

Interactive comment on “Balancing energy and environmental concerns: the case of the Kayraktepe dam, Turkey” by Ö. Sever et al.

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We would like to thank for the valuable comments of the reviewer #1. We have reviewed referee' suggestions, and the necessary changes and explanations will be made in the revised article. An item-by-item summary of our responses to the review comments is provided in this sheet.

Comment: The paper provides an interesting overview, but lacks comprehensive analyses of the different options. The focus of the paper is primarily on the flood mitigating effect of the two options and sediment flushing. Whilst these are important, the paper would be greatly strengthened with more in-depth analyses of other key issues such as the costs, the different numbers of people who will be displaced, and the differing
C6351

environmental impacts (e.g. the implications for the “several endemic species”).

The Kayraktepe Dam is a large dam and therefore it contains all the potentials of giving damages to its own environment but at the same time to contribute to the development desire of the country through its energy. Its scale is very large and there has been no any environmental impact assessment for it, yet. Therefore there is a limited number of study on the environmental properties of the area which will be occupied by the reservoir lake. However, the agricultural activities of the upstream are well known. So far, official reports of the dams are strengthening on its capacity of the energy production and flood control. Therefore in the present study we emphasizes that there could be some other choices, more environmentally friendly to reach the targets. Also, we want to still leave room to the environmentalist to discuss the project.

Comment1: This paper discusses the options for reconfiguring a controversial dam project in Turkey. Instead of one large (125m) dam built for flood control, electricity generation and irrigation, the proposal is for a medium sized dam and five run of river dams. A third alternative which is for a single large dam (89.50m?) is mentioned but not evaluated in any detail.

Kayraktepe-1982 has the height of 135 m (type mistake in the manuscript will be corrected) Kayraktepe 1997 has the height of 99.5 m. Kayraktepe 2010 one medium (height of the dam= 53 m) dam and five diversion weirs. In the manuscript Kayraktepe-1997 and 2010 were compared. The diversion weirs do not have any effect to the river nature, since they don't have storage facilities.

Thus in order to make it clear, we will add the following paragraph in 11774/9 will be changed as:

The new project, namely Kayraktepe-2010 consists of one medium dam (53 m) and five run-of-river type hydropower stations. Four of them are located at the upstream of the dam. Since run-of-river type hydropower stations do not have storage capacities, they do not have direct effect on the river flow.

Comment: Page 11771 (line 3-7) A little more detail on the exact negative environmental impacts would be useful. What are the endemic species and what is the perceived risk to them? What is the name of the Ramsar site, why was it designated and how big is it?

The Goksu delta is a protected special area (PSA) by both at the national and international levels. Thus the study tries to emphasize the importance of the area by depending previous decisions and studies. In the paper the importance of the delta is acknowledged based on decision on the delta and the researches on the delta, we go into detail about the fauna and flora. However, there are a limited number plausible research on the delta and a brief summary can be done as follows:

450 bird species were recorded in the Goksu Delta. 352 of them are included in Ramsar list and 12 of these bird species in the Ramsar list are prone to extinction. Especially purple gallinule (*Porphyrio porphyrio*) under the threat of extinction is one of the most important bird species in the Delta (OCK,2005). Marine animals such as *Collinactus papidus*, *Caretta caretta*, *Cheloniomydos monchos monchos* and *Epinephelus aneus* living in the delta are under protection. In addition 441 plant species exist in the delta. 8 of these are endemic and 32 of these are rare (Gulikal 1992 and Uslu 1993). Harmancioglu et al., (2001) claimed that the silting-up of the reservoir and the loss of spring flushes of freshwater, sediment and nutrients will degrade the coastal ecosystem, reduce fishers productivity and lead to significant coastal erosion after the construction of Kayraktepe dam. The reservoir lake will change the microclimate of the Goksu Basin, adversely affecting the flora and fauna of the region, including certain rare species. It will destroy also fish habitats and spawning grounds (Ozturk, 2011)

We will re-arrange 11771/5 as follows: Environmental: The Kayraktepe Dam will have negative effects on the river both upstream and downstream. There are several endemic species in the dam lake area. The Göksu Delta is located downstream from the site which is recognised as a Ramsar site in 1994. It covers 15 000 ha and meets three internationally important wetland criterion out of nine: key biodiversity area, important

C6353

plant area and important bird area (www.ramsar.org, Gulikal 1992 and Uslu 1993, Harmancioglu, 2001, OCK, 2005 and Ozturk, 2011). The dam will cut off sediment supply to the area downstream, which eventually leads to loss of fertility and long term coastal erosion (Harmancioglu, 2001).

