

Diarizos Sites Status: February 2019

Introduction:

The Diarizos river, 42 km in length, is the fourth longest river in Cyprus but second in terms of water flow. In 1998 the dam at Arminou was inaugurated. Its water storage capacity of 4.3 million cubic m is relatively small, but its main purpose is to divert water via a pipe to the Kouris dam. There is also controlled flow from the dam into the Diarizos Valley, which is supplemented by water from other sources such a spring at Trozena and others located in the Arsos area.

Several sites in the Diarizos Valley have been monitored by the Cyprus Dragonfly Study Group (CDSG) since 2013. Some sites that were initially selected, dried up following the years of below average rainfall. These included the upstream sites listed as Kidasi 1, 2, 3, 5 and 6, while Kidasi 4 was destroyed by a farmer. Above the Arminou Dam, the river near the Elias bridge was dry for much of the time and dragonfly numbers around the Kelefos bridge dropped to such lows that it was not considered worth monitoring from 2015 onwards. The lowest sites, Kouklia reed beds and Lower Diarizos also dried up. When water was present, however, all these sites proved to be good habitats for dragonflies. Coordinates for all sites are given and mapped out in the Appendix1. Several sites have had permanent water and have been monitored twice monthly since 2013. These include Diarizos 5, 3, 1 and 2. These sites are of particular significance since they host the rare zygopteran, *Ischnura intermedia*. However Diarizos 1 and 2 in particular were being taken over by reeds (*Arundo donax*).

Rainfall so far during this hydrometeorological year (1st October 2018 - 30th September 2019) has been exceptionally high. On 8th February it was at 526 mm, which is 140% of the norm for the period in an average year (Department of Meteorology, 2019). There was particularly heavy rainfall during January 2019. On 15th January, water inflow into the reservoirs at 23 million cubic m was the highest level ever recorded in a single day (Financial Mirror 2019). For two days around this time the pipe to the Kouris reservoir could not cope with the inflow to the Arminou dam which consequently overflowed. (Y. Christofides pers comm.) This resulted in flooding of the Diarizos valley with strong water flow transporting debris, significantly affecting sites and in some cases cutting out new channels. In this note the changes observed in the sites are reported.

Status of the sites

The four sites that have been regularly monitored were visited on 12th January (Chris Morgan, David Sparrow [DJS] and Ros Sparrow [RLS]) 22nd January (RLS and Heather Stroud [HS]) and 5th February (DJS, RLS and HS). On the 12th January the sites were largely as before, but with more water and a faster flow. On 22nd January the transformation at all sites was amazing. It was clear that the river had completely burst its banks and, in full spate, flooded the whole valley floor, while transporting a great volume of rocks and debris downstream. Having partially subsided, it had settled into a new course in various places, or opened new side channels. Three of the sites (D1, 2 and 3) were no longer accessible by car since the tracks had been washed away. On the 5th February the river was still flowing in its new course but access to D1 by car was possible via a newly levelled ford and stony track. Access by vehicle to D2 and D3, however, was not possible and is unlikely to be so anytime soon.

Details of the status of each of the sites is now given.

Diarizos 3

This site (which is also a picnic site) is located beyond the Extreme View Café, below the two well-known large rocks between which the road passes. It is possible to get down to the site on foot on the downstream side of the large rocks. It was previously also possible to reach the site by car, down a track on the upstream side of the rocks.



On 12th January the river was flowing as normal between the tree-lined banks, as shown in the images above.

However by 22nd January the site had been transformed. The whole picnic area was covered in stones brought down by the flood. The banks had been scoured and a lot of vegetation destroyed—but fortunately the trees seemed to have survived. Surprisingly although there were no physical obstructions such as reeds in the original course, the river had carved out an additional new channel along what was previously the track through the site (upper photo on next page). As a result the track down from the upstream side of the large rocks now ends in a precipice with a torrent below (see photo right). The new and the original channel then converge at the start of the picnic area (lower photo on next page).

It is assumed that the river chose this new course since, with no vegetation to stabilise the soil, the track through the site offered the path of least resistance. Interestingly on 5th February the flow was stronger through the newly-created channel than the original one.





