ROADSIDE TREES – AN IMPORTANT ELEMENT OF THE OPEN AREAS' LANDSCAPE

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Abstract

Tree plantings accompanying communication routes fulfil several technical, aesthetic and environmental functions. In the past, in open areas, they visually marked the route of the road (identification of the local road in the landscape thanks to regular trees - important in winter), protected against unfavourable weather conditions (excessive sun, strong wind, heavy snowfall), emphasized the importance of the space (representative roads, main entrances to villages, cities, residences). Properly shaped (proper structure and adaptation to the spatial context) allows for shaping landscape interiors, exposing an attractive spatial scenery or covering unattractive objects and views. The change and diversity of plant plantings along roads affect the safety of their users - it prevents monotony and driving fatigue. They have a clear environmental impact (protecting surrounding areas against noise and pollution), especially when part of a coherent system of mid-field trees. Ancient avenues are an essential and valuable element of the cultural landscape. In Europe, roadside tree plantings have a long tradition as a permanent landscape element. In some countries, the accelerated development of the road network in recent years has changed the established order of space organization along expressways and highways.

Keywords: plants along roads, landscape, environment

Introduction

In the landscape of open areas, trees accompanying communication routes play a unique role. In addition to environmental functions, this type of tree stands have purely utilitarian importance, they have long been identified - and used for centuries (Majdecki 1993), and they visually mark the route of the road (e.g. identification of the road in the landscape thanks to regular trees - important in winter), they protected against unfavorable weather conditions (e.g. protection against excessive sun, strong wind, intense snowfall), emphasized the importance of the space (e.g. representative roads, main entrances to villages, cities, residences) (Fortuna-Antoszkiewicz, Łukaszkiewicz 2012). Properly shaped trees (proper structure and adaptation to the spatial context [Fortuna-Antoszkiewicz 2002]) have a landscape significance - they allow for exposing an attractive landscape or covering unattractive objects and views. For travelers, it is the sequences seen from the road that are often the first or even only contact with a given region and the surrounding landscape, and such an image is remembered (Fig. 1). The variety of forms and changes in the rhythm of plantings along roads affect the safety of their users - they counteract monotony and driving fatigue (Graffstein 1989). The presence of ancient avenues is a valuable element of the cultural landscape in the historical dimension (protection of the cultural landscape) and also proves the maturity and sensitivity of the area's owners - to the beauty of the landscape and the value of natural elements (Fortuna-Antoszkiewicz 2019; Fortuna-Antoszkiewicz, Łukaszkiewicz 2016, 2017, 2018).

Author's research

The authors conduct many years of research in selected agricultural areas of Poland (main research site: central Poland - Mazovia). Roadside tree stands are observed in their arrangement and spatial structure - object and overall systems (independent element or part of a more extensive area system). Roads and their surroundings in other European countries are subject to comparatively systematic observation. At the same time, research on the history and tradition of introducing roadside trees in Poland is continued - achievements, research facilities, effectiveness of activities (archival research, literature review).

Results

Agricultural areas of Mazovia, local roads. At the research sites, the authors identify forms of roadside tree stands - rows and strips (less common). Generally, these are projects mainly from the 1960s and

1970s, occasionally older ones (the trees are about 100 years old or more). Their gradual degradation is observed; in many places, there is an apparent loss of continuity and a lack of additions. The structures are built mainly by aging plant material (trees in the mature and senile stages), e.g. short-lived species: poplars (*Populus* x*canadensis* 'Marilandica', *Populus* x*euroamericana* Guiner, *Populus* x*berolinensis* (K. Koch) Dippel 'Berlin'), fruit trees (*Malus sp., Pyrus sp.*); longer-lived species: mainly *Tilia sp.*, *Acer sp.*, occasionally e.g. *Fraxinus sp.*, *Quercus rubra*. Due to natural factors (ageing of trees), the first to disappear are tree stands composed of short-lived species and varieties (e.g. *Populus nigra* L. 'Italica', *Populus simonii* Carrière 'Fastigiata', *Populus* x*canadencis* Moench, fruit trees species). There is an apparent fragmentation of tree stands, often by cutting down/removing subsequent sections - the most common causes are lack of improper care (strong, invasive cuts in tree crowns), change in land functions, and new road investments. New plantings are introduced sporadically, mainly in the form of sectional trees - these are additions (e.g. *Tilia sp.*) and are introduced relatively locally and on a facility-by-object basis (e.g. historical avenues). A similar problem occurs in other regions of the country.

