

## **An Overview of Risk Assessment for Tree Climber Arborists**

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**Abstract**

The present paper reviews published risk assessment for tree climbers arborists. Little is known about risk factors on arborists who work on heights by means of ropes and pruning or felling with saws and chainsaws. A wide risk assessment should be done.

**Keywords:** arborists, tree climbing, risk assessment, safety, urban green areas

**1 Introduction**

Climb a tree is in itself a dangerous operation, because of the height and the consequent risk of fall.

Nevertheless this working method is required whereas it isn't possible to operate with aerial lifts and pruning or felling a tree is necessary. This kind of work allows the arborists to move within the canopy and reach the target branch to perform right pruning. In case of felling and dismantling of a tree, the arborist has a privileged view of the structure of the tree and he can easily tie up branches or limbs for rigging operations. Besides tree climbing helps in tree assessment operations, when instrumental analysis at height is required (fig.1).



Figure 1- Tree climber with Resistograph analyzing wood resistance

Nowadays there are many devices which allow a safe climb and a comfortable displacement within the canopy, but arboriculture is hazardous work (Julius 2014). This statement is true for several agricultural operations, but especially for arborists who work for the management of urban green areas and tree care. Falling from height, mentioned above, is just one of several risk to which the tree climber arborist is exposed.

## **2 Materials and methods**

Reviewing of the literature about this topic, show how little is the knowing about tree climbing safety. Arboricultural associations produced studies about tree climber's issues. Especially ISA (International Society of Arboriculture) published many papers, but also HSE (Health and Safety Executive UK) and OSHA (Occupational Safety and Health Administration, U.S. Department of Labor) have dealt with this topic. Besides, many private technical offices in Germany, Scotland and North Wales have dealt with safety in arboriculture.

To know information about risk assessment for tree climber arborists is not enough searching among academic papers, because of the poor investigation of this topic, but is requested searching between arboricultural journals, arboriculture association's publication and at last technical standards from forefront States regulation. This search was done using electronic databases such as Scopus, Science Direct, Google Scholar as well as Google.

## **3 Results**

By documents found, emerge that academic literature just dealt with arboriculture safety aspect about tree stability assessment or public liability litigation or risk mana-

gement (Davison 2014). The most studied topic is the contrast between cost and benefits of trees in urban contest. An extensive list of tree urban benefits and ecosystem services are reported such as social, economic, health, visual and aesthetics benefits; along with air quality, carbon, storm water, energy, habitat, noise, micro climate related ecosystem benefits (Roya 2012). On the other hand, disservices are also numerous and concern social problems/hazards related to tree stability, insects, allergy; and costs and expenditures for maintenance, pruning and restoring damage caused by tree failure or branch fall (Roya 2012). About this topic there are numerous publication which explain quantified tree risk assessment reasoning on acceptable risks, probability of impact with vehicles, pedestrian or structure (Ellison 2005), but nothing was said about tree failure risk in respect with the tree climber arborist working on it.

Fall from height risk, is also studied, because of its high injury rate, quote "Several studies have been performed examining the causes of injuries and deaths from falls, such as those from the National Institute of Occupational Safety and Health (NIOSH) Fatal Accident Circumstances and Epidemiology (FACE) reports (NIOSH, 2000), OSHA report on falls from scaffolds (OSHA, 1979), OSHA report on falls from elevated platforms (OSHA, 1991), the study of McCann (2003) for deaths in construction related to personnel lifts and the study of HSE (2003) for falls from height in various industrial sectors" (Aneziris 2008). In the aforementioned paper it's analyzed the sequence of events that constitute an accident and is developed a model that quantifies the probability of fall from ladders, roofs, scaffolds, holes in ground, moveable platforms and nonmoving vehicles, but nothing is known about falling from a tree; neither probability nor triggers.