Diarizos 5



This site is located below the large rock that can be seen from the Extreme View Café. In most years during the rainy season, the river here had already spread out creating several flooded areas. The image on the left above was taken in April 2015 and the image on the right in June 2017.

During most rainy seasons there has been a large overflow pool on the access track, beside which we usually park. As would be expected, this was quite extensive earlier this year as shown in this image taken on 12th January.



Following the flood, the river has opened up several channels and water is now flowing through at least five of them. The main ones are the channel near where we usually park and there is another on the other side of the stream complex.



This has been an important site for dragonflies in the past. The vegetated area in the middle of the valley, which previously formed the main river bed, seems to have been spared the worst of the flood. So hopefully there is a chance that larvae may have survived in this location.

Diarizos 1 and 2



These two adjacent sites have been important and the most species-rich sites on the island. When monitoring started in 2013 the river bed was free from reeds (*Arundo donax*) (left hand image above) and the sites remained relatively reed-free until October 2015, when vegetation started to encroach on the watercourse. D1 was particularly badly affected and by late 2016 was fully choked. D2 was slightly better with some open areas. Image on right shows D1 in June 2018.



The above left hand image shows D2 in August 2014 and the left hand image in June 2018. When visited on 12th January 2019 the flow on the river was strong and some of reeds had been swept away. There were some open spaces between the two transects which looked quite promising. On returning to the site on 22nd January, it was amazing to find that the whole area of the valley had been reshaped—"geomorphology rampant in the Diarizos valley", as Ros commented, having attended the Earth Sciences group. The valley floor was strewn with rock debris and the river was now running ca 100 m closer to the main road.



It was not possible to drive to the D1 site since the track at the end of the concreted part had been washed away and as can be seen in this image the river had shifted its course significantly. The original course was through the line of trees that can just be seen half way up the left hand picture. The right hand image shows just how dramatic the action of the water had been.



On returning on 5th February we found that access to D1 was now possible by car. A new track and ford had been levelled and rubble cleared off the tracks. We decided not to try driving through the ford and instead walked to D1. Two farmers had however made the crossing in their pick-up trucks. The bridge was still intact and, as would be expected, the reeds at D1 had been cleared as shown in the photo below taken from the bridge, but there was no flow of water—the river had been diverted! It therefore seems likely that D1 will be permanently lost.





From D1 we were able to walk only about 50 m towards D2: the rest of the track to D2 had been swept away and now formed the new course of the river. The upper image is a view towards D2; the furthest point that can be seen on the river was the place where we used to park the car. The vegetation in the top half of the photo marks the original course of the river. The lower photo was taken below the end of the existing track from D1 to D2.





In carving out the track, the river cut deeply into its bank as shown in the photo above. Roger and Heather visited the site on 24th January and spoke to one of the farmers. He told them the lost track was the only access to his orchards and showed a video of the river in flood with water from one side of the valley to the other. He also commented that this was the worst flood in the valley since 1969. Checking on the Ministry of Meteorology website, 1968 - 69 was the last hydrometeorological year of extremely high precipitation (defined as $> 130\%$ of the normal level i.e. more than 654 mm). Another farmer they spoke to further downstream had lost six beehives. Part of the road to the bentonite mine at Kidasi had also been washed away, although this had since been bulldozed through to allow access.

