LONG-TERM MONITORING OF THE RECRUITMENT AND DYNAMICS OF LARGE WOOD IN KAMIENICA STREAM, POLISH CARPATHIANS

Paweł MIKUŚ[1], Bartłomiej WYŻGA[1]

[1]Institute of Nature Conservation, Polish Academy of Sciences, Kraków, Poland, e-mail: mikus@iop.krakow.pl

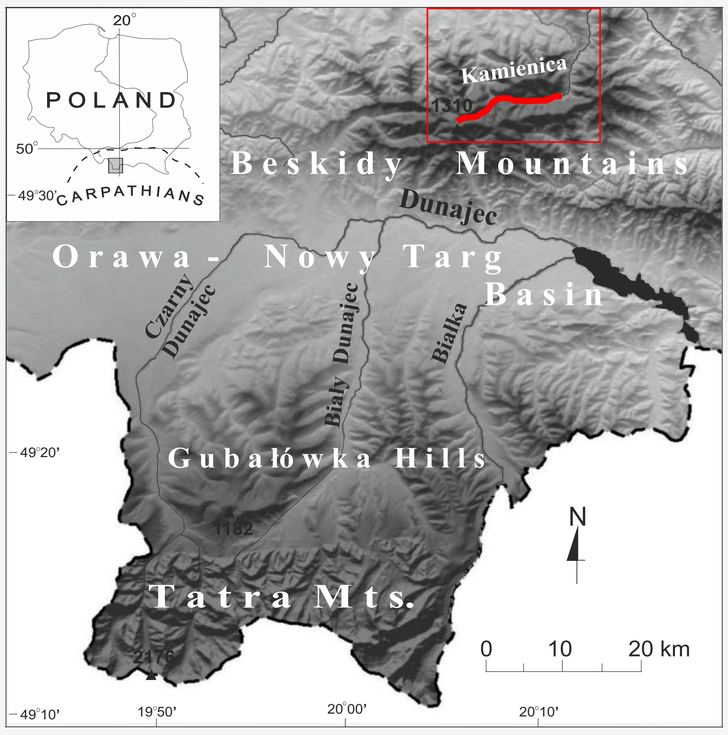
Introduction

The rates and locations of recruitment, transport and retention of large wood considerably influence wood-related flood hazard; however, these processes may differ between watercourses of different size and their particular reaches. One of the methods of studying wood dynamics in any mountain stream is systematic monitoring od wood supply and mobility. Our investigations were performed in second- to fourth-order Kamienica Stream, Polish Carpathians (in the Gorce Mts. National Park) (**1**) and they continue to this day.

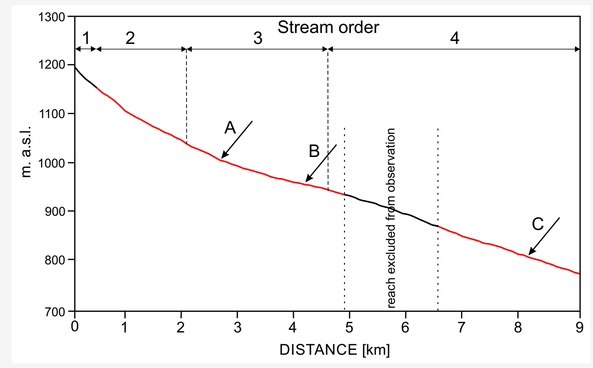
In 2009, 429 living trees growing along three reaches of its upper course (**2**) were tagged with numbered metal plates. The timing and mechanisms of tree recruitment to the stream (**4**) have been monitored for 9 years. Wood inventory performed in 2012 documented amounts (**5**), orientation (**6**), location (**7**) and the degree of preservation (**8**) of large wood after a prolonged period with low to moderate floods; the data were next compared with the results of similar inventory performed after a large flood of 1997.

Bark beetle infestation that resulted in the widespread dieback of spruce forest in the Kamienica valley significantly increased the rate of spruce tree delivery to the stream. Many of this trees are longer than the channel width and often form complete and active dams (**9**).

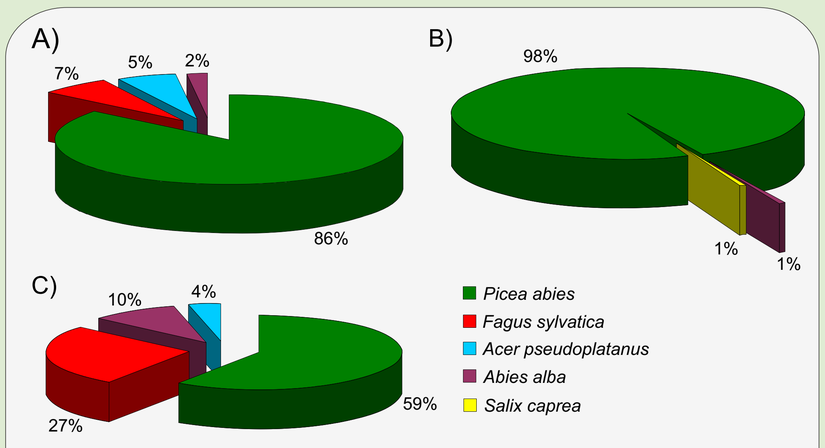
Since 2010, studied sections are colonized by beavers, bulding dams and ponds. However, the dynamic of mountain streams makes that this structures used to be cyclically destroyed and rebuilt (**10**).



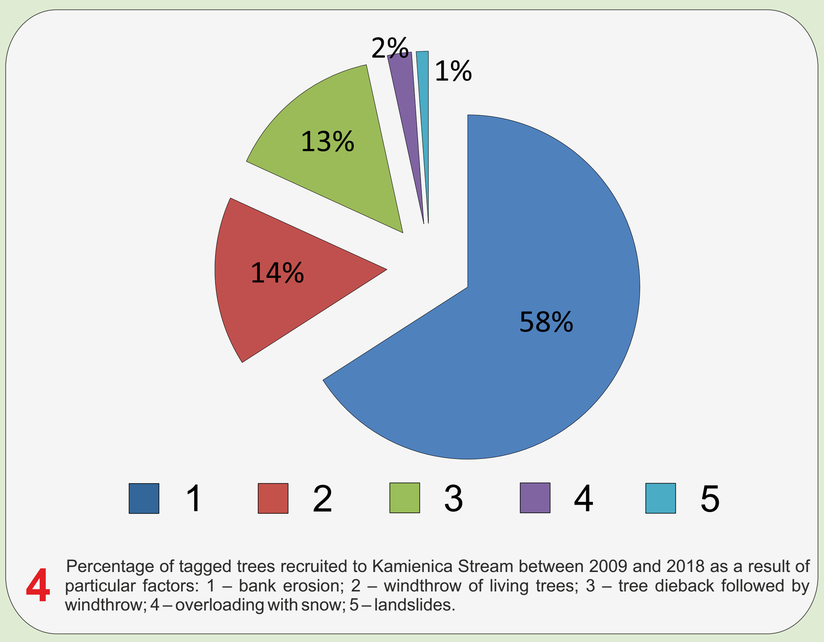
1 Location of the studied reaches of Kamienica Stream.



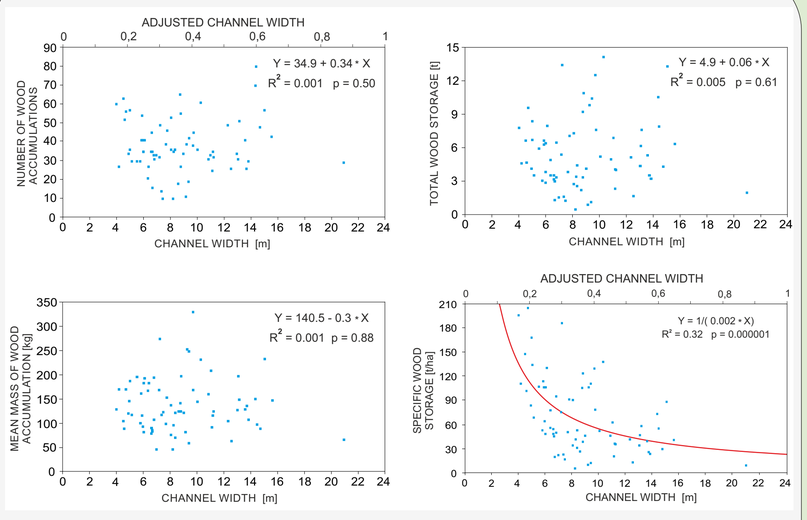
2 Locations of the studied reach showed on longitudinal profile of Kamienica Stream. A,B,C - reaches with tagged trees. Reaches covered by wood inventory were marked with red line.



