

# TREEHOUSE CONSTRUCTION SYSTEMS AND METHODS

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## Abstract

The trend of building treehouses is emerging in the Czech Republic as well as other European countries. This paper contains information about the author's present background research of this phenomenon. The study aims to map the present state of practical realizations, their construction systems and methods, as well as the scientific state of art. Furthermore, the established systems and methods will be tested and assessed based on their utility in the Czech environment.

## Keywords

Treehouse, construction system, method, wooden architecture, small scale architecture

## 1 INTRODUCTION

The objective of this article is to give information about the author's ongoing research of treehouses, as well as to outline the initial concerns within the topic. This article should provide a useful map for further specification of research. In the context of the Czech Republic and Slovakia, the study should ultimately provide suitable construction systems and methods for local environment. There is no tradition of treehouses typology in the Czech Republic, so the motivation behind this research is to provide a relatable context and suitable solutions for architects. Thus, the idea is to avoid a copy-paste approach to building treehouses.

The issues discussed by the background research will cover the areas that need to be addressed during planning of a treehouse, such as construction systems, methods and materials, typology of treehouses, historical origins, geographical origins, dendrological concerns, legality, architectural theory, and ecology. To assess the adequacy of construction types in the Central European environment, a large number of existing realized buildings will be examined. This approach can provide a qualitative sample with a different time gap at each project. Consequently, the construction methods can be observed in different stages of the building life cycle.

The research should employ the research by design method to test the found principles against real circumstances. It is possible that experiments will need to be performed in order to prove the feasibility of each principle.

As the first project inside this research, the author is currently working on SGS grant named "Execution project using BIM methodology of a mobile wooden object". The objective of this grant is to build a mobile light study laboratory on a tiny house plateau as shown in Fig. 1. The contribution of project to the author's research comes from using software tools as an automatic weight and cost calculation methods on one hand, and from exploring light-weight wood construction system on the other hand. [1] Both aspects will be crucial for effective treehouse structure analysis.

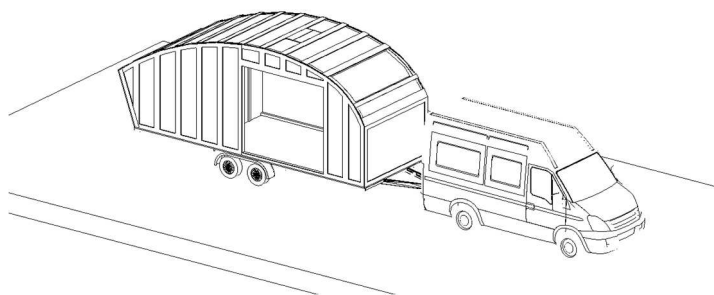


Fig. 1 Construction view of Mobile light study laboratory [1].

## 2 LITERATURE OVERVIEW

The topic is defined by an uncommon building typology, which means there is a limited number of scientific resources and documentation. A better image of the subject is provided through non-scientific publications and actual project realisation, which are provided for illustration. The following areas should be addressed to provide an overview about the state of the art.

### History

In order to understand why treehouses are built today, it is important to look into the past as well. McKinney gives this insight:

“In the West, four ages of treehouse building can be identified: ancient Roman times, Renaissance Europe, the Romantic period of the late eighteenth and early nineteenth centuries, and the turn of the twentieth century to today. While Westerners have been building treehouses as a fun exploration into nature, there have also been communities of native islanders living in trees for practical purposes.” [2].

Ewawani gives an in-depth historical description since the Roman era [3]. Both publications mention the Korowai aboriginal people, who build treehouses. And there is a publication specifically on the impact of images of aboriginal treehouses on global visual culture [4].

### Geography

There are treehouses on all 6 continents that contain trees. “The main factors influencing the treehouse structures are the distribution of tree species, differences in climatic factors and regulatory conditions in construction.” [2].

The geographical position strongly influences the degree, by which the treehouses are furnished and ready for long-term living. There are more cabin-like treehouses, with simple furnishing, without any utility networks. On the other hand, more complex treehouses exist in climatic areas, with lower thermal insulation requirements throughout the year. Vacenovská [5] writes about the specifics for the Czech Republic. In this regard, the question could be raised: could hunter outposts be considered as Czech-specific treehouses?

### Typology and use

There is no standard to categorize the typology of treehouses. However, different approaches to categorization were applied in various studies. Treehouses can be distinguished by their position to the tree, supports, shape, program, scale, and other aspects [6].