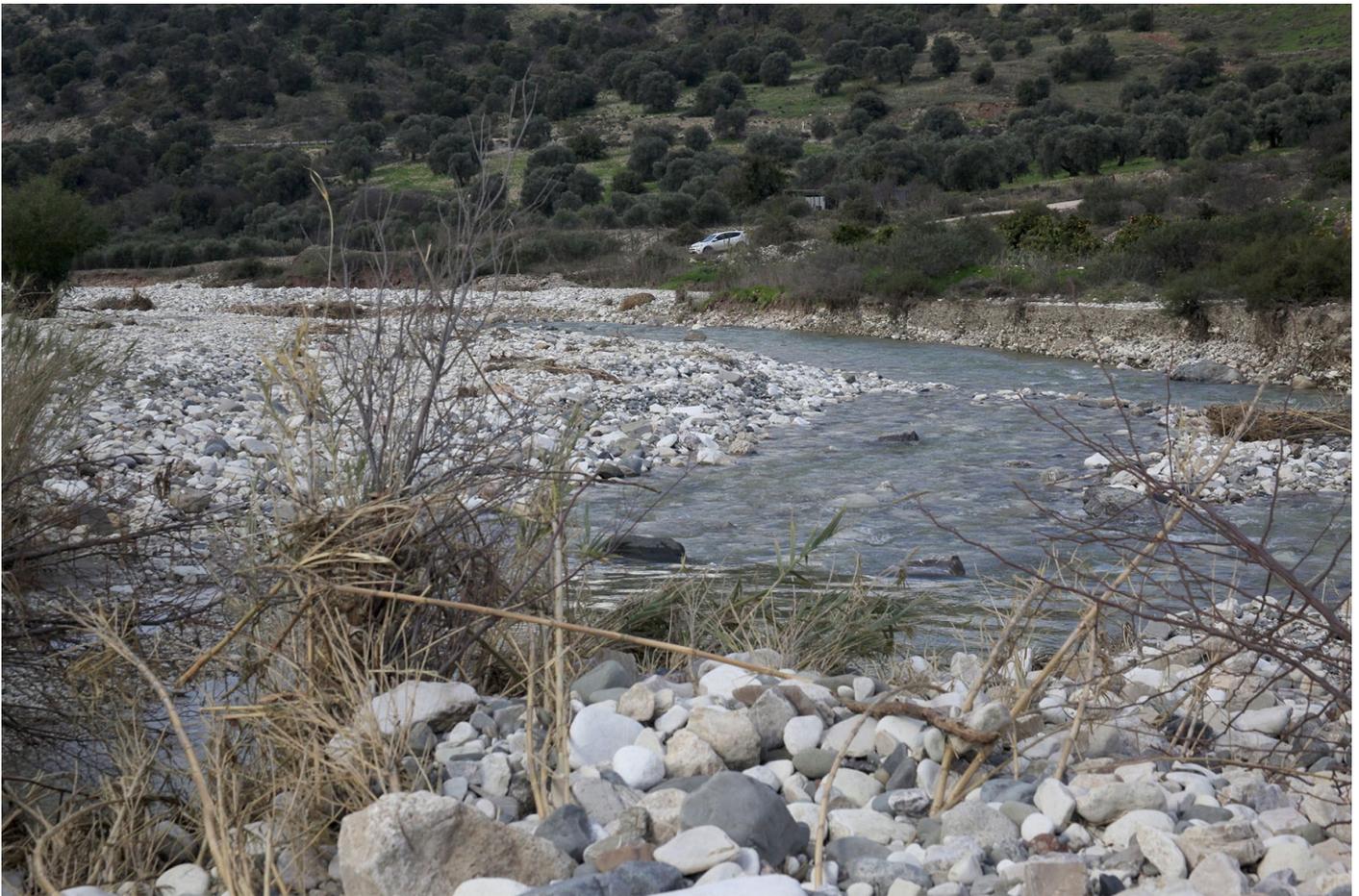
In the photo below some of you may recognise the green gate that was just before the parking spot for D2 - the track was previously only slightly below that level!





That is quite impressive, but then, remarkably, at the point where what is left of the D1 to D2 track ends, the river makes a sharp right turn as shown in the above photo. The probable reason for that is that the ground directly ahead is stabilized by the vegetation, especially tree roots and the river takes the course of least resistance as shown in the photo below.





Having made the right turn, the river then selected the path of least resistance and cut a new channel into what previously was an un-vegetated track on the western side of the previous river bed. It then heads south towards the sea. On travelling up the valley we noticed for the first time that wherever we could see the river it had flowing water.

Kouklia reed beds

Two other downstream sites were initially monitored - Kouklia reed beds and Lower Diarizos - but these were dropped in 2016 when the flow dried up and until this season remained dry. When water was present both sites were of interest, and the most important on the island for *Orthetrum taeniolatum*.



The above left hand picture shows Kouklia reed beds in July 2015 when there was still a steady flow on the river. Half way up the picture the wall of the small water storage tank (which had been empty since 2016) is visible. The photo on the right shows the site in December 2018.



The photos on this page show the site on 5th February 2019. The valley had clearly been completely flooded. Vegetation on the river bed had been stripped and the whole area was strewn with rocks and stones. The access road had obviously also been flooded but had already been cleared. As shown in the lower photograph the upper and lower walls of the tank had been washed away. Unlike the previous sites, however, the river had remained on its original course.