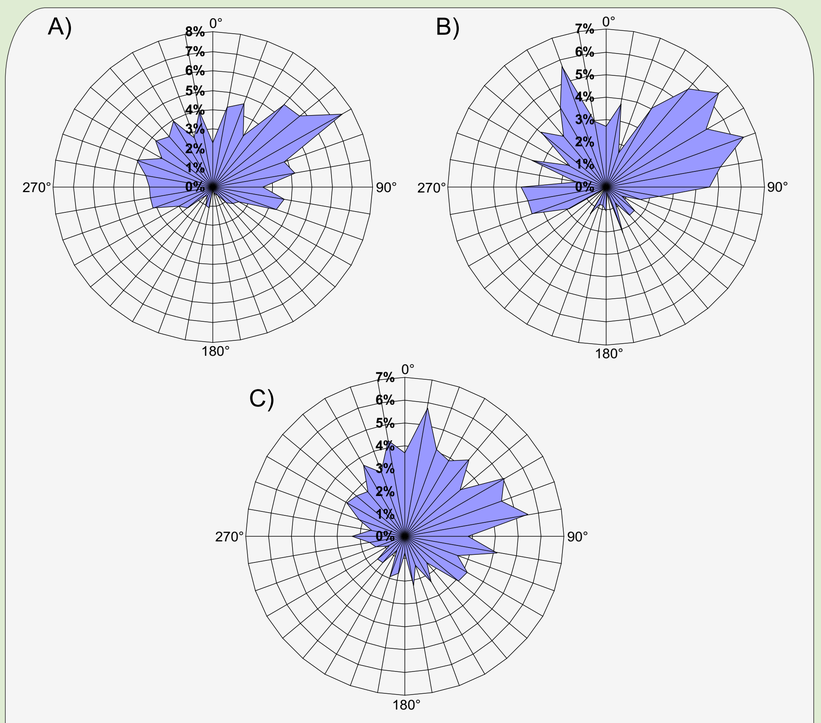
3 Species composition in the uppermost (A), middle (B) and lowest (C) studied reach of Kamienica Stream.



4 Percentage of tagged trees recruited to Kamienica Stream between 2009 and 2018 as a result of particular factors: 1 – bank erosion; 2 – windthrow of living trees; 3 – tree dieback followed by windthrow; 4 – overloading with snow; 5 – landslides.

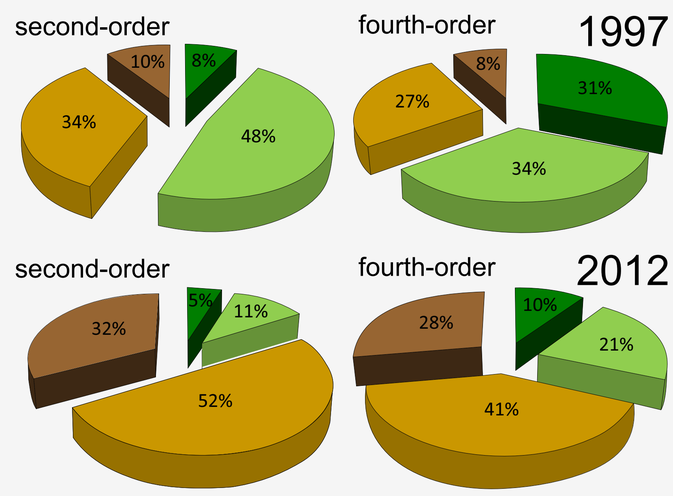


5 Scatter plots and estimated regression relationships between number of wood accumulations, mean mass of wood accumulations, total or specific wood storage and river width during wood inventory performed in Kamienica Stream in 2012. No regression lines are indicated for the relationships which are not significant.

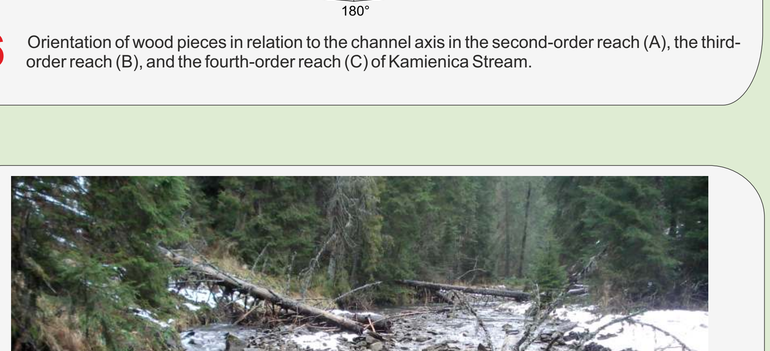


6 Orientation of wood pieces in relation to the channel axis in the second-order reach (A), the third-order reach (B), and the fourth-order reach (C) of Kamienica Stream.

7 Predominant types of large woody debris location within studied sections. 1 - top of the log in the channel; 2 - the whole log in the channel; 3 - the whole log on the left channel; bar; 4 - in channel dam; 5 - the whole log on the right channel bar; 6 - the whole log on the channel bank; 7 - spanning over the channel.

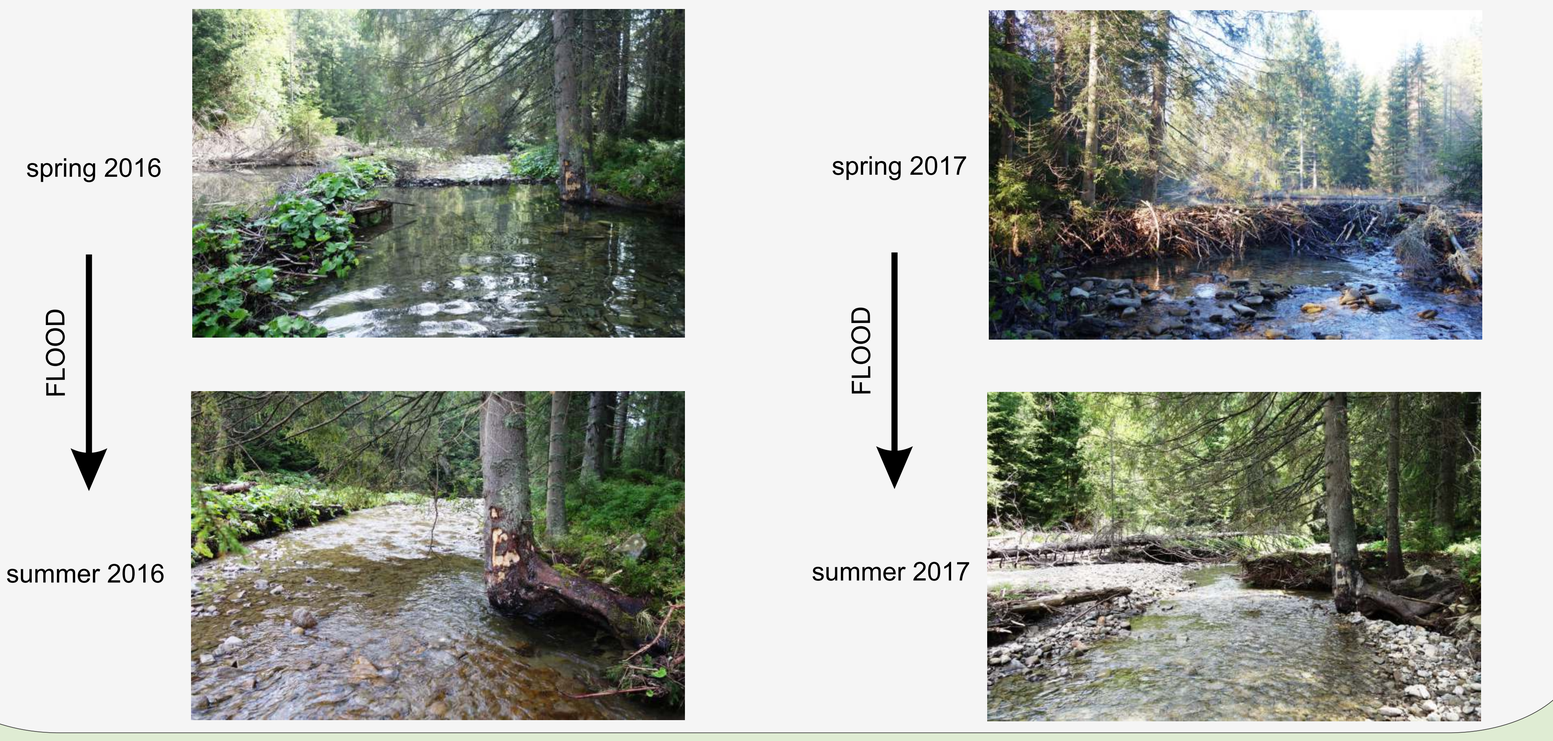


8 Classes of large wood decay recorded in second- and fourth-order reaches of Kamienica Stream in 1997 and 2012. 1 - fresh, bark adgeres tightly, 2 - loose bark, 3 - no bark, wood hard, 4 - no bark, wood soft.



9 Spruce tree fallen to the channel of Kamienica Stream in a monitored reach. The tree was tagged with a numbered aluminium plate (shown by a white arrow) when growing close to the channel bank to allow its identification after displacement in the stream. The fallen tree forms a complete dam.

10 The unstable nature of beaver dams



Conclusions

Presented methods for monitoring of large wood dynamics are time-consuming but low-cost and can be highly informative about large wood dynamics in the stream.

Wood supply to the Kamienica Stream is the result of several processes, the most important of which is bank erosion and strong wind.

Results of the 9-year-long monitoring suggest an increased rate of wood recruitment to Kamienica Stream resulting from recent bark beetle infestation of the spruce forests in the valley.

Large woody debris is arranged more or less regularly in the channel.

However, both monitoring of wood transport and wood inventories indicate that the mobility of large wood in the stream is limited and can increase during medium and large floods, which took place two times during observation period. Thus flood hazard to downstream, inhabited valley reaches that potentially results from the considerable amounts of large wood stored in the upstream reach is little.