Something more was studied about arborists handsaws. Experiments was done about ergonomics and efficiency on the latters utilizing both electromyography and subjective assessment "to provide quantitative biomechanical data on the effects of saw design and work height" (Mirka 2009). This study underlines the importance of a neutral posture during the work and an appropriate sizing of the handle of the tool to reduce efforts on hand, wrist and shoulder and minimize the development of carpal tunnel syndrome and hand/wrist tendonitis (Mirka 2009).

Regarding regulation, several States has got technical standards for operators working on height: Italian regulation just has "D.lgs 9 Aprile 2008, n°81", the occupational safety ordinance, which contains in title IV, subtitle II, section I-II, minimum safety requirements and obligations, but without specific technical references for arborists. Otherwise, U.S. regulation has got ANSI Z133 standard, an arborists-specific safety standard. It is a guideline currently revised every six years, and it concern about operating a chainsaw, brush chipper, aerial lift, appropriate use of specific personal protect equipment (PPE) (Julius 2014).

Nevertheless, neither academic papers nor regulation are exhaustive about arborists risk assessment, security procedures, specific occupational diseases.

As announced, specific studies were done, since 1924 by ISA (International Society of Arboriculture), the biggest arborists professional association in the world. ISA was founded by some researcher and arborists in Connecticut (U.S.A.)

with the purpose of sharing of urban arboriculture. Nowadays, ISA has got over 22.000 members in the world (ISA Italia website), and publishes two magazine: “Arborist News” and “Arboriculture & Urban Forestry”, in which can be found informative and technical articles and experimental works and research. Twice articles are shipped only to ISA’s members. An interesting contribution regarding risk and hazard assessment, was done by Mark Bridge at the ISA’s 2005 Annual Conference and Trade Show, in Nashville, TN. In his lecture he exposed the possibility to assess the level of risk for arborists and portray it in a risk matrix, as used by health and safety organization or the military (M. Bridge 2005).

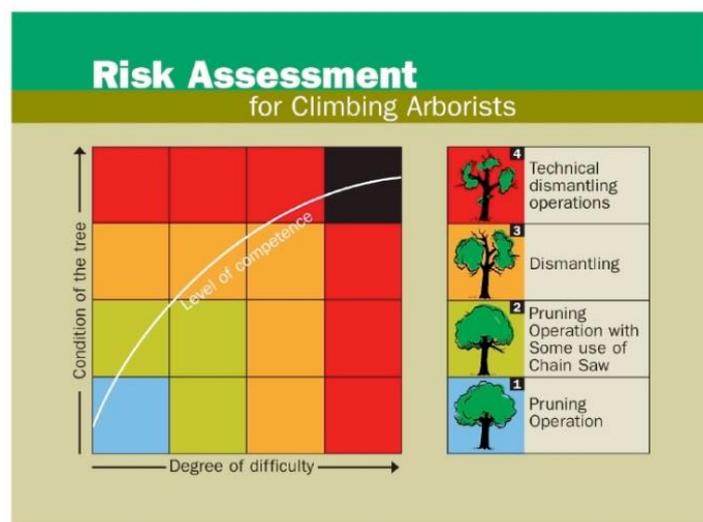


Figure 2 - Risk Assessment Matrix for climbing Arborists

Such matrix (fig. n.2) was introduced in 2002 at the Augsburgger Baumplfegetage in Augsburg, Germany. On the horizontal axis there is the degree of difficulty of the job, increasing from left to right hand; on the vertical axis there is represented the Visual Tree Assessment, increasing from bottom to top. The matrix resulting from combining those two factors resulting in a color coding, from blue to black, going from easy works such as pruning operations with handsaw, to dismantling operations using chainsaw and finally unclimbable trees. Furthermore it’s added a “curved white line that represents the level of competence of the climber and of the crew on site”. This curved line means that the level of competence in this kind of work, increases quickly in the first months of activity, then progress with less speed, because of major difficulties of technical dismantling operations that require more knowledge and skills to operate proficiently and safe.

## 4 Conclusions

Arboriculture is a profession growing, especially in big cities, where urban green areas and urban trees must be maintained and it seems strange that still there aren’t

academic studies about safety, ergonomics and efficiency as well as agricultural field (Cecchini et al. 2010), like hazelnut sorting (Colantoni et al. 2013) or vegetable grafting (Colantoni et al. 2012). Several risk factors incumbent above arborists should be analyzed, first of all fall from height, followed by risks arising from the use in height of the chainsaw (cut, noise, vibration, hydrocarbon combustion residue and wood powder inhalation), electrocution. Not least the ergonomics problem, due to required posture for pruning and dismantling with the harness.

Furthermore several working methods are taught in the different training centers, but nothing is known about which is the most safe, productive, less tiring for the operator and less frying for tools.

New depth studies are desirable, to improve safety and productivity to this emergent kind of work, that is dedicated to the proper management of urban green areas.

## References

- [1] O.N. Aneziris, I.A. Papazoglou, H. Baksteen, M. Mud, B.J. Ale, L.J. Bellamy, A.R. Hale, A. Bloemhoff, J. Post, J. Oh, Quantified risk assessment for fall from height, *Safety Science*, **46** (2008), 198-220.  
<http://dx.doi.org/10.1016/j.ssci.2007.06.034>
- [2] M. Bridge, Risk and Hazard Assessment for Arborists, *ISA 2005 Annual Conference and Trade Show*, Nashville, TN, August 6 – 10 2005.
- [3] M. Cecchini, R. Massantini, D. Monarca, The ergonomics analysis tools for the assessment of the risk of musculoskeletal disorders due to the repetitive movements of the upper limbs of the workers employed in agriculture, Towards environmental technologies, *International Conference on Agricultural Engineering*, Clermont-Ferrand (France), 6-8 September 2010.
- [4] A. Colantoni, D. Monarca, R. Bedini, A. Marucci, B. Pagniello, M. Cecchini, Vegetable grafting in greenhouses: the risk of musculoskeletal disorders for workers due to repetitive movements of upper limbs, *Safety Health and Welfare in Agro-food Agricultural and Forest Systems* (2012), ISBN 978-88-905473-4-8.
- [5] A. Colantoni, M. Cecchini, D. Monarca, S. Riccioni, R. Bedini, The risk of musculoskeletal disorders due to repetitive movements of upper limbs for workers employed in hazelnut sorting, *Journal of Agricultural Engineering*, **44** (2013), 10th Conference of the Italian Society of Agricultural Engineering, Viterbo.

- [6] A. Davison, J.B. Kirkpatrick, Risk and the Arborist in the remaking of the Australian Urban Forest, *Geographical Research*, **52** (2014), no. 2, 115-122. <http://dx.doi.org/10.1111/1745-5871.12043>
- [7] M.J. Ellison, Quantified tree risk assessment used in the management of amenity trees, *Journal of Arboriculture*, **31** (2005), no. 2, 57-65.
- [8] A.K. Julius, B. Kane, M.T. Bulzacchelli, H. Dennis P. Ryan III, Compliance with the ANSI Z133.1 – 2006 safety standard among arborists in New England, *Journal of Safety Research*, **51** (2014), 65-72. <http://dx.doi.org/10.1016/j.jsr.2014.09.010>
- [9] G.A. Mirka, S. Jin, J. Hoyle, An evaluation of arborist handsaws, *Applied Ergonomics*, **40** (2009), 8-14. <http://dx.doi.org/10.1016/j.apergo.2008.02.011>
- [10] S. Roya, J. Byrne, C. Pickering, A systematic quantitative review of urban tree benefits, costs, and assessment methods across cities in different climatic zones, *Urban Forestry & Urban Greening*, **11** (2012), 351-363. <http://dx.doi.org/10.1016/j.ufug.2012.06.006>
- [11] <http://www.isaitalia.org>

**Received: March 30, 2015; Published: October 16, 2015**