Lower Diarizos

In 2012, after several wet winters the Lower Diarizos was a particularly good site with 16 Odonate species being recorded there. In 2013, however, the site had much less water and a track was constructed through it as shown in the photo above. The site then dried up and remained dry until the start of the rainy season in 2018. The photo below shows the site on 24th December 2018. As can be seen it had a little water and some vegetation.





Matt reported on 2nd February that there had been extensive flooding in the valley; that the Kouklia Reed Bed pool had been destroyed and 80% of the road leading to it swept away. As seen in the previous section the pool had indeed been swept away, but when we visited on 5th February the road had been regraded and the Lower Diarizos had been totally transformed by the flood. As shown in the photos above (looking upstream) and below (looking downstream). The vegetation had been swept away and a wider channel along the previous course carved out. There was now a strong flow on a wide stream.



Discussion

Following the very heavy rains, all of the rivers and streams that we have seen have clearly been in flood, but none as severely affected as the Diarizos. D1, 2 and 5 have been particularly important for several species, in particular *Ischnura intermedia*. D1 and 2 have been particularly badly impacted and there is concern about the fate of any dragonfly larvae that were there. Any larvae in D5 would have had a better chance of survival but given the extent of the flooding they are also a matter for concern. D3 was one of the island's most important sites for *Calopteryx splendens*, *Epallage fatime*, *Trithemis festiva* and *Onychogomphus forcipatus*.

It will be necessary to assess the impact of the flood and also to redefine the monitoring transects, since the original ones have either been washed away or will now no longer be relevant. Also sites that have been dry for several year now have water again, and it will be interesting to see if these become recolonised.

References

Department of Meteorology 2019. http://www.moa.gov.cy/moa/ms/ms.nsf/DMLrain_en/DMLrain_en?opendocument. Downloaded 8th February 2019

Financial Mirror. 2019. <http://www.financialmirror.com/news-details.php?nid=36411> downloaded 8th February 2019
http://www.moa.gov.cy/moa/ms/ms.nsf/DMLcyclimate_en/DMLcyclimate_en?OpenDocument

Appendix:

Coordinates and map position of the Arminou Dam and sites monitored on the Diarizos river

Note: the river between the Kouklia reed beds and Diarizos 1 is open, lacking very much suitable vegetation on the banks. Until recently it has had very little water and has not been considered to be of interest for dragonfly monitoring.

Ref	Site	N dec deg	E dec deg	N deg min sec	E deg min sec	Alt
EB	Elias Bridge	34.895951	32.774138	34 53 45.4	32 46 26.9	550
Kf2	Kelefos 2	34.889556	32.747361	34 53 22.4	32 44 50.5	449
Kf1	Kelefos 1	34.888444	32.748333	34 53 18.4	32 44 54.0	454
AD	Arminou Dam	34.875082	32.737446	34 52 30.3	32 44 14.8	435
Kd5	Kidasi 5	34.827528	32.721111	34 49 39.1	32 43 16.0	316
Kd6	Kidasi 6	34.824194	32.718639	34 49 27.1	32 43 07.1	304
Kd4	Kidasi 4	34.815611	32.717556	34 48 56.2	32 43 03.2	289
Kd2	Kidasi 2	34.814278	32.716417	34 48 51.4	32 42 59.1	284
Kd1	Kidasi 1	34.807056	32.716194	34 48 25.5	32 42 58.3	272
K3	Kidasi 3	34.806722	32.715194	34 48 24.2	32 42 54.7	271
D3	Diarizos 3	34.795367	32.702300	34 47 43.3	32 42 08.3	254
D5	Diarizos 5	34.787775	32.694673	34 47 16.0	32 41 40.8	234
D2	Diarizos 2	34.786222	32.688000	34 47 10.4	32 41 16.8	222
D1	Diarizos 1	34.785778	32.685944	34 47 08.8	32 41 09.4	219
KRB	Kouklia reed beds	34.716833	32.573528	34 43 00.6	32 34 24.7	34
LD	Lower Diarizos	34.714369	32.567926	34 42 51.7	32 34 04.5	31

