

# THE FOREST OF THE LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN: SERVING TEACHING AND RESEARCH

GERHARD MÜLLER-STARCK, STEFAN FRIEDRICH, THOMAS KNOKE

## **Abstract**

In this study, the historical peculiarities and the site conditions of the forest of the Ludwig-Maximilians-Universität, München, Germany, are surveyed. Results from an extended forest inventory, which includes students' contributions, are summarized. Guidelines for current and future forest management are also discussed.

The university forest supply manifold opportunities for teaching and training. In addition, they can be utilized efficiently for corresponding research projects. These forests bridge the gap between academic educational targets and actual practice. Interdisciplinary issues, research networking and links to the job market are significant requirements as well.

Direct ownership by the respective university or by any other educational institution helps substantially to realize objectives in teaching and research. In the case of external ownership, long-lasting contracts and flexible management regulations, which grant scientific and educational liberties, are essential.

**Keywords:** University forest, in-forest training, forest inventory, forest management, teaching, internship, research projects, ownership.

## **History and site**

During secularization, the forests of the Monastery of Seligenthal (Landshut) were assigned to the Ludwig-Maximilians-Universität München (LMU) by the Elector Maximilian Joseph, ("Kurfürst") in the year 1802. During the 19th century, parts of this university forest were sold. The remaining area amounts to a total of 478 ha (432.5 ha woodland).

This university forest today serves as a learning tool for students, particularly of the Study Program Division Forest Science & Resource Management, Technische Universität München (TUM). It is also utilised for research projects. The forest (see Figure 1) consists of two parcels, i.e. "Bocksberg" (87.8 ha woodland), and "Klosterholz" (344.7 ha woodland), situated 6 km from each other. Even after the transfer of the Faculty of Forest Science from LMU to TUM, this forest is still owned by LMU and managed independently from the State Forest Service. It is

supervised by personnel of the Study Programme Division Forest Science & Resource Management, currently Prof. Dr. Thomas Knoke, (TUM).

