soil, somewhere between 8-12 cm thick.

How has this come about? Why hasn't the soil been washed away by flowing rainwater or blown away by wind? It is important to understand how this soil layer has managed to build up and remain intact, because it is key to maximising what we can hope to achieve when we plant up this tract of land.

Even in the dry months, it is plain to see that the thin layer of soil is held in place by a short grass that is almost ubiquitous. This is *Oropetium thomaeum* – known as **'rockgrass'** – which is a vitally important plant of dry places and especially so in rocky parts of the Thar Desert.

Rockgrass subsists by 'holding hands' with a thin layer of **liverworts** – which are an ancient and 'primitive' plant related to mosses and, like mosses, lacking roots – which are barely

visible in the dry season. Liverworts are called ‘resurrection plants’ because it appears as if they die out and then come back to life again and again, but in fact liverworts do not die but become **dormant** in the long dry season, and then are able to spring back to ‘life’ when it rains. Even a short spell of rain outside the monsoon months will cause liverworts to become bright green.


(LEFT) *Liverworts and Oropetium in the monsoon.*
(RIGHT) *Showing how even small patches of soil are ‘protected’ by these plants*

Together, rockgrass and liverworts form a thin covering that holds soil in place.

You only have to try and imagine what would happen if they did <u>not</u> exist – erosion by wind and water would ensure that rocky places would remain *completely* bare, stripped of soil and vegetation. It is this crucial partnership between (the roots of) rockgrass and (crustose) liverworts that enables soil to build up on bare rock, which eventually becomes a substrate on which other plants can grow. (NOTE: There are reasons to believe that there may be *other* microbial partners too, but this is a matter of conjecture).

Soil layer held in place by Oropetium and liverworts in a granite habitat, now supporting diverse grasses

This is a fundamentally important process in rocky deserts. In botany and ecology, the role of *Oropetium* and liverworts amounts to a primary process of **succession** in rocky deserts that enables and supports all other plants to colonise rocks in very adverse conditions. How long does it take for rockgrass and liverworts to collect soil and protect it? No one knows for sure. A few thousand years would be an educated guess. Perhaps this too is an underestimate.

The important question to ask ourselves is:

Can we afford to destroy and undo the important successional work of *thousands* of years because we are in a hurry to remove a few thousand invasive trees?
I don't believe there can be 2 different answers to this question. Not if we have our priorities right.

We DO need to eradicate *baavlia* and *Acacia tortilis* from this habitat because these tree species have a proven negative impact on other plants. But the *only sensible* way to do this is by adopting a means that does NOT destroy the delicate and vulnerable natural ecology of this special place.

The thin soil layer in Beriganga is a precious gift that we need to nurture and use as an ally when we try and restore this tract with its native flora.

Driving heavy earth-moving equipment across the rhyolite plain will strip away rockgrass and its partners, which will crumble under the weight. Other alternatives – such as using toxic

herbicides like Roundup (Glypsophate) or 2,4-D or other foliar sprays – are even worse, because they kill plants, insects, microbes without discrimination. Using fire as a means of control has been tried without notable success. Biological control – using beetles that feed on the sugars in *baavlia* pods and destroy the seeds – has also not worked because the beetles turned out not to be host-specific.

What **has** worked with unqualified success is a **manual method** of grubbing out the top part of *baavlia's* root system, which was first tried out in Rao Jodha Desert Rock Park (hereafter shortened to 'RJP') in 2006. *Baavlia* is known to have an extremely long root system and folklore says that the tree is able to regenerate if even a small part of its root is left inside the soil.

In RJP, we learned that *baavlia* has a 'budding zone' restricted to the top part of its root system, reaching down no more than about 60 cms below ground level. When we dug down into the rock to remove the top 60 cms of its root system, *baavlia* failed to regenerate. Using this method, we removed many thousands of *baavlia* trees and bushes from 70 hectares of rhyolite-dominated land next to Mehrangarh Fort. There has been zero regeneration of *baavlia* after this procedure, and this provides us with a simple precedent to follow.

The big problem we had to address in RJP was **how** to dig down into hard, crystalline volcanic rock to a depth of 60 cms? For abundant caution, we added an additional 20 cms to make a total of 80 cms (a little over 2.5 feet) that we needed to dig down into.

This, in essence, will be our principal challenge in Beriganga – to devise an effective means of digging down 80 cms into the rocky surface in order to remove all of *baavlia's* budding zone so as to ensure that it does not coppice and regrow.

How will this be done?

In RJP, after casting around for other kinds of solutions, we employed members of a community of skilled traditional miners known as **Khandwaliyas**, who use these primary tools:

- A crowbar (*laggiya*) 90 cm long
- A hammer weighing 300 gms
- A big hammer (*ghaniya*) – 4 kgs
- A trowel (*karani*)
- A set of sharpened chisels

The Khandwaliya miners were instructed to break through the rocky surface to a minimum depth of 80 cms, pull out *baavlia* roots to the extent that they had been exposed, and then 'settle' the excavated pits with a planting soil mix so that they were ready to take new plantings i.e. Each excavated pit became a new site to fill with soil in which to grow some new kind of native, desert-adapted plant.

I am not going here into the different kinds of soil mixes and the species of plants that are suitable for placing in excavated pits. Given the regular spacing of *baavlia* plants in the Beriganga site, we may not even wish to use all the pits in this way, but the essential point I wish to establish is the principle of converting *baavlia* pits into new planting sites.

So here we have a method and a protocol that has been tried and tested, which avoids the negative effects of using heavy earth-moving equipment.

Recommended Procedure
Khandwaliyas are skilled labour who, on today's date (April 2022), charge about ₹750 per day.

I suggest that for the purposes of removing the enormous numbers of *baavlia* from the Beriganga site, it will be more economical to hire a small workforce of unskilled labour and get them trained by a small *toli* of Khandwaliyas.

If we employ 1 Khandwaliya to lead a small group of 4 or 5 labourers, we should be able to go about removing *baavlia* effectively and with more economy than by using only Khandwaliyas.

I am attaching a Google Earth image showing the area that needs to be cleared in the first Phase of eradicating *baavlia*.

I hope Jodhpur's Forest Department will enforce these recommendations, which – in our opinion – are the only sensible way to proceed if we wish to create a thriving community of native desert plants in the new park.

–
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April 2022