THE EFFECTS OF A WOOD PRODUCTS PLANT EFFLUENT ON THE MOUNTAIN FORK RIVER IN SOUTHEASTERN OKLAHOMA

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CONCLUSIONS

1. According to this investigation, the Weyerhaeuser Company's waste water discharge did not have an adverse effect upon the Mountain Fork River during July and August, 1974.
2. The chemical and biological analyses indicated the Mountain Fork River was of good quality above and below the Weyerhaeuser Company discharge.
3. The Weyerhaeuser Company discharge was found not to have violated the water quality standards considered.

RECOMMENDATIONS

1. An extensive literature search needs to be conducted about similar investigations, such as this one, so comparisons could be made with the findings herein.
2. Since only two months were examined, further investigation should be conducted under a variety of flow conditions to examine seasonal and possible long term variations in the biological communities.
3. Further consideration needs to be given to determine if a waste load allocation study could be conducted on this segment of the Mountain Fork River.
4. If a future investigation is planned for this river segment more emphasis should be placed on flow data, river and discharge volume.
5. If at all possible prior to modifying Weyerhaeuser's present discharge permit limitations more information should be examined regarding nonpoint and point source waste loads entering the Mountain Fork River.

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SECTION I

INTRODUCTION

In July, 1974, the Oklahoma Water Resources Board (OWRB) proposed to investigate the Mountain Fork River above and downstream from a discharge of waste water from the Weyerhaeuser Company's Craig Plant, near Broken Bow, Oklahoma, (Appendix). The objectives of the investigation were:

1. To generate sufficient data to assist in setting maximum effluent discharge concentrations.
2. To determine the effects of the industrial effluent on the benthic community of the Mountain Fork River for the period sampled.
3. To determine the effects of the industrial effluent on chemical water quality in the Mountain Fork River for the period sampled.
4. To determine the effects of the industrial effluent on the physical character of the Mountain Fork River for the period sampled.
5. And if possible, to assess the assimilative capacity of the Mountain Fork River with reference to dissolved oxygen.

The Weyerhaeuser Company, Craig facility, manufactures fiberboard and particleboard. The waste water discharged from the facility is regulated by the EPA under National Pollutant Discharge Elimination System permit number OK0000737 and by the OWRB under Waste Disposal permit number W-69-006.

In the area of study, the Mountain Fork River flows over alluvium deposits of recent origin, cuts across Quachita structures and appears to be a superimposed river having a dendritic pattern. The soils in the study area are classified as Miller-Yahola-Teller which were formed in sediments brought in by western rivers, in this case the Red River, and are richer in plant nutrients than are locally derived deposits.[1] The vegetation is mostly forest augmented by silviculture activities managed by the Weyerhaeuser Company.

SECTION II

MATERIALS AND METHODS

Six sites along the Mountain Fork River in McCurtain County near Idabel, Oklahoma were selected for chemical and biological monitoring during July and August, 1974. Sites 1 and 2 were located on the river above the Weyerhaeuser Company discharge and sites 4, 5, and 6 were located downstream of this discharge. Site 3 (not in the river) represented the Weyerhaeuser discharge.

Benthic macroinvertebrates (Figure 1, Table 1), were collected at sites 1, 2, 4, 5 and 6 during July and at sites 1, 2, 4, & 5 during August, utilizing a surber sampler (Figure 2) in both months. After the frame was placed on the substrate, with the top frame extending above the water suface, each rock within the bottom frame was removed by hand from the substrate and brushed with a stiff bristle brush. Any organisms attached to the rocks were dislodged and carried by the river current into the net. After each rock had been brushed, the remaining substrate was brushed to insure that all organisms within the frame would be carried into the net. This process took from five to ten minutes.

After all organisms from a site had been collected into the net, the contents were transferred to a glass jar, using a polyethylene washing bottle filled with the preservative, iso-propanol containing approximately 0.25 g/L rose bengal stain. Each jar was filled with the preservative after the transferal.