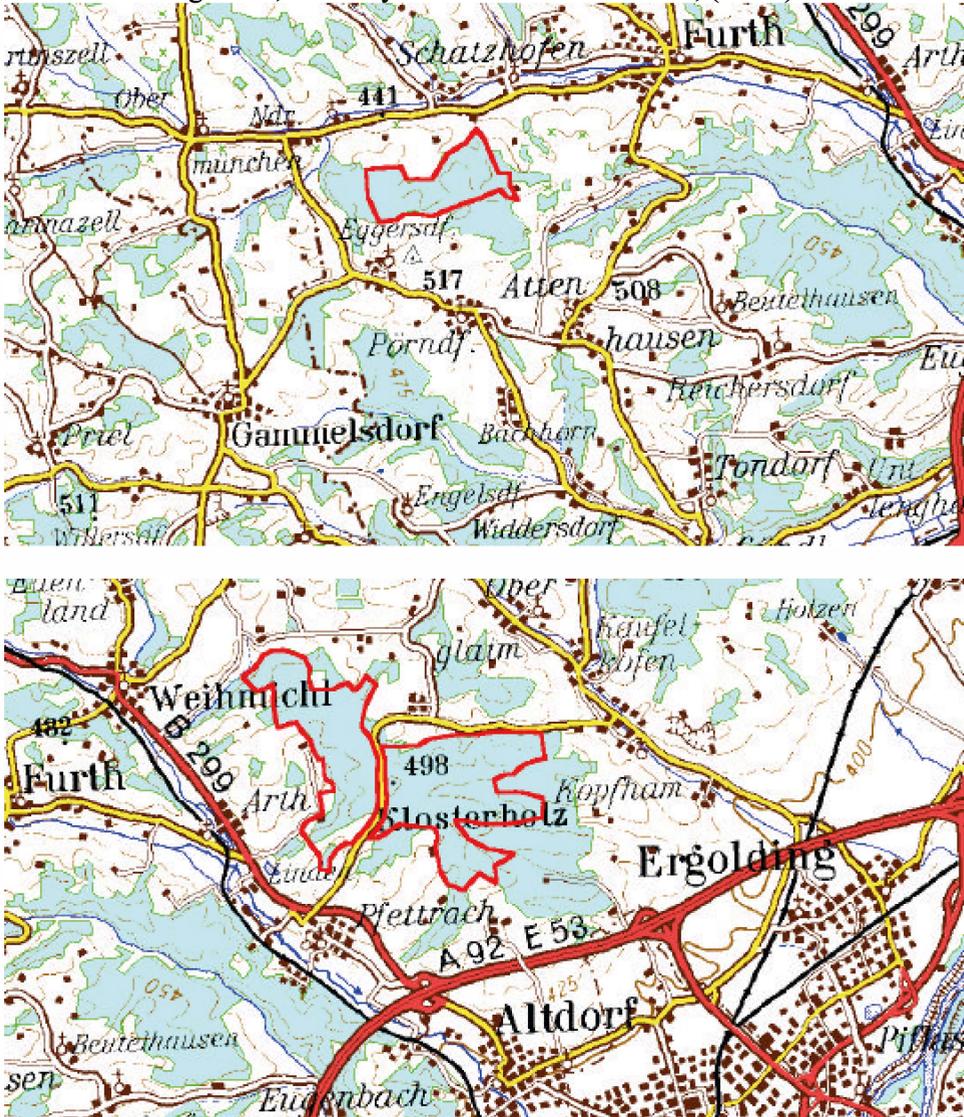


Figure 1: Location of the forest sections “Blocksberg” (above) and “Klosterholz” (belowright), 50 km northeast of Munich nearby the town of Landshut. Forests are encircled in red.

The university forest geographically belongs to the zone of the “Tertiäres Hügelland“. The regional natural forest vegetation is part of the *Fagus-Abies* forest zone. There, temperatures are slightly higher than the Bavarian mean values and precipitation is lower: average annual temperature is 7.8 °C (15.7 °C during vegetation period), annual precipitation is 700 mm (280 mm during vegetation period). On sandy soils, water can become a minimum factor. Still, site conditions offer excellent growing conditions for Norway spruce.

## Forest inventory and management

In both districts, the university forest consists of stands of various deciduous and coniferous tree species, among which Norway spruce (*Picea abies*) is the predominant species (see Figure 3). Most of the species are represented in a large variety of age classes. In Figure 2, the complexity of stand structures is illustrated by the example of “Klosterholz”.

In most of the operations which deal with the inventory and the management of this complex university forest, students are involved. This input is a significant part of in-forest training of students (see subsequent chapter).

The impacts of forest management on the species composition are substantial. These impacts are illustrated by contrasting the results of an inventory in the year 2002 with those of the subsequent one in 2016 (see Figure. 3).

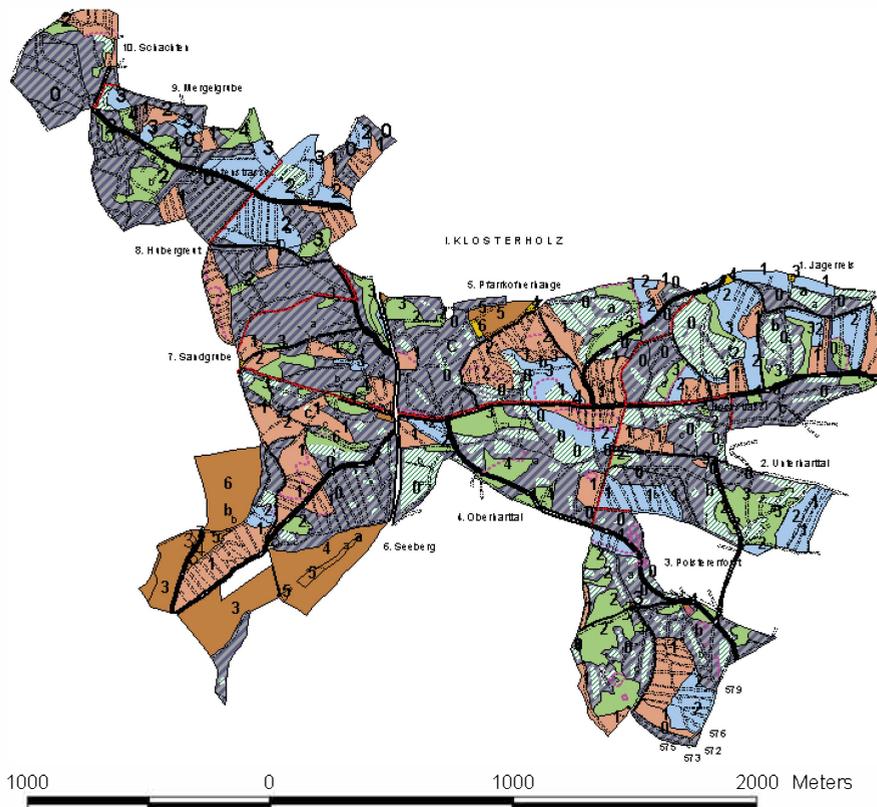


Figure 2: Forest planning map of the “Klosterholz” illustrating the small scale treatment units. Hatching indicates the oldest units.

A substantial reduction of the portion of Norway spruce is clearly indicated, when the value of 46.3% from 2016 is compared to the value of 59.3% from 2002 (Friedrich *et al.*, 2017). This is a remarkable change within a time interval of only 14 years. Pine and Larch species reveal only small reductions in their respective areas, whereas Douglas fir (*Pseudotsuga menziesii*) and Silver fir (*Abies alba*) have a higher share of the forest area. Generally, deciduous tree species benefit from the reduction of the portion of Norway spruce. This is especially true for European beech (*Fagus sylvatica*).

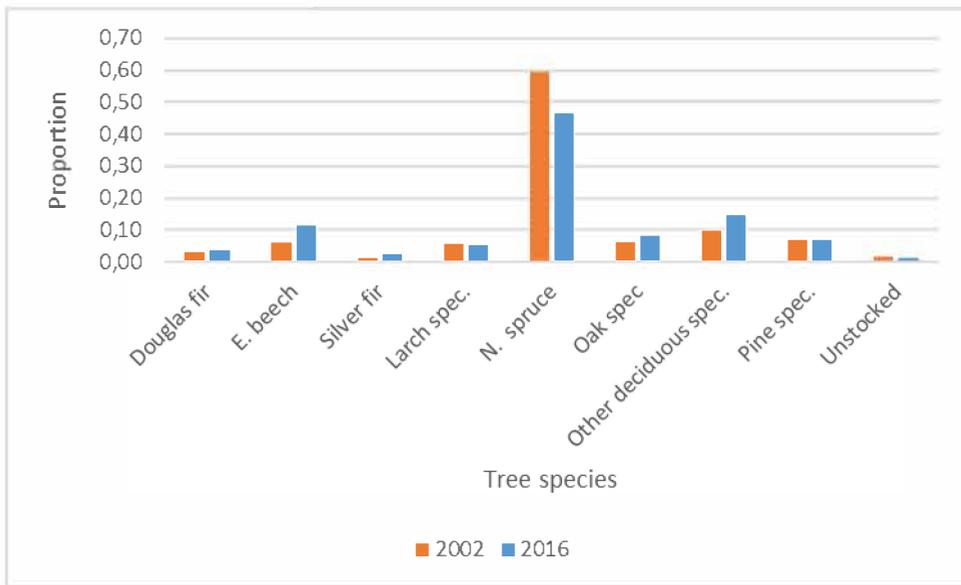


Figure 3: Proportions of tree species in the university forests (“Blocksberg” and “Klosterholz” together) in the years 2002 and 2016 (adapted from Friedrich *et al.*, 2017).

Figure 3 demonstrates the change in the silvicultural treatment of the university forest. There an abandoning of a management strategy concentrating on spruce towards one which is intended to adapt to climate change with a broader portfolio of tree species is evident. Two strong drivers behind these changes were the high volumes of unplanned harvests due to storm damages and the ensuing bark beetle infestations.

Another trend concerning forest management in the university forest pertains to the distribution of the age classes of the forest stands. Again, the situations of 2002 and 2016 are taken into consideration. Figure 4 illustrates dynamics with respect to seven age classes, each of which is comprised of 20 years. Within the total of 140 years, changes are evident in terms of a decreasing representation of classes six and seven (100-140 years) and an increasing representation of the middle age classes, following utilization.



Figure 4: Distribution of age classes in the university forest ( “Blocksberg” and “Klosterholz” pooled) in the year 2002 in contrast to 2016 (Friedrich and Knoke, 2017).

In more detail, the increment and mode of forest utilization within the time interval of 2002-2016 was assessed as follows (timber without bark):

- Change in standing volume:  $-52 \text{ m}^3\text{ha}^{-1}$  to a total standing volume of  $333 \text{ m}^3\text{ha}^{-1}$
- Extraction and natural losses:  $13,4 \text{ m}^3 \text{ ha}^{-1} \text{ year}^{-1}$
- Increment:  $9,6 \text{ m}^3\text{ha}^{-1} \text{ year}^{-1}$

The financial situation is beneficial for LMU because of extensive wood extraction, even despite the high volume of unplanned harvests. The financial yield since 1978 is 4.4 m. Euro, i.e. on average 277 Euro per ha per year. The corresponding value for the interval 2003-2015 is 405 Euro per ha per year. In the year 2015, 970 Euro per ha were achieved.

The investments in regeneration are low because Silver fir and Norway spruce are regenerated naturally. European beech and Douglas fir are planted only for completion of stands (actions taken in response to severe damages following windthrow and bark beetle infestation).

### Teaching and research

The university forest is utilized in various ways:

#### *Excursions and training courses*

Regularly, students of the TUM School of Forest Science and Resource Management make themselves familiar with the silvicultural challenges, caused by

a small scaled forest structure with uneven aged stands of different deciduous and coniferous species. When taking related fields such as hunting into consideration, Forest Management is often a major topic of discussion. Excursions and training courses form significant elements of in-forest teaching and thus underline the necessity of the practice of incorporating forest curricula as claimed by Schmidt *et al.* (2016). Consequently, the access to training grounds provided by universities and demonstration forests is essential. For corresponding perceptions of the TUM School of Forest Science and Resource Management see Weber and Müller-Starck (2016).

#### *Involvement of students in forest inventory and planning*

In most of the actions which deal with the inventory and the management of this complex university forest, students are involved. The forest inventory was conducted by professionals and assisted by students. Management strategies are developed with input from Master's and Bachelor's theses. These actions play a significant role in the in-forest training of students.

#### *Examinations and theses (Bologna Cycles 1-3: BSc, MSc, PhD)*

Exams are regularly held in the subject of "Forest management" twice per year. Silvicultural courses are given five times per year.

Four recent Bachelor's theses deal with forest operations like thinning or regeneration (1), an economic analysis of the stock of dead wood (1) and with tending strategies in stands of *Fagus sylvatica* (2).

Four ongoing Master's theses address the enhancement of forest inventory methodology and one completed thesis tested regression models for regeneration on the inventory's data set. Currently, three PhD theses deal with this university forest, using data gained from the permanent and intensive forest inventory in economic models.

#### *Research and corresponding networking*

The owners and managers of the university forest provide open access to information concerning natural and financial data for research. This is done especially well in comparison to other public or private forest enterprises where data will not be released. Researchers therefore find good prerequisites for studies in the university forest. One example is the potential of carbon sequestration in existing forests (Knoke and Weber, 2006).

Current research projects deal with seeding experiments (*Fagus sylvatica* in cooperation with the University of Göttingen) and the testing of non-indigenous tree species (*Cedrus libani*, *Juglans spec.*). In addition, percolating water in forest soils is a focus in this research (cooperation with TUM/Hydrology). Research networks deal with renewable energy projects (wind). The results from research projects and monitoring data are communicated to representatives of governmental and non-governmental institutions and forest management collectives such as the Bavarian Forest Society and the German Forest Society.

## Conclusions

The university forest, which consists of two parcels, is relevant for teaching in various ways: TUM study programs benefit from its peculiarities (species richness, small scaled structure) and the opportunities it presents for in-forest teaching. Thus, the practical relevance of forestry curricula is underlined. Moreover, forest management is flexible, therefore challenging silvicultural concepts such as modification of the species composition and the age class distribution can be tested. Corresponding research projects are expected to stimulate teaching and to increase the benefits of this forest for the university. During the near future, more effective and less time consuming methods of forest management planning will be the focus.

The uncommon arrangement of ownership by the LMU and management by the TUM does not interfere with the benefits of this forest for teaching and research. In this forest, management is granted a large amount of liberty by the university forest's owner (represented by the financial board) and is not restricted as could be the case when the ownership of a university forest delegates management to a second party. The LMU/TUM forest constellation supplies the necessary degree of freedom in order to optimize the utilization of this university forest for students, researchers and people who are included in corresponding networks.

University forests must be efficient in order to connect academic educational targets with practice. Criticism from forestry practice is well known. It includes statements such as: teaching and the resulting competence of graduates is too theoretical and too far removed from the practical situations of working life. In-forest teaching and active participation in forest management tasks will efficiently help to close such gaps. In addition, contact with representatives of governmental and non-governmental institutions and enterprises, respectively, via the university forest will promote links to the job market.

Generally, any constellation of ownership and management of university forests needs long-lasting contracts and flexible management regulations.

### *Acknowledgements*

We greatly appreciate the proof reading by Michael Du.

## References

- Friedrich, S., Döllner, M. and Knoke, T., 2017: Permanente Stichprobeninventur im Universitätswald der TUM. *Allgemeine Forst Zeitschrift für Waldwirtschaft und Umweltvorsorge* 72 (19), 13 - 14.
- Friedrich, S. and Knoke, T., 2017: Results of the third permanent forest inventory in the Ludwig-Maximilians-University's forest. Freising, Internal Report, Institute of Forest Management, Technische Universität München, pp. 19.

- Knoke, T. and Weber, M., 2006: Expanding Carbon Stocks in Existing Forests - A Methodological Approach for Cost Appraisal on the Enterprise Level. *Mitigation and Adaptation Strategies for Global Change* 11: 579-605.
- Schmidt, P., Lewark, S., Müller-Starck, G. and Ziesak, M. (Eds.), 2016: Practice Orientation in Forestry Curricula in Universities and Universities of Applied Sciences. *SILVA Publications* 12.
- Weber, M. and Müller-Starck, G., 2016: Contemporary understanding of practice orientation – a view from the School of Forest Science and Resource Management of the Technische Universität München. Pp. 17-23 in Schmidt, P., Lewark, S., Müller-Starck, G. and Ziesak, M. (Eds.): Practice orientation in forestry curricula in universities and universities of applied sciences. *SILVA Publications* 12.