There are books for the wider public presenting photographs of cabins and treehouses. Such books can be used as a source of inspiration for architects as well as for information about existing projects [7], [8], [9], [10], [11].

Another source of inspiration are articles about individual buildings, such as [12], [13].

Matijs Babris [14] analysed 210 publicly accessible treehouses around the world to categorize them by their use:

- Hotels, accommodation – 130.
- Dwelling houses in trees – 37.
- Objects of interest, sightseeing platforms, attractions – 18.
- Tents in treetops, glamping – 9.
- Restaurants, cafes – 7.
- Outdoor camping platforms – 7.
- Office spaces – 3.
- Outdoor cinema – 1.

Some of the less common building serviceability requirements will become significant for treehouses, such as lateral movements (sway), wildlife, or cleaning.

### Construction

There is substantial literature on how to build a tree house. There are several practical manuals on this topic and many books with case studies and essays. Andreas Wenning [15] presents 25 examples, along with new designs and essays on statics and construction. Nelson [10], [16] gives another 35 examples with explanations of how they

were built in “New Treehouses of the world”. And yet another plethora of examples with plans and drawings can be found in the book “The treehouse book”.

The practical manuals include commercial company guidebooks, DIY handbooks, and publications for parents [17], [18], [19].

Very interesting is the paper by Vacenovská [5] on the treehouses structure, which takes into account the following aspects of treehouses made of wood:

- Characteristics of the wooden construction.
- Specifics for designing wooden structures.
- Lifespan and wear of wooden structure.
- Modern constructions.
- Possibilities of treehouses and their type.
- Anchoring elements of treehouses.
- Composition of enclosing shells – treehouses.

Construction type can be assessed by different criteria, one of which is the way by which the structure is attached to a tree. In his paper Matijs Babris [14] suggests, there are 5 main corresponding types of fasteners for attaching and securing Treehouses as shown in Fig 2.

1. Bolt fasteners – drilled or nailed metal joints in wood:
2. Hanging treehouses.
3. Structures with partial load transfer to artificial supports (columns).
4. Organically supported treehouse structures.
5. Ring constrictors.

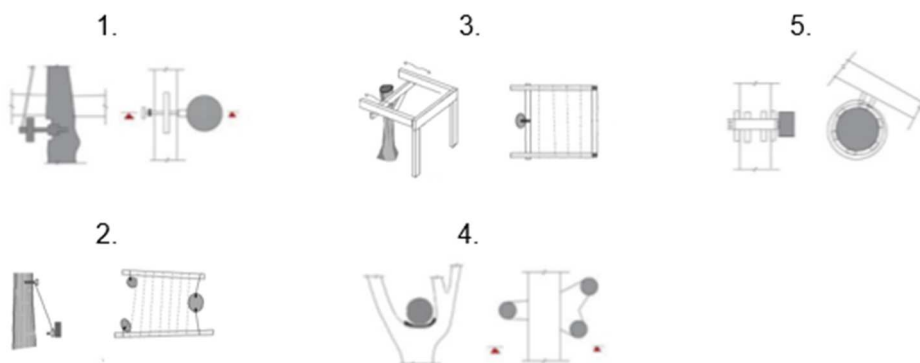


Fig 2. Types of construction with respect to tree attachment by Babris [14], illustrations for 2. and 3. by Souza [20].

## Dendrology

When selecting a tree to build a treehouse in, the following should be taken to consideration: tree health, species, possible harm, environmental impact, and professional arborist evaluation [21].

The book by Kroner, “The Perfect Treehouse: From Site Selection to Design & Construction”, gives more advice on how to select the right tree for the house [22].

Certainly, the stability of the tree will have to be consulted with arborists. The author is already in contact with specialists from Czech University of Life Sciences in Prague. Topics that are most likely to be addressed include load-bearing capacity of the supporting trees, the danger of falling branches, the danger of nearby tree falls, lightning protection, etc.

## Legislation

It is not entirely clear how treehouses should be treated legally. It is crucial to know what type of area the plot is defined in the zoning plan of the municipality. Of particular concern are buildings inside or near areas designated for forest use, which require special approval [23]. To decide whether a building, must have a valid building permit prior to construction, the Czech Building Act No. 283/2021 Coll. [24] must be consulted.

Architects must be very cautious about fire safety as the risks in wooden structures are high, especially in connection with trees. Wooden construction must comply with applicable legislation and should be equipped with fire safety precautions [5], [24], [25].

There are regulations in Czech Republic, that should be used as references for designing, for example, Eurocode EN 1995 for wooden buildings [26]. Other key standards include ČSN 73 4301 [27] for fire safety and ČSN 73 4301 [24] for residential buildings.

## Ecology

Treehouse tourism fits well in the category of sustainable tourism, but the growing need to provide unique, specific travel and accommodation experiences by the tour operators and hoteliers, creates overuse in term “sustainable”. Andrea Giampiccoli proposes a model of treehouse tourism, and a key recommendation to develop TT in a sustainable way. [28] The importance of concerns about sustainability in present era is the main message of Nelson’s book “New Treehouses of the world” [10].

## Architectural theory, culture and other fields

Treehouses operate symbolically in tandem with culture. The paper by McKinney focuses on treehouses as imagined in modern America. “The act of building a treehouse is synonymous with the dominating ideas about boyhood in modern America.” [2] “Treehouses throughout history are all united by the desire to dwell in nature, to become more connected to the natural world without completely rejecting the comforts and structure of civilization.” [2].

Treehouses pose opportunities for tourism as they allow creating a unique and valuable space for tourism in nature parks and other protected areas [14].

Treehouses connect with a certain lifestyle, which is described in the book “Treehouse letters, The Unabridged Michigan Forest Life Journal” by Dan Ellens. [29] This self-sufficient or off-grid living is in the contrast to the hustle of city life [7]. By reading such literature, one can experience the perceptual aspect of treehouses, which can be fundamental to treehouse design.

## 3 METHODOLOGY PROPOSAL

Here is the proposed structure of research that will be undertaken:

1. Assemble the already used cases of **construction systems** and methods (case studies)
2. Based on relevant literature and interviews with treehouse owners and users, propose a **set of requirements** for the sample treehouse projects. define clearly what a treehouse must fulfil.
3. Similarly, propose a **set of criteria** (expected criteria are for example: weight, load-bearing capacity, thermal properties, speed of construction, cost, etc.). These criteria will serve as the basis for rating the systems.
4. **Research by design:** Create several treehouse projects, each with a different construction system. All must fulfil the requirements (2) and will be assessed by criteria (3).
5. Asses the construction systems in terms of the criteria and **compare** them.

Other methods that are applicable to obtain the results expected: practical modelling, research by design, and experimental testing. Ther research process is illustrated in Fig 3.

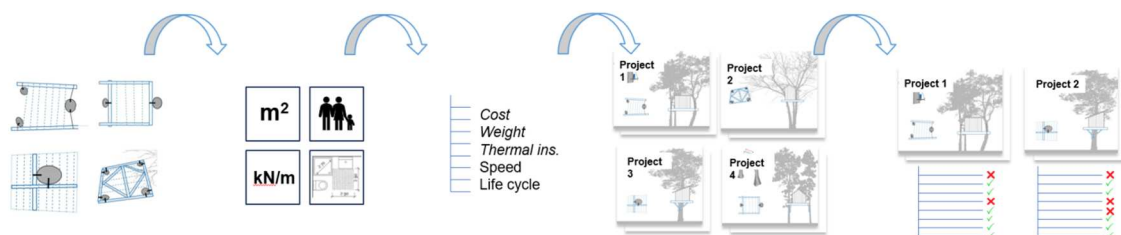


Fig. 3 Illustration of 5 steps in which the research will be undertaken. The 4 construction systems by Souza [30] are not binding for future research, pictures are illustrative.

## 4 DISCUSSION

There are various sources of information about treehouses, including scientific papers. However, the topic is not widely documented. More information can be obtained from unofficial sources, manuals, and from personal experience.

Since the treehouse construction is fairly wide topic, it is important to raise specific questions that the research should answer. Those questions are:

- Is there an ideal construction system for treehouses? If so, which one?
- What are some requirements for the construction systems of treehouses?
- What specific aspects will influence treehouse design?
- Are there some construction principles that can be derived from these requirements?
- What tree species are suitable to build treehouses on? Which attachment methods are appropriate?

## 5 CONCLUSION

To get a complete picture of the subject, further study of publications will be required, and special emphasis needs to be placed on personal experience. Research must be consulted with arborists. Main objective of the research is to provide clear solutions to treehouse structure in climatic environment of the Czech Republic.

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