National roads in Poland. Over the last few years, new road investments have been successively implemented - subsequent sections of highways and national roads are being put into operation. These long-awaited projects undoubtedly improve local and supra-regional communication, enabling efficient domestic and international road transport. At the same time, it is associated with a negative impact of the investment on the surroundings through the emission of noise and pollution, as well as fragmentation of the area. In the vicinity of new national roads, concerning the previously developed principles of using trees and shrubs as protective structures, a significant change is observed:

- limiting the use of tall vegetation as road framing / minimal share of tree plantings - mostly these are row arrangements that are not very diverse, often with excessively dense planting spacing (→ maintenance problems in the future);
- visual dominance of technical solutions (acoustic screens) - used on long sections, often at the very edge of the road (no space for introducing vegetation) (Fig. 13); in some places, the screens are "planted" with vines (currently in various stages of development), which over time will somewhat mask the aggressive presence of this form of cover (Fig. 14).

Acoustic protection, such as screens, are created to protect areas classified in local development plans or based on the commune's classification as areas subject to acoustic protection. So, in theory, one of the essential elements of the investment process is environmental protection. Meanwhile, on roads managed by GDDKiA[7], noise barriers have an area of over six mln m² (it is constantly growing) (https://www.gov.pl/web/gddkia/ekrany-akustyczne-przy-drogach---co-mowia-przepisy), which, taking into account the area of the entire road structure (separated strip of land with roads, roadsides, parking lots and various road technical facilities) significantly increases the impact of road investments on the environment, creating a vast biologically inactive surface. The vines growing on the screens will, over time, minimize this vital problem, which is growing in the face of the climate crisis. Acoustic screens are gradually becoming an increasingly prominent spatial element on a national scale, strongly emphasizing the route as an engineering structure that strongly interferes with the surroundings. In the context of protection and preservation of landscape values, long sections covered with acoustic screens have a negative impact on the physiognomy of a given area.

Acoustic screens are used to reduce noise, but their impact on reducing traffic pollution is practically negligible. The phytoremediation effect is demonstrated by biofilters, including the largest of them - trees, which can directly capture dust particles and also contribute to the reduction of gaseous pollutants in the air, e.g. CO, NO_2, NH_3 (Sadowiec and Gawroński 2013). The simplest, oldest and most effective way to reduce pollution is to plant endangered areas, in this case, the surroundings of roads, with trees with dense foliage (Bell and Treshow 2004) - the more extensive the plant belt, the more effective its impact. As has been found for a long time, the concentration of pollination in a tree-covered area decreases by up to 10%, while in an area with a similar area but without trees, it decreases only to 50% (Niemirski 1973). So, planting rows of trees and shrubs, or preferably diverse strips of trees, is a much more universal solution - it limits the spread of traffic pollution while providing acoustic protection.

Discussion

Observing the landscape of non-urban areas in other European countries (e.g. UK, Czech Republic and Germany), it can be concluded that maintaining roadside trees is a standard for shaping and

[7] GDDKiA - Generalna Dyrekcja Dróg Krajowych i Autostrad (*General Directorate for National Roads and Motorways*) / The national roads in Poland managed by GDDKiA currently total 17 791 km (https://www.gov.pl/web/gddkia/ogolne-informacje-o-sieci-drog-krajowych).

using such areas (Figs. 1-2, 5-6). A model level of shaping and permanent maintenance of tree stands on various types of roads is represented, for example, by England (Fortuna-Antoszkiewicz, Łukaszkiewicz 2016) (Figs. 3-4, 11-12). It is due to the strongly respected tradition, but also to the awareness of the benefits of extensive plant systems accompanying roads - effectiveness in limiting the spread of traffic and noise pollution, and positive impact on the landscape. In various countries, there is a constant presence of mature and older woodlots, which are controlled and protected (Fig. 6), as well as activities involving their supplementation and renewal, as well as the successive introduction of new plantings. Natural covers in the form of various plant systems dominate in open areas around highways (Figs. 9-10). For example, Ukraine is a country where systemic roadside tree plantings have been introduced over the years as an essential element of protecting vast agricultural areas (Fig. 7-8).

Conclusion

- Original research has shown that in selected research areas, the following is observed:
  - agricultural areas of Mazovia region, local roads: gradual degradation of existing roadside tree resources - ageing of trees and disappearance of shrubs, losses in plantings and lack of replacements; cutting/removing individual structures and, above all, lack of systemic continuation (no new plantings); a similar problem occurs in other regions of the country;
  - surroundings of new national roads: low share of tree plantings (mainly little-differentiated row arrangements with excessively dense planting spacing) and visual dominance of technical solutions (acoustic screens) used on long sections.
- The lack of systemic trees on national roads and their replacement only with a technical form (acoustic screens) leads to **the deformation of cultural landscapes**, i.e. to a reduction in their physiognomic value and, consequently, in the tourist attractiveness of a given region (social and economic aspects). Moreover, abandoning tall vegetation along communication routes and running roads on long sections in "corridors" covered with screens **significantly reduces the safety of road users** (weariness with the monotony of the view), which especially applies to people travelling long distances.
- Meanwhile, road trees in open landscapes perform several essential protective functions of significant landscape importance. Appropriate spatial structure of tree stands near roads (location, form of tree cover, internal structure, spatial arrangement) and appropriate selection of tree/shrub species - **ensure the effectiveness of their impact** → landscape and protective function (limiting pollution, ensuring safety).
- **Various tree stands** adapted to the spatial context (landscape) and environmental conditions (topography, climate, soil, water, and habitat conditions) ensure the stability and durability of plant systems, and the road—depending on the situation—can be highlighted or harmoniously "embedded" into the surrounding landscape.