Page 11771 (lines 8-9) It is not clear exactly why the high population is an issue. Are these people living upstream or downstream of the proposed dam. Without quantitative information on how many people would need to be relocated and, for instance, how much agricultural land would be inundated it is hard to put this in context.

In order to clear out the confusion the following sentence will re-written Old Sentence: Social: Over the years the area has been heavily populated by people and the main economic activity is agricultural, tourism and husbandry.

as follows

New Sentence: Social: Over the years the reservoir lake area has been populated by the people who are economically active in agricultural, tourism and husbandry. Thus, several people will resettle, if the dam is constructed.

Page 11771 (line 21-22) It is debatable if the WCD report was the biggest ever victory for environmentalists and NGOs. The report was intended to be a balanced review of the development impacts of large dams and outlined a new approach to decision-making in relation to large scale infrastructure projects. The WCD report is mentioned here, but there is no further discussion in the paper. It would be useful to consider somewhere what implications the WCD report has for the specific case of dams on the Goksu basin.

The impact of WCD report was different to the public and state. The government of countries who are still in heavy dam business like India, Turkey, Brazil reacted to the report with heavy critics. On the contrary environmentalist activist saw it a strong tool to defend their position. Therefore, it did not serve to its purpose of to be a balancing tool

C6354

in Turkey. Thus, we try to underline this issue. Re-consideration of Kayraktepe Dam was one of the impact of the report that the government decided to leave the dam to the public sector after failing to find export credit the IlÄssu Dam (another controversial large of Turkey). It is expected that The discussion of Kayraktepe will further accelerate during funding process. This is one of the motivations for present study.

Thus in 11771/20 The reference of the Turkish Position will be inserted as (Turfan, 2000)

Page 11772 (line 5-6) It is not clear what is meant by "contractual matter of water usage rights have been edited with the publication of June 2003".

The sentence "Contractual matter of water usage rights have been edited with the publication of June 2003." will be removed since it is somehow duplication of the first sentence and making confusion.

Page 11772 (line 26) It would be useful if Table 1 included a summary of the changes to the scheme design on each of the key dates – 1982, 1997 and 2010. As I understand it:1982 was the original 125 m high dam; 1997 was still a single dam but reduced to 89.50 m; 2010 was a single medium sized dam (height not specified here) in combination with 5 run of river dams. The scheme as discussed in this paper is the 2010 configuration.

We will arrange Table 1 according to your and editor' suggestions. Page 11773 (line 13) figure 1 is not very clear. It would be useful to indicate which dams have been built and which are planned.

The Figure 1 is placed very small, we will ask editor if they can enlarge it. In addition we re-draw the Figure 1 which is attached.

Page 11773 – general characteristics of the basin. It would be useful to include a bit more information on: i) altitude range within the basin; ii) something on why this basin is good for hydropower production; iii) typical livelihood activities – presumably

C6355

agriculture; iv) landuse etc.

We will insert the following line into 11552/5

The highest peak of Goksu basin is summit of Karadag at an altitude of 2509 m. Since Goksu River has permanent discharge, the government wants to construct a large scale dam to supply reliable energy as well as provide flood control with large scale. Agriculture is the main activity within the project area, and most of them are dry farming. In the area related to the project, livestock is usually just for the families' own consumption. The animals kept in the region are mainly sheep and goat. There are no pasture lands that will be inundated.

