Table 1: The different ecosystem services provided by the DNP.

Provisioning services	Regulating services	Supporting services	Cultural services
Food: Mayas Ecosystem provides the conditions for growing food for both human and wild animals. Mayas provide fish for human consumption and grass for wild animals. Forests also provide food for human consumption such as honey.	**Local climate and air quality:** Trees provide shade for wild animals whilst forests influence precipitation both locally and regionally. Trees or other plants also play an essential role in regulating air quality by removing pollutants from the atmosphere.	**Habitats for species:** The DNP ecosystems provide different habitats for many individual plant or animal that are essential for a species' lifecycle to survive. Migratory species including mammals, birds and fish are all depend upon different ecosystems during their migrations.	**Tourism:** High potential opportunity for tourism and education (e.g. attractive place for local people and foreigner and opportunity for research and training). Thus, it provides considerable economic benefits and is a potential source of income for the country.
Fresh water: Mayas ecosystems play a vital role in the local hydrological cycle, as they regulate the flow and purification of water. Vegetation and forests influence the quantity of water available locally and further downstream.	**Carbon sequestration and storage:** Ecosystems regulate the global climate by storing and sequestering greenhouse gases. In this way forest ecosystems in the DNP are carbon stores. Biodiversity also plays an important role by improving the capacity of ecosystems to adapt to the effects of climate change.	**Nutrient cycling:** Mayas ecosystems regulate the flows and concentrations of nutrients through a number of complex processes that allow these elements to be extracted from their mineral sources or recycled from dead organisms.	**Aesthetic appreciation and inspiration for culture and art:** The NDP Biodiversity, ecosystems and natural landscapes have been the source of inspiration for much of the art, folklore and culture in Sudan.
Raw materials and Medicinal resources: The DNP ecosystems provide a great diversity of materials for construction and fuel including wood and charcoal. The DNP ecosystems also provide many plants used as traditional medicines for local people.	**Moderation of extreme events:** The DNP plays an important roles in modulating the effects of extreme events. For example prevent or reduce flooding. Mayas wetlands attenuate floods by absorbing runoff peaks and storm surges.	**Maintenance of genetic diversity:** Some habitats have an exceptionally high number of species which makes them more genetically diverse than others.	

Table 3: Man-Kendall results of annual rainfall at the 12 examined precipitation stations.

Station	Kendall's tau	S	P-value	Trend
Bahir Dar	-0.09898	-107	0.3320	No significant change
Gonder	-0.1176	-156	0.02217	No significant change
Samsam	-0.1979	-111	0.1023	No significant change
Umsienat	0.1658	93	0.1728	No significant change
Doka	0.3333	187	**0.0051**	Significantly increasing
Hawata	0.2141	120	0.0777	No significant change
Gedarif	-0.1260	-755	0.0515	No significant change
Gadambalyia	0.0607	34	0.6247	No significant change
Damazin	0.3158	60	0.0537	No significant change
Abu Naama	0.2762	29	0.1659	No significant change
Um Benien	0.2952	31	0.1370	No significant change
Sennar	-0.0533	-228	0.4513	No significant change

Table 6: Medians and significant counts for IHA parameters for both Dinder and Rahad. Numbers in bold designate values that are statistically significant at 5% significant level.

IHA PARAMETERS	Dinder			Rahad		
	MEDIANS		SIGNIFICANCE COUNT	MEDIANS		SIGNIFICANCE COUNT
	Pre	Post	Medians	Pre	Post	Medians
Parameter Group #1						
January	0	0		0	0	
February	0	0		0	0	
March	0	0		0	0	
April	0	0		0	0	
May	0	0		0	0	
June	0	0		0	0	
July	43.4	49.82	0.6997	44.95	65.42	**0.006006**
August	266.3	210.4	0.5025	133.7	152.7	**0.003003**
September	292.1	297.6	0.8448	143.2	165.7	**0.02503**
October	101.2	89.91	0.4334	49.08	67.15	0.08308
November	0	14.19		0	14	
December	0	0		0	0	
Parameter Group #2						
1-day maximum	546.8	468.7	**0.04304**	166.6	175.8	0.2262
3-day maximum	513.4	444.4	0.08308	164.4	175.5	0.1241
7-day maximum	465.6	394.4	0.09209	159.1	173.1	**0.04104**
30-day maximum	372	321.3	0.1832	143.9	166.9	**0.01401**
90-day maximum	265.3	208.4	0.3213	113.7	137.7	**0.01201**
Number of zero days	250	233	**0.01602**	244	215.5	**0.002002**
Base flow index	0	0		0	0	
Parameter Group #3						
Date of maximum	244	250	0.3003	252	256	0.2893
Parameter Group #4						
High pulse count	1.5	3	0.08509	2	2	0.4164
High pulse duration	63.5	11.5	0.1562	41	39.5	0.8679
Parameter Group #5						
Rise rate	31.45	19.78	**0.009009**	4.56	2.67	**0.04905**
Fall rate	-17.15	-8.08	**0.007007**	-4.37	-2.435	**0.01101**
Number of reversals	39	43	0.06406	33	31	0.5495