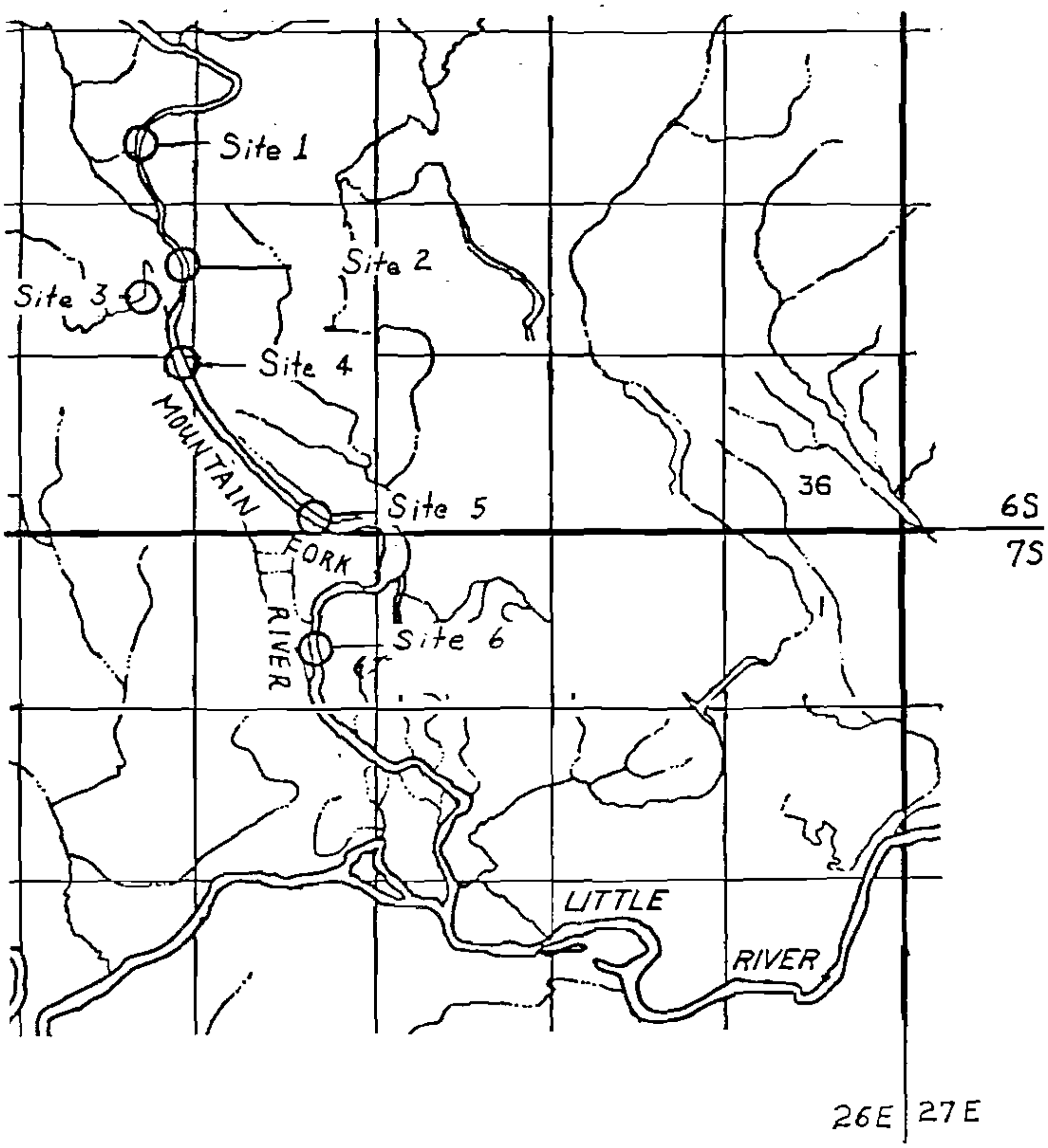

Figure 1. The five sites monitored on the Mountain Fork River in 1974 and the effluent sampling site (Site 3).
Each site represents five benthic sampling points, except for Site 3.

Table 1 - Legal descriptions of the six sites illustrated in Figure 1 monitored during 1974 on the Mountain Fork River.

SITE	DISTANCE FROM DISCHARGE, km[b]	LEGAL DESCRIPTION
1	- 1.6	NW¼, SE¼, Sec. 20, T 6S, R 26EIM
2	- 0.3	SW¼, NE¼, Sec. 29, T 6S, R 26EIM
3[a]	0.0	NW¼, SE¼, Sec. 29, T 6S, R 26EIM
4	0.7	NE¼, NE¼, Sec. 32, T 6S, R 26EIM
5	2.8	SW¼, SE¼, Sec. 33, T 6S, R 26EIM
6	5.4	SW¼, SE¼, Sec. 4, T 7S, R 26EIM