Page 11774 (line 5) – need to explain why the proposed lowering of the dam was "economically advantageous". It would also be useful to know something (if only a little) about the likely change in environmental and social impacts arising from the first proposed reduction in the dam height (i.e. to 89.50 m)

We will insert the following sentence into 11774/5

The relief from the cost of expropriation and resettlement was the main reason of the increasing benefit.

Page 11774 (line 9) – there is a lot of information in table 2 but it would be useful to have a brief description of the Kayraktepe project. What is the height of the main dam in this case and a brief description of the run of river dams – all upstream? Will these run of river schemes affect flow in any way?

Page 11779 (line 10-16) This is the first mention of "numerous villages" that would be flooded but there is nowhere in the paper is there discussion of how many households/people are affected by the different schemes (both upstream and downstream)?

We will incorporate the following information in 11774/5 two answer both comments.

The new project (Kayraktepe-2010) consists of one dam and five river run off hy-

C6356

dropower plants. The main dam has a height of 53 m and the total lake area will be 820 ha. Number of inundated villages located in upstream of the dam was 43 and it will force about 2200 people to resettle elsewhere according in Kayraktepe-1982 schema. It is reported that there will be 11 village with 5000 ha land will be flooded if Kayraktepe 1997 will be realized. However, In Kayraktepe 2010 schema, a dramatic reduction in expropriation area by % 83.5 was achieved, where originally 5000 ha area was reduced to approximately 820 ha. None of the villages at the upstream will be inundated. A plan view of Kayraktepe-1997 and Kayraktepe-2010 alternatives were prepared by using a 1/25000 scaled topographic map and can be seen in Figure 3.

Page 11775 (line 21-22) More detail of the flood frequency analyses would be useful. How did the use of additional flow data affect the floods with different return periods? A table or figure showing the flood magnitude with different return periods would be useful. Page 11776 (line 5) Why was the 500-year flood selected as the one for which the dam would offer downstream flood protection? Why not a flood with a longer return period? Has there been any consideration of the possible impacts of climate change on the

In the feasibility of the 1997 report the peak value of 100 years is given as 2286.9 m³/s. In the analysis with an updated data, it is calculated as 1584.60 m³/s. However, in the new analysis new projects at the upstream is also considered. On the other hand 500 year return period flood peak value is calculated as 1981.30 m³/s. The flood analysis of downstream is performed according to 500 yr return period due to regulation asking to use 500 yr return period if the area is populated. However in 1997 project the flood calculation is based on 100 yr flood peak.

Page 11776 (line 4) Mention is made of “more advanced techniques” but these are not described. Why were these techniques not used in the analyses for this study?

We want to give reference related with the non-parametric flood frequency analysis which was done for the same area. However as it was mentioned in the text (page

C6357

11775 line 17), we use the same methodologies with the aforementioned feasibility reports to make the comparison on an equal basis.

Page 11777 (line 26) Retrogradational is not a commonly used word – a definition would be useful.

In parenthesis “moving backward.” will be written.

Page 11778 (line 3) The erosion of >200,000 m² which is not due to damming but to changes in flow needs to be much better explained. Why and how have flows changed? Why is this causing erosion? How would the planned dams affect the sedimentation? It would also be useful to have some information on the size of the delta and total annual sediment deposits. This would enable these rates of erosion to be placed in context.

It is reported that in the past the layout of the river within delta was re-routed due to some agricultural purposes.

Page 11778 (line 13-22) A better explanation of the Basson diagram method would be useful. Maybe include it as a figure. It would also be useful to know why the 2010 configuration is more suitable for flushing than the 1997 configuration. Specifically, what is it about a medium size dam and five run of river dams that makes this option more suitable than a single large dam?

The paragraph re-designed as below:

The suitability of flushing can be examined by using criteria deduced from Basson's Diagram (Basson and Rooseboom, 1997). The results for both the Kayraktepe-2010 and the Kayraktepe-1997 formulations are summarised in Table 5. In the table, K_w ($=C_0/MAR$) and K_t ($=C_0/MSY$) are the ratios of storage (C_0) to mean annual river runoff (MAR) and storage to mean annual sediment yield (MSY), respectively. According to Basson's criteria, seasonal flushing is suggested in regions where K_w value is between 0.03–0.2. On the other hand, there will be excess water for flushing when $30 < K_t < 100$ (Tigrek and Aras, 2011). Therefore, Kayraktepe-1997 which has a very

C6358

large storage capacity is not suitable for flushing; however, the Kayraktepe-2010 is suitable for seasonal flushing.

Technical corrections The English could be tightened somewhat. The figures are not very clear and could be improved by including more detail. A figure showing the difference in area inundated by the different schemes would be useful

We will consider all your valuable suggestions in the final version. Once again we thanks to you for your valuable suggestions and comments.

References

- 1) Harmancioglu, N., Alpaslan, N. and Boelee, E.: Irrigation, health and environment: A review of literature from Turkey, Colombo, Sri Lanka: International Water Management Institute (IWMI), IWMI working paper 6, 2001. 2) Gulkal, O.: Goksu Delta'sinin dogal ve kulturel potansiyelinin belirlenmesi ve kullanimlar yonunden degerlendirilmesi (in Turkish), M.Sc., Thesis, Graduate School of Science Engineering and Technology, Cukurova University, Adana, Turkey, 1992. 3) Uslu, T.: Goksu Delta'sinda kiyi kumul yonetimi, Uluslararası Goksu Delta'si çevresel kalkinma semineri bildiri metinleri, Dogal Hayati Koruma Cemiyeti, Istanbul, 1993.
- 4) Ozel Cevre Koruma Kurumu, Goksu Deltasi, T.C. Cevre ve Orman Bakanligi Ozel Cevre Koruma Kurumu, Ankara, Turkey, 2005.
- 5) Turfan, M. Turkish Position against WCD report . 2000 http://www.talsperrenkomitee.de/symposium_benefits_and_concerns_about_dams/turkish_r
- 6) www.ramsar.org : "The List of Wetlands of International Importance, http://www.ramsar.org/cda/en/ramsar-about-sites/main/ramsar/1-36-55_4000_0__"

Figure 1b

Figure 3 Comparison of Kayraktepe 1997 and Kayraktepe 2010 with respect to inundated area.

C6359

Please also note the supplement to this comment:

<http://www.hydrol-earth-syst-sci-discuss.net/9/C6351/2013/hessd-9-C6351-2013-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 9, 11769, 2012.

C6360

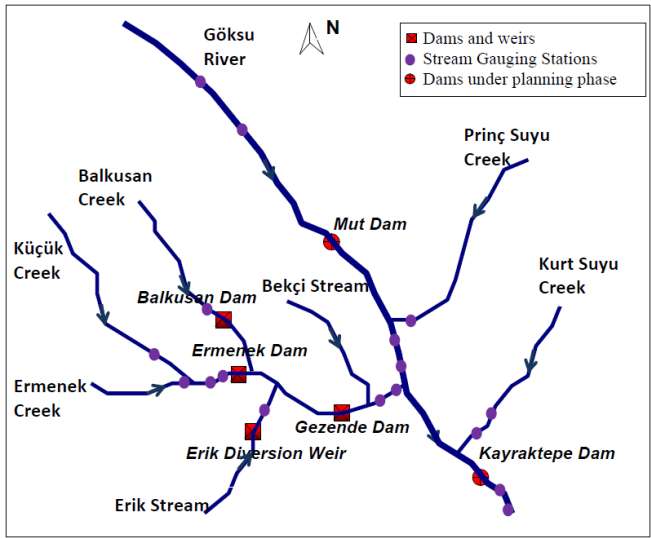


Fig. 1. Figure 1b

C6361

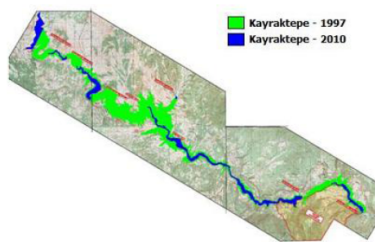


Fig. 2. f

C6362