Trees in Challenge Courses and Adventure Parks – Aspects of a Modern Use of Trees for People

by Andreas Detter

Ropes courses are increasing in popularity. Adventure parks are constructed in managed forests or within parks, and usually are run as recreational facilities. But using living trees as anchor points raises issues in risk management. Furthermore, permanent damage to trees or to the soil structure could affect long-term sustenance and growth conditions. On the other hand, ropes courses in trees offer unique experiences which people obviously find very attractive.

Figure 1 adventure parks

European technical standards for ropes courses also address the issue of tree inspection. The suitability of trees used as anchor points shall be assessed by an arborist. Their capacity to bear loads generated from the ropes course and participants in a fall-arrest-scenario must be evaluated. Yet there is very little scientific data on the loading of trees in an adventure park. A 2010 research project studied reactions of trees to dynamic loads generated from horizontal belay ropes. The results showed that stresses are concentrated at the rope attachment point. Slender trees will experience different modes of sway from dynamic loads in the rope system than in natural wind events.

Often, adventure parks are erected in stands that are managed and used by forestry. Damages resulting from the installation of ropes courses may result in a reduction of the economic value of the trees, but as long as the quality of the soil is not affected, this may be balanced by the income generated from a commercial adventure park. In cases where trees in city parks or stands near cities are used, any damage to the trees may affect the performance and longevity of the urban forest. Therefore, special attention should be given to the attachment points.

Forming a permanent connection between a strong, rigid structure (platforms, steel cables) and a growing, living tree is a technical challenge. In many cases, bolting trees is not feasible because of the potential permanent damages to central parts of the trunk. Wrapping slings around the trunk or attaching platforms may cause pressure on the phloem and xylem, resulting in dysfunctional tissue, growth depressions, or irreversible structural damages. Wooden blocks are used in order to dissipate pressure, polymeric layers may accommodate for increment growth, and adjustable configurations allow for adequately adapting platforms and rope attachments to increasing stem diameters and may minimize damages on trees in a support structure.

Figure 2 wooden blocks helping to dissipate pressure on the park, protective layers for stem and bark

Figure 3 bark damage at platform attachment, European Ash, 1 year post installation

Trees may also be affected by soil compaction as the forest is now used by hundreds of participants each day. In many cases, hydraulic lifts and other heavy machinery will be used during the installation of an adventure park. Simple preventive measures would be able to minimize soil compaction. Even if most of the action takes place aloft, participants will move within the forest, spectators will stroll underneath and trainers will be in place to assist if required. Those peoples' movements may be channeled by providing clearly encircled paths between elements, starting points where people can queue. Those parts of the soil surface may be protected against compaction by layers of woodchips or gravel.

Figure 4 channeled visitor path covered with wood chips

picture: Bergwolf GmbH, A. Esswanger

Criteria for tree-friendly, sustainable ropes courses in trees

Provided here is a non-exhaustive list of criteria that may characterize a good way of erecting and running an adventure park:

1. Site selection

- Choose stable stands with low wind exposure to prevent tree failure in storms.
- Choose a deep soil structure with good resistance against compaction or good regeneration potential.

- Choose sites with good potential for root development. Avoid impermeable layers and water saturated soils. Wind throw often indicates unstable stands and sites.
- Choose sites with a sufficient choice of trees with big diameters. Avoid dense stands with tall and slender trees. Wind fracture areas indicate stands with insufficient strength.

2. Tree selection and assessment of suitability

- Choose suitable tree species with regard to risk of girdling (low increment growth rates), susceptibility to superficial damages (good compartmentalizers), pressure application at attachment points (thick bark), and capacity to bear additional forces (high compressive strength in the living tissue).
- Choose trees with good vitality in order to enable compensation growth.
- Ensure sufficient load bearing capacity in the ropes course; consider attachment height, tree height, stem diameter, and species-specific strength properties.
- Assess stem strength and root stability in storms, e.g. by using http://treecalc.arbosafe.com or other means to determine safety factors against wind loading.
- Inspect for defects and signs for structural weakness—if in doubt, advanced inspections may be required.
- Check for habitats and specimen of endangered or protected species.

3. Construction of the ropes course

- Protect the trees (root zone, stem, crown) from damages during the construction period, e.g. soil compaction, mechanical impact, phytotoxic substances.
- Use root protection layers for paths and assembly areas.
- Choose tree-friendly attachment systems. Wrapping around the stem will not always be less damaging than using bolts. The attachment method should be selected according to the following criteria:
  - The tree's ability to compartmentalize damages and compensate for strength loss
  - Decay already present in the wooden body
  - Annual increment growth at the attachment points

  - Accommodate for the requirement to adjust attachments
  - Expected static loads from the ropes course (average and extreme) and susceptibility of bark and the entire tree against infestations
- Minimize bending moments on the stem. Use guy wires to stabilize trees by converting bending loads into axial compressive forces.
- Never pull V-shaped unions apart. Use the backward leader for the attachment in order to keep the union under pressure instead of tension.
- Be aware of complex dynamic reactions of trees after connecting trees in a stand. As a solution, use dynamic cables to minimize forces and avoid stress concentration points.

4. Maintenance

- Avoid damages to bark and wooden parts by installing protective covers, mats, and shields.
- Monitor the use of the paths and assembly areas in the root protection zone and, if required, install further barriers to channel the visitors' movements.
- Annually inspect trees used as anchor points in the load bearing structure. Re-inspect after exceptional events (windstorms, ice) for signs of recent failure.
- Inspection and maintenance of the attachment points in order to avoid girdling and growth depressions.

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