a Weyerhaeuser discharge

b Negative distances indicate upstream sites

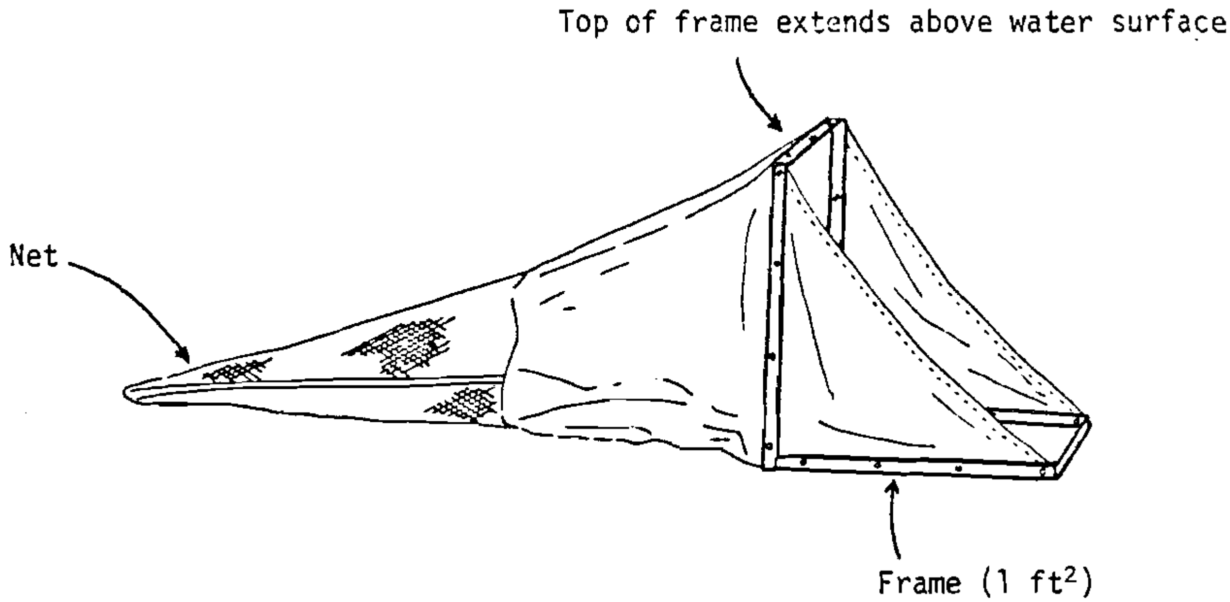

Fig. 2 Diagram of a Surber Sampler[2].

In the laboratory, the organisms were separated from the substrate debris by sorting through jar contents in white enamel pans and placed into jars with the alcohol-rose bengal preservative. The organisms were identified with the aid of dissecting and compound microscopes using accepted keys such as those by Mason[3], Pennak[4] and EPA[5].

After all organisms from all sites had been identified and enumerated community diversity, redundancy, and similarity were calculated according to equations displayed in Figure 3.

Four one liter water samples were taken at each monitoring site including the discharge from the Weyerhaeuser Company (Site 3). Site 6 was not sampled during August. The samples were collected beneath the surface in the main flow with polyethylene containers. One sample was preserved with 2 mg/L concentrated H_2SO_4 for analysis of chemical oxygen demand (COD). A second sample was preserved with 40 mg/L of $HgCL_2$ for determing the phosphorus and nitrogen concentrations. The two remaining samples were iced in the field and refrigerated in the lab until analyzed: one for biological oxygen demand (BOD), the other for the determination of residues, chloride, sulfate and hardness. All collection and preservation techniques were based upon methods suggested by the EPA[13] and USGS[14].

The Weyerhaeuser Company analyzed the BOD samples due to the short holding time required. All other analyses were performed according to methods promulgated by the EPA[13], USGS[14], APHA[2], or ASTM[15].

Measurements of pH, temperature, specific conductivity and dissolved oxygen were made *in situ* using a Hydrolab Surveyor 6D Portable Water Quality Analyzer (Austin, Texas).

Fig. 3 Equations used to determine the various community indices. All factorials of integers calculated by adding logarithms,

$$(\text{i.e.,}\quad \log N! = \sum_{i=1}^{n} \log i\ )$$

Factorials of fractions were calculated using Stirling's approximation:

$$\log N! = \sqrt{2N\pi}\left[(N/e)^{N}(1+1/12N-1)\right]$$

1. Community diversity (References 6, 7, 8, 9, 10, 11, 12):

$$\bar{d} = \frac{1}{N}\left[\log_2 N! - \sum_{i=1}^{S} \log_2 n_i!\right]$$

2. Redundancy (Reference 10):

$$r = \frac{\bar{d}_{max} - \bar{d}}{\bar{d}_{max} - \bar{d}_{min}}$$

$$\bar{d}_{max} = \frac{\log_2 N! - S \log_2 (N/S)!}{N}$$

$$\bar{d}_{min} = \frac{\log_2 N! - \log_2 (N-S+1)!}{N}$$

3. Similarity (Reference 12):

$$S_0 = \frac{2C}{A+B}$$

$\bar{d}$ = community diversity

s = total number of taxa

n_i = number of individuals in the i^{th} taxon

N = total number of individuals $\sum_{i=1}^{S} n_i$

r = redundancy

S_0 = similarity

A = number of taxa upstream from point of interest

B = number of taxa downstream from point of interest

C = number of taxa common to the upstream and downstream sites

SECTION III

RESULTS AND DISCUSSION

Due to several complicated factors the assimilative capacity of the Mountain Fork River was not calculated. Large volumes of water were released from Broken Bow Reservoir creating unstable river conditions during the project period. Furthermore, the Mountain Fork River had many large deep pools that would have interfered with the transport of dye and produced inaccurate time of travel data.

Approximately 14,246 benthic organisms were collected during July and August in 1974 from the Mountain Fork River (Table 2). Of these 14,246 organisms, only 13,883 were separated into 58 different taxa because of the 363 unidentifiable pupae.

The most abundant organism collected was *Rheotanytarsus sp.*, a chironomid. Only one specimen of Ephoron was collected downstream of the discharge (Site 3) in August, however 34 were collected in July. Members of the Rhyacophilidae family were collected both above and below Site 3 in July, but in August this family was not collected. The explanation for this absence of these two taxa in August is that probably an emergence occurred prior to sampling for that month. Furthermore the river velocity and shifting substrate possibly could explain the absence of these taxa downstream of the discharge point or that their absence was due to a introduced pollutant.

Table 2. Benthic macroinvertebrates** collected from 7 km of the Mountain Fork River in McCurtain County, Oklahoma, during July and August, 1974. Number of organisms collected is in parentheses, and whether the organism was found upstream or downstream is indicated(*).

TURBELLARIA
Unidentifiable species (21) B-U

NEMERTEA
Unidentifiable species (1) J-U

BRYOZOA
Unidentifiable species (1) J-U

ANNELIDA
Oligochaeta
Unidentifiable species (214) B-B

HIRUDINEA
Unidentifiable species (33) B-B

ARTHROPODA
Arachnida
Hydracarina
Unidentifiable species (15) B-B
Crustacea
Isopoda
Asellus (63) B-B
Insecta
Plecoptera
Neoperla (42) B-B
Ephemeroptera
Ephoron (107) B-B
Stenonema (638) B-B
Cinygmula (2) J-D
Ameletus (54) B-B
Siphlonurus (7) A-B
Isonychia (215) B-B
Ephemerella (4) J-U
Caenis (239) B-B
Tricorythodes (664) B-B
Baetis (2) J-U
Odonata
Amphiagrion (10) J-U, A-D
Agrion (3) J-D
Hemiptera
Nepidae
Unidentifiable species (1) J-U

Megaloptera
Corydalus (84) B-B
Chauliodes (4) A-U

Trichoptera	
Leptoceridae	
Unidentifiable species/pupae (19)	B-B
Rhyacophilidae	
Unidentifiable species (32)	J-B
Hydropsychidae	
Unidentifiable species/pupae (32)**	B-B
Macronemum (1)	J-U
Chematopsyche (1942)	B-B
Psychomyiidae	
Unidentifiable species/pupae (38)	B-B
Polycentropodidae	
Polycentropus (1321)	B-B
Neureclipsis (7)	J-U, A-B
Hydroptilidae	
Tascobia (*Stactobiella*) (75)	J-B, A-B
Lepidoptera	
Elophila (84)	B-B
Coleoptera	
Elmidae	
Unidentifiable species (581)	B-B
Psephenidae	
Unidentifiable species (2)	B-U
Dryopidae	
Unidentifiable species (1)	J-D
Diptera	
Simuliidae	
Simulium (73)	B-B
Rhagionidae	
Atherix (34)	B-B
Empididae	
Hemerodromia (18)	J-D, A-B
Chironomidae	
Pentaneura (2)	J-U
Ablabesmyia (28)	B-B
Einfeldia (2)	A-U
Dicrotendipes (3)	B-U
Parachironomus (1)	J-U
Xenochironomus (1)	J-U
Pseudochironomus (2)	B-D
Polypedilum (47)	B-B
Stenochironomus (1)	J-U
Rheotanytarsus (6026)	B-B
Orthocladius (7)	B-B
Trichocladius (4)	J-D
Eukiefferiella (30)	B-B
Psectrocladius (13)	J-B
Cricotopus (324)	B-B
Unidentifiable pupae (331)**	B-B
MOLLUSCA	
Gastropoda	
Ferrissia (390)	B-B
Helisoma (30)	B-B
Physa (14)	J-B, A-D
Pelecypoda	
Sphaerium (304)	B-B
Anodontia (*Utterbackia*) (2)	J-D

* groups not included in community diversity calculations

** B - means both July and August

\- B means both upstream and downstream of Site 3

J means July

A means August

U means upstream of Site 3

Approximately 37 taxa were common to both upstream and downstream sites, but only 14 and seven taxa were common for the upstream and downstreams sites, accordingly. The 14 taxa only found upstream were Nemertea, Bryozoa, Ephemeroptera, Baetis, Nepidae, Chauliodes, Macronemum, Psephenida, Pentaneura, Einfeldia, Dicrotendipes, Parachironomus, Xenochironomus, and Stenochironomus (Table 2). Cheumatopsyche, Rheotanytarsus, Stenelmis and Tricorythodes are just a few of the taxa collected above and below Site 3.

The qualitative view of taxa distribution is somewhat misleading, but quantitatively a more accurate picture can be given. Table 3 shows the quantitative view for similarity between sites. The similarity between sites was found to generally vary between 0.7 and 0.8. Sites 2 and 5 were the most similar (0.9), and Sites 2 and 6 had the least similarity, 0.6. The mean similarities for July and August were 0.75 and 0.78 accordingly, about the same for each month.

The upstream and downstream diversities were compared in a one-way analysis of variance[16] utilizing an IBM 5110 and IBM 370-158 system. With July and August diversites combined, the F ratio equalled 0.403 which indicates no significant differences between upstream and downstream sites. The same was true with the months separated and the F ratios for July and August were 0.183, and 2.683, accordingly. A similar procedure comparing the redundancy values also revealed no differences identified with the July and August F ratio's = 0.004, July F = 0.485 and August F = 0.768. Such low F ratios suggest that the Weyerhaeuser Company's waste water discharge did not alter the downstream biological communities. However, that assumes the downstream communities are considered to be the same at the upstream sites. Another explanation for accepting the null hypothesis (no significant differences) is that possibly an insufficient amount of data was compared.

TABLE 3. The similarity of sites in the Mountain Fork River above and below the Weyerhaeuser Company discharge for July and August, 1974.

MONTH	SITES COMPARED	RATIO	SIMILARITY INDEX	MEAN
July	1 to 4	$\frac{2(20)}{30+30}$	0.7	
	1 to 5	$\frac{2(17)}{30+14}$	0.8	
	1 to 6	$\frac{2(21)}{30+33}$	0.7	
	2 to 4	$\frac{2(26)}{39+30}$	0.8	
	2 to 5	$\frac{2(23)}{39+14}$	0.9	
	2 to 6	$\frac{2(23)}{39+33}$	0.6	
				0.75
August	1 to 4	$\frac{2(20)}{33+25}$	0.7	
	1 to 5	$\frac{2(25)}{33+31}$	0.8	
	2 to 4	$\frac{2(23)}{35+25}$	0.8	
	2 to 5	$\frac{2(28)}{35+31}$	0.8	
				0.78

The diversity ranged from 3.9 in July at Site 2 to 1.9 in August at Site 5 (Table 4). The highest diversity below the discharge was 3.6 for Site 6 in July. The August diversity indices were lower than in July. This August decline was probably due to a large insect emergence and from a late summer flow decrease. Since the flow varied somewhat the overall August diversity decline might have also been due to some substrate disruption. These fluctuating community indices for July and August are graphically represented in Figures 4 and 5.

The reason for the lack of discharge data relates to Weyerhaeuser's state discharge permit requirements. In the summer of 1974 this facility was not required to monitor flow, therefore the Weyerhaeuser's discharge ditch did not contain a flow measuring device at the time of this study. Currently flow measurements are recorded and the discharge volume averages approximately 2.87 MGD according to Weyerhaeuser's March 1, 1978, federal discharge monitoring report required by the Company's National Pollutant Discharge Elimination System (N.P.D.E.S.) Permit. According to an unissued Oklahoma Waste Disposal Permit, Weyerhaeuser's discharge volume approximated 2.02 MGD in 1973.

The Mountain Fork River flow rate varied a great deal in 1974[17]. In July, 1974, the flow rate, about 2 miles upstream of Site 1, varied between 3,260 to 169 cfs but averaged 1,494 cfs. In August of the same year the flow rate averaged 643 cfs, but varied between 1,860 to 180 cfs. These large flow fluctuations are primarily due to the varying power releases from Broken Bow Reservoir (Table 5). Table 5 contains the average daily releases from Broken Bow and the river flow rate, measured near Eagletown, for August 1974, through September 11, 1974 (information received from Gamel, Weldon M., correspondence dated 12 September 1974, Department of Army Corps of Engineers).

TABLE 4. Community diversity and redundancy indices for the five sites monitored on the Mountain Fork River during July and August, 1974.

	July		August	
Site	$\bar{d}$	r	$\bar{d}$	r
1	3.001	0.401	2.738	0.467
2	3.893	0.264	2.745	0.478
4	3.375	0.316	2.529	0.462
5	2.699	0.291	1.863	0.634
6	3.638	0.280		

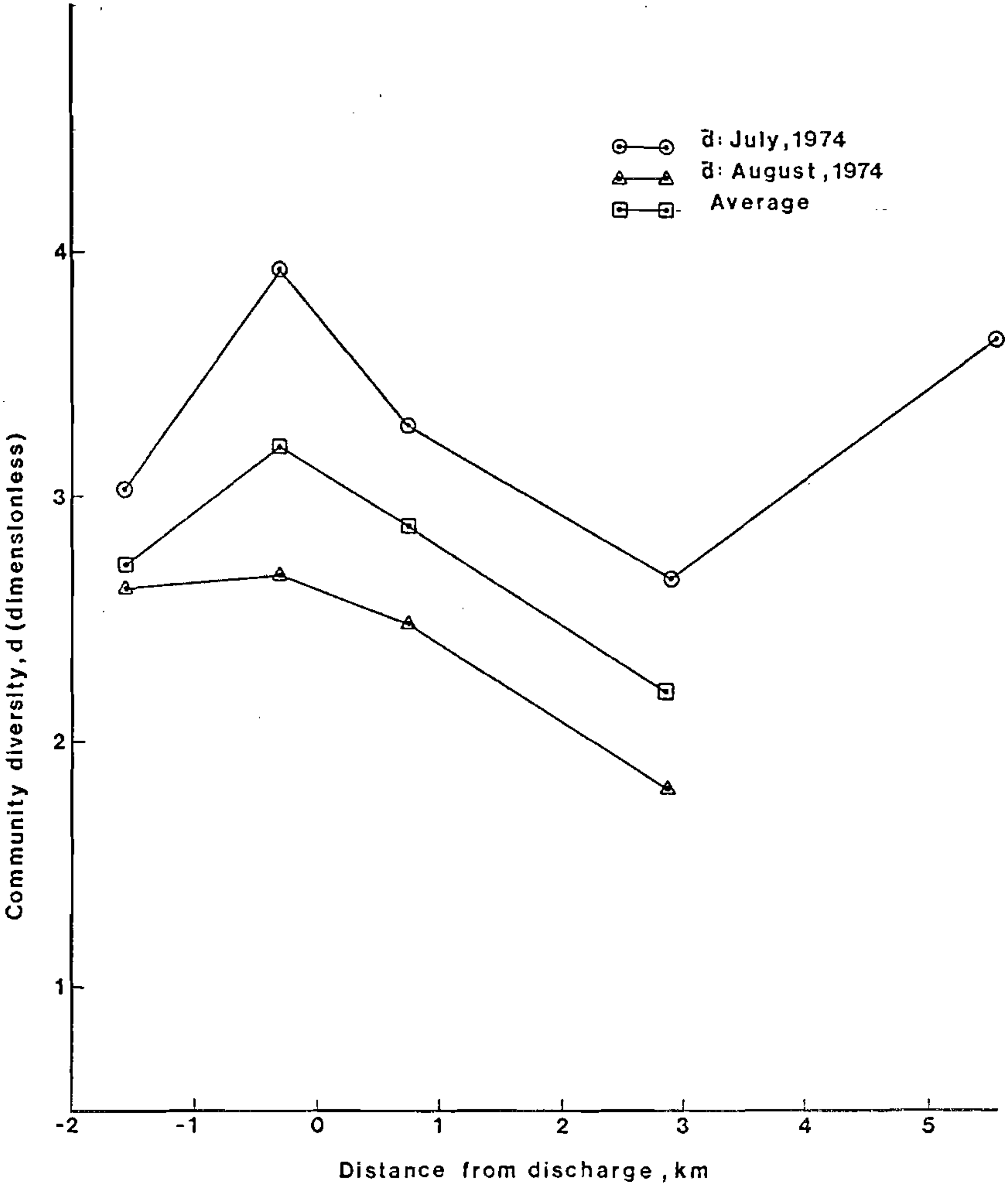

Figure 4. Community diversity ($\overline{d}$) in the Mountain Fork River during July and August, 1974.

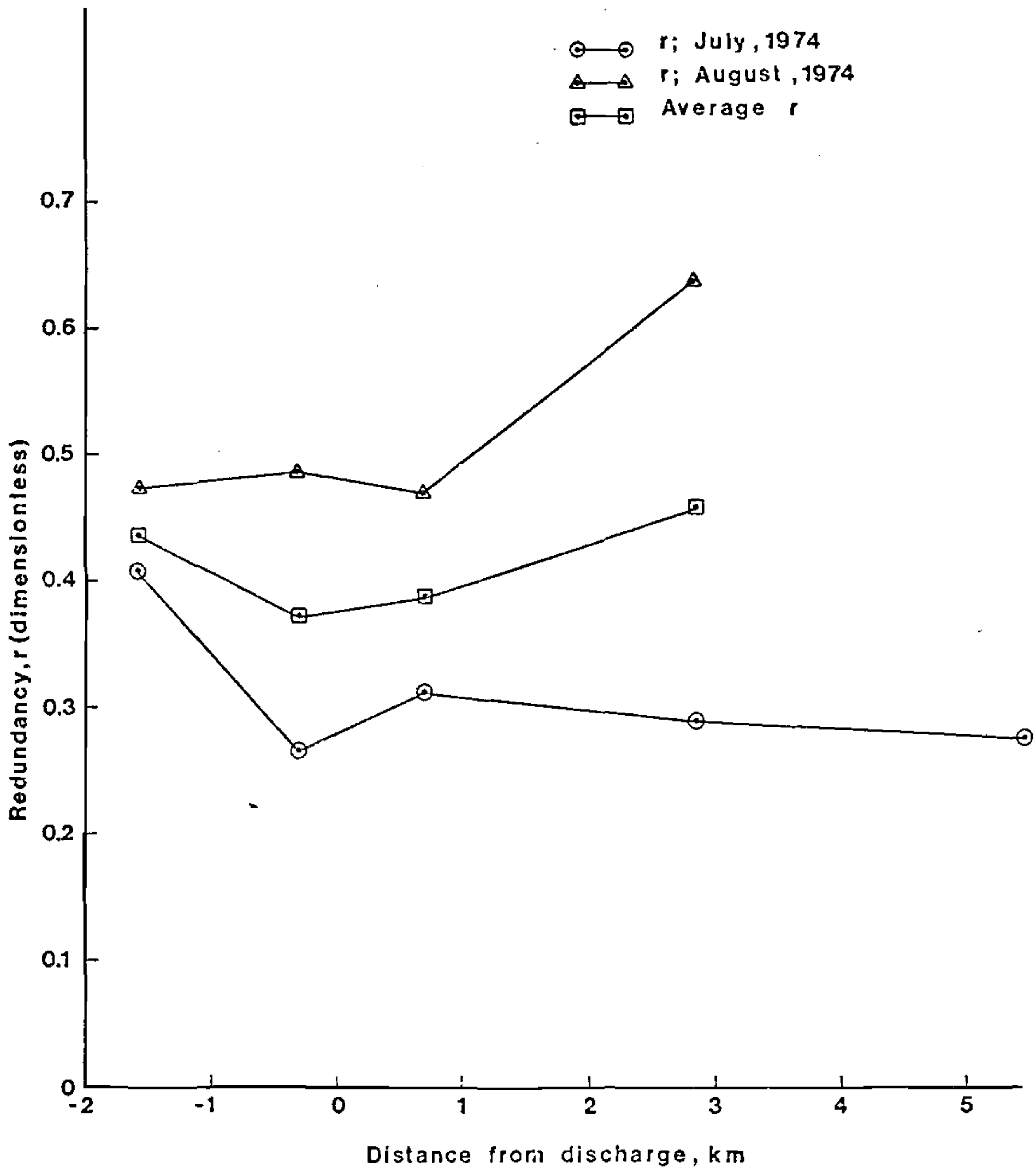

Figure 5. Redundancy (r) in the Mountain Fork River during July and August, 1974.

Table 5. Flow measurements for the Mountain Fork River during August and September, 1974.

BROKEN BOW		EAGLETOWN			
Date	Average Daily Power Release (cfs)	Time	Stage (ft)	Discharge (cfs)	
1 August	1649	8A	3.54	1070	
2	1231		3.08	720	
3	429		2.11	380	
4	6		1.32	155	
5	6		1.25	140	
6	430		1.41	175	
7	6		1.27	145	
8	6		1.20	132	
9	681		2.68	580	
10	1054		2.65	570	
11	6		1.31	153	
12	6		1.23	135	
13	1063		2.56	550	
13		1050A	1.21	170	measurer
14	1497	8A	3.41	960	
15	579		2.32	440	
16	697		2.49	500	
17	573		2.24	420	
18	561		N.R.		
19	6		1.31	153	
20	716		4.48	1950	
21	1337		4.55	2070	
22	1547		5.09	2700	
23	914		5.09	2700	
24	721		N.R.		
25	589		N.R.		
26	6		N.R.		
27	866		2.67	580	
28	6		1.36	160	
29	6		1.30	150	
30	870		1.26	145	
31	6		2.16	400	
1 September	6		1.36	160	
2	6		1.38	165	
3	6	240P	1.23	168	measurem
4	6	8A	1.20	132	
5	591		1.32	155	
6	6		1.30	150	
7	588		1.92	320	
8	6		1.32	155	
9	6		1.30	150	
10	799		2.54	550	
11	995		5.10	2700	

N. R. - No reading

The general trend concerning the discharge (Site 3) was that most parameters were present in smaller concentrations in August than in July Table 6). COD was 3,180 mg/1 in July and only 102 mg/1 in August, approximately a 97% reduction. BOD experienced about a 96% decrease (i.e., 480 to 18.0 mg/1). The other parameters that experienced decreases in August were turbidity, hardness, nitrate, total phosphorus and TDS. Only four parameters remained about the same or increased in August compared with July; chlorides, sulfates, ammonia and suspended solids. Possibly Weyerhaeuser's waste water discharge decreased and or a precipitation decrease occurred in August explaining the lower concentrations observed, but this is strictly speculation.

The primary water quality parameters that were thought to possibly experience the largest degree of variation were TDS, DO, BOD, COD and turbidity. However, the instream concentrations above and below the discharge appeared to be about the same (Table 6). The DO in the discharge was 2.7 mg/1 in July, but about 7 mg/1 in the river above and below the discharge. In August the BOD was actually lower downstream 1.0 mg/1 compared to a mean of 1.5 mg/1 upstream. The turbidity was under 6 mg/1 up and downstream of the discharge. TDS was the most inconsistent instream parameter which varied at all sites during July. Sites 1 and 3 were probably not monitored *in situ* during August due to equipment malfunction.

From this preliminary data evaluation, the water quality parameters analyzed only gave rough estimates of the instream and discharge concentrations. Replicate samples at several sites should be collected and analyzed so dependable statistical comparisons could be made. Without replicate samples it is possible to obtain "erroneous" results and not know it. Furthermore, if adequate flow data was available and concentrations were converted to waste loads (pounds/day) and compared appropriately then possibly a more understandable interpretation could be made.

Table 6. Chemical and physical data obtained in July and August, 1974, from the Mountain Fork River - Oklahoma Water Resources Board's investigation. Site 6 was not monitored in August, and Site 3 represents the discharge.

PARAMETER	JULY						AUGUST				
	1	2	3	4	5	6	1	2	3	4	5
PHYSICAL											
DO (mg/l)	7.4	7.5	2.7	7.3	6.3	6.2		5.7		6.0	5.8
Cond (μmho/cm)	18.0	20.0	870.0	20.0	20.0	22.0		48.0		49.0	49.0
Temp (°C)	23.5	24.5	22.5	23.8	24.9	25.5		23.0		22.5	23.0
pH (standard units)	7.9	7.9	7.9	7.9	7.9	7.9		7.8		7.8	7.8
CHEMICAL											
COD (mg/l)	12.0	12.0	3180.0	0.0	15.0	15.0	10.0	3.0	102.0	0.0	4.0
Turbidity (JTU)	3.2	3.0	115.0	2.6	2.2	5.1	1.8	1.5	4.0	1.25	1.2
Hardness as $CaCO_3$ (mg/l)	54.0	42.0	266.0	46.0	17.0	17.0	37.0	17.0	41.0	42.0	30.0
Chloride (mg/l)	5.0	3.0	2.0	4.0	4.0	5.0	4.0	3.0	7.0	4.0	3.0
Sulfate (mg/l)	4.0	2.0	6.0	1.8	1.6	1.8	4.4	4.4	8.0	5.0	5.0
Nitrate (mg/l)	0.03	0.03	0.83	0.03	0.03	0.13	0.17	0.09	0.01	0.01	0.93
Ammonia (mg/l)	0.75	1.25	1.13	0.88	0.88	1.0	0.88	1.0	13.0	1.88	1.38
Total Phosphorus (mg/l)	0.02	0.05	0.09	0.04	0.02	0.2	0.02	0.02	0.02	0.02	0.02
TDS (mg/l)	18.0	2.0	212.0	14.0	64.0	4.0	4.0	2.0	6.0	2.0	2.0
Suspended Solids (mg/l)	1.0	2.0	10.0	11.0	1.0	18.0	1.0	1.0	25.0	1.0	2.0
BOD (mg/l)	1.4	1.2	48.0	1.8	3.4	1.4	1.8	1.2	18.0	1.0	1.0

In summary the results of the chemical and physical analyses (Table 6) did not illustrate a consistent trend downstream of the Weyerhaeuser discharge. For example, ammonia was lower downstream in July whereas it was higher downstream in August, although un-ionized ammonia[18] was found to be higher than the recommended limit both up and downstream of the Weyerhaeuser discharge. All other chemical and physical characteristics were within acceptable environmental limits established by the EPA[18] and the OWRB[12]. Therefore, the results presented herein indicate that the Weyerhaeuser discharge during July and August 1974, was acceptable from a water quality standpoint.

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14. Brown, Eugene, M.W. Skougstad and M.J. Fishman, *Methods for Collection and Analysis of Water Samples for Dissolved Minerals and Gasses*, U.S. Department of the Interior, Geological Survey, U.S. Govt. Printing Ofc., Washington, D.C. (1971)

15. American Society for Testing and Materials, *Annual Book of Standards, Part 31, Water*, ASTM (1975)

16. Steel, Robert and James Torrie, *Principles and Procedures of Statistics*, McGraw-Hill, (1960)

17. United States Dept. of the Interior Geological Survey, *Water Resources Data for Oklahoma, Part 1, Surface Water Records, 1974*, Oklahoma City, Okla. (1975)

18. U.S. Environmental Protection Agency, *Quality Criteria for Water*, pre-publication copy (1974)

APPENDIX

COOPERATIVE AGREEMENT
BETWEEN
WEYERHAEUSER COMPANY
AND
OKLAHOMA WATER RESOURCES BOARD

THIS AGREEMENT is entered into as of the 15th day of July, 1974, by WEYERHAEUSER COMPANY, party of the first part, and OKLAHOMA WATER RESOURCES BOARD, party of the second part.

The parties hereto agree to maintain a cooperative research program on the Mountain Fork River to determine the impact of treated industrial waste discharges upon the benthic community in the river. Said project shall not exceed a duration of three (3) months.

Expenses incurred by the party of the second part in the performance of this program shall be paid by the party of the second part with reimbursement by the party of the first part for all such direct costs not to exceed $4,555.05. Indirect costs incurred by the party of the second part shall be borne by the party of the second part. The party of the second part shall furnish the party of the first part statements of expenditures as may be needed to satisfy fiscal requirements.

All information gathered, the analysis and conclusions derived in the fulfillment of this Agreement shall be made available to the party of the first part. The party of the second part shall keep the party of the first part informed as to the progress and status of the program. At least two (2) copies of the finalized report shall be presented to the party of the first part.

The party of the first part shall provide a boat for use during the study, and also perform certain of the chemical analyses required. The party of the first part shall provide a person to aid the party of the second part in sampler placement and sample collection.

WEYERHAEUSER COMPANY

By [signature]
Mill Manager [signature]
July 17, 1974

OKLAHOMA WATER RESOURCES BOARD

ATTEST:

[signature]
Secretary

By [signature]

JAMES R. BARNETT, Acting Executive Director
MICHAEL R. MELTON, Assistant Director

OKLAHOMA WATER RESOURCES BOARD

N.E. 10TH AND STONEWALL - 12TH FLOOR • OKLAHOMA CITY, OKLAHOMA 73105 • (405) 271-2555

March 8, 1979

Mr. Duane Motsenbocker
Director, Environmental Resources
Mid-South Region
Weyerhaeuser Company
Box 1060
Hot Springs, Arkansas 71901

Re: Mountain Fork Report

Dear Mr. Motsenbocker:

Enclosed are two copies of "The Effects of a Wood Products Plant Effluent on the Mountain Fork River in Southeastern Oklahoma". The suggestions we received from you regarding the report were incorporated therein.

As per our July 15, 1974, agreement the Oklahoma Water Resource Board requests that your company reimburse this agency in the amount of $4,555.05 for fulfillment of said agreement.

If we can be of further assistance in this matter, please contact Jim Long of this office at (404) 271-2541.

Sincerely,

James R. Barnett
Acting Executive Director

JRB:JHL:sdh

Encl: