Field Investigation for Yielding of Sediment and Logs due to Nashizawa Debris Flow Events in 2014

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INTRODUCTION

Debris flows with boulders and driftwoods triggered by rainfall of typhoon Neogri took place in Nagiso-Town, Nagano Pref., on 9th July in 2014. The accumulated rainfall depth in Nashizawa catchment was 114 mm/day, and 80 to 97 mm/h in intensity. A part of debris flow was trapped in some sabo dams, but the others overflowed and brought on following damages: One person was dead, three people were injured, one house was fully, five houses were partially destroyed and many roads were damaged. All driftwoods were deposited in Nashizawa fan, Kiso River and reservoir at downstream reach. Present study reports that driftwoods yielding and runoff volume are estimated by field survey and aerial photograph analysis in comparison with previous data. Yielding and runoff of sediment by debris flows will be shown in manuscript through those are not described here.

NASHIZAWA BASIN

Nashizawa is composed of Onashizawa (catchment area A=2.55 km^2, average bed slope=1/3.4) and Konashizawa (catchment area A=0.73 km^2, average bed slope=1/2.9). The bedrock underlying the watershed is granite, and there are many boulders around 2 m in diameter on the bed. Debris flow disasters took place previously around the basin. Vegetation consists of Japanese cypress in the upstream and consists of planted Japanese cypress and Japanese cedar and broadleaf tree in the middle to downstream reach. There are fallen and remained logs in the basin.

ESTIMATION FOR YIELDING LOGS VOLUME

Volume of driftwoods from Onashizawa and Konashizawa were estimated by analysis of aerial photos (erosion area) and field survey. Estimated driftwood volume is 2,880 m^3, totally, and the volumetric ratio of conifer and broadleaf tree for total volume was 0.74:0.26 (**Tab.1**). Driftwood volumes of conifer and broadleaf tree were largest comparison with previous studies (**Fig.1**). Specific weight of green woods was estimated by log-samples that passed 1 to 6 weeks after cutting, as follows: 0.98 to 1.06 for broad-leaf trees and 0.64 to 0.77 for conifer.

Area	Location	①Erosion area (m^2)	②Log volume (m^3/100m^2)	Ratio of logs volume Conifer	Broadleaf tree	③Driftwood yielding volume(m^3) Total	Conifer	Broadleaf tree
Onashizawa	Upstream	36,600	3.43	0.93	0.07	1,255	1,167	88
	Middle downstream	32,800	2.40	0.59	0.41	787	464	323
	Downstream	14,600	1.09	0.47	0.53	159	75	84
Konashizawa	Upstream	900	3.43	0.93	0.07	31	29	2
	Middle downstream	27,000	2.40	0.59	0.41	648	382	266
Total						2,880	2,117	763
Ratio						100%	74%	26%

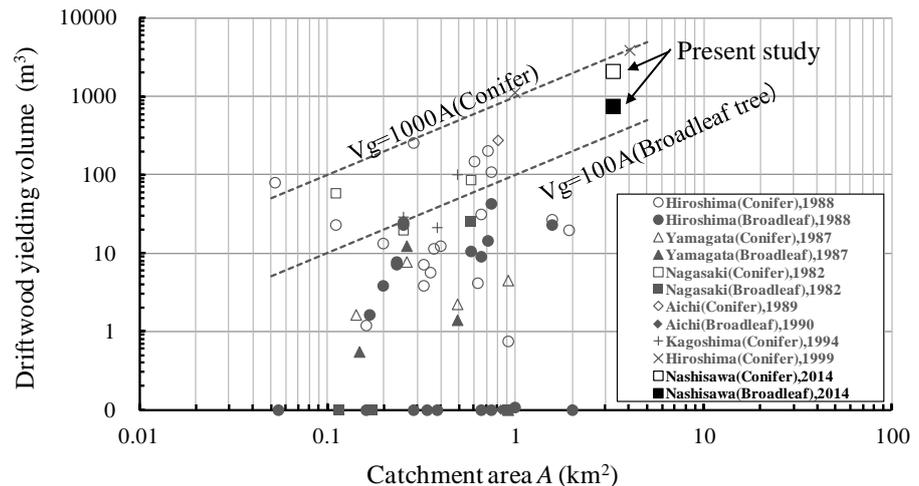**Table 1** Estimated driftwoods yielding volume

ANALYSIS FOR LOGS DIMENSION AND DEPOSITED LOGS

Length and diameter of logs more than 0.1 m in diameter, that is near the median in frequency distribution in diameter of standing trees, are calculated by measurement using aerial photo, and driftwoods runoff volume is estimated by following two ways because there are

Fig. 1 Relations between catchment area and driftwoods yielding volume

a lot of small pieces of logs in deposited driftwoods on the surface in the reservoir, through image analysis using aerial photo. Those are as follows:

(1) The ratio of logs for deposition in area at reservoir is set same value as that of Kiso River.

(2) Calculation for the ratio of logs for deposition in area for every location such as flood area on Nashizawa fan, Kiso River and reservoir.

Estimated total driftwood volume is 430 m^3 (Case 1) and 766 m^3 (Case 2), respectively (**Table 2**). Runoff rate of driftwoods takes a range of 14.9 % to 26.6 %. Runoff rate takes relatively small values because driftwoods can be trapped by sabo dam or deposited in the bed.

Table 2 Estimated driftwoods for runoff volume

Case	Location	①Deposited area of driftwoods(m^2)	②Ratio of logs area in deposited area	③Mean value of logs diameter(m)	Driftwoods runoff volume(m^3) Total ④	Conifer ④*0.74	Broadleaf tree ④*0.26
Case1	Flood area	1,341	0.32	0.20	68	64	22
	Kiso river	6,769	0.20	0.20	270	200	70
	Reservoir	9,368	0.03	0.20	74	55	19
	Total				430	319	111
	Ratio(driftwoods runoff volume / driftwoods yielding volume)				14.9%		
Case2	Flood area	1,341	0.32	0.20	86	64	22
	Kiso river	6,769	0.18	0.20	237	175	62
	Reservoir	9,368	0.18	0.20	443	328	115
	Total				766	567	199
	Ratio(driftwoods runoff volume / driftwoods yielding volume)				26.6%		

CONCLUSION

Yielding driftwoods volume of conifer and broadleaf tree in debris flow events were analyzed by specific weight of logs, images of aerial photo and so on. Specific weight of green wood was 0.98 to 1.06 (broadleaf tree) and 0.64 to 0.77 (conifer).

The volume took almost maximum value in comparison with previous data applied to sabo planning in Japan. The runoff rate of driftwoods took the range of 14.9 % to 26.6 %. Data and survey for sediment runoff will be shown in detail in manuscript.

REFERENCES

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