LOCAL ROADS

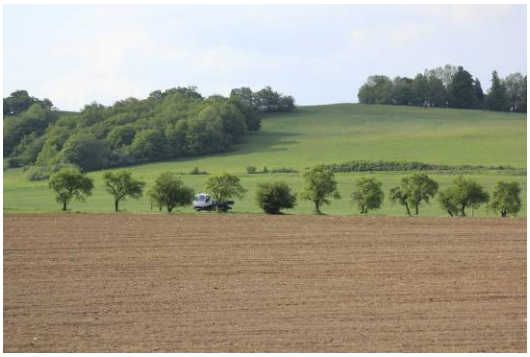


Fig. 1: **Czech Republic, Moravia** / local road planted with fruit trees - cultivating traditions and effective protection of landscape values [J. Łukaszkiewicz, 2018]

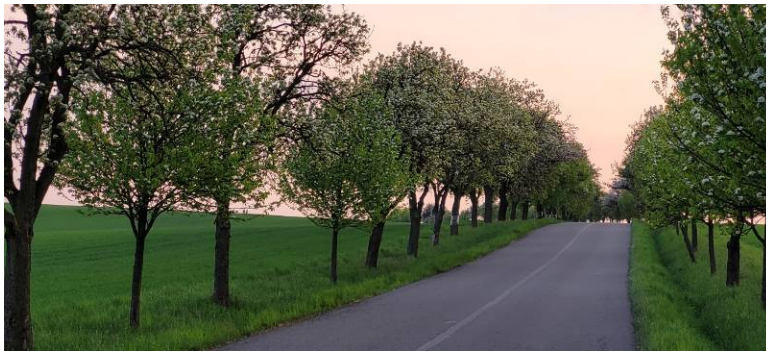


Fig. 2: **Czech Republic, Moravia** / local road in agricultural landscape - surrounded by *Malus sp.* fruit trees with high decorative and biocenotic values [P. Wiśniewski, V 2022]

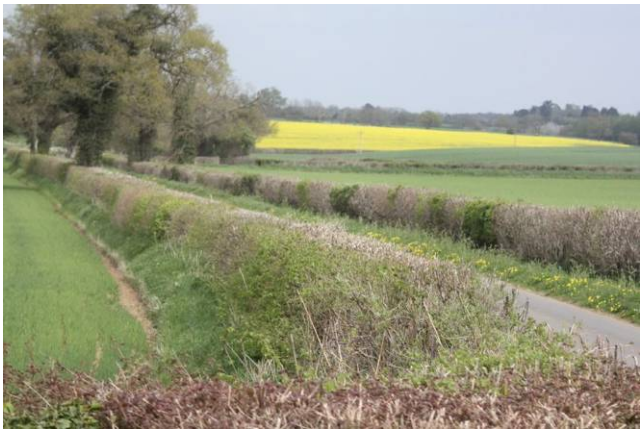


Fig. 3: **UK, Surrey county** / local road lined on both sides with hedges and trees of various species - tradition in a modern landscape [J. Łukaszkiewicz, IV 2015]

Fig. 4: **UK** / local road in a hilly landscape and roadside trees in a linear, two-sided form – the protection of farmland and historic landscape [J. Łukaszkiewicz, 2007]

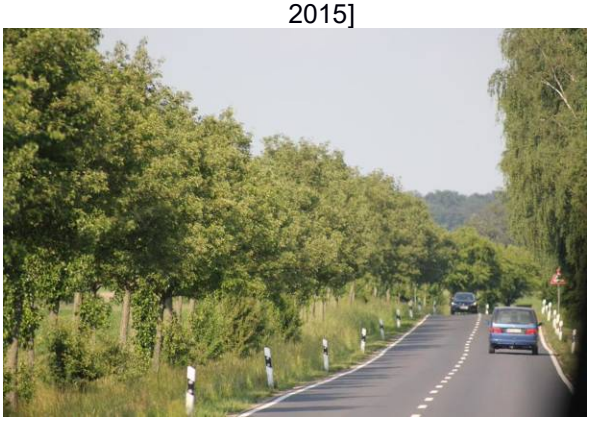


Fig. 5: **Germany, Brandenburg** / local road - fruit trees (left)
with additional belt trees of other species, including: silver birch (right) [J. Łukaszkiewicz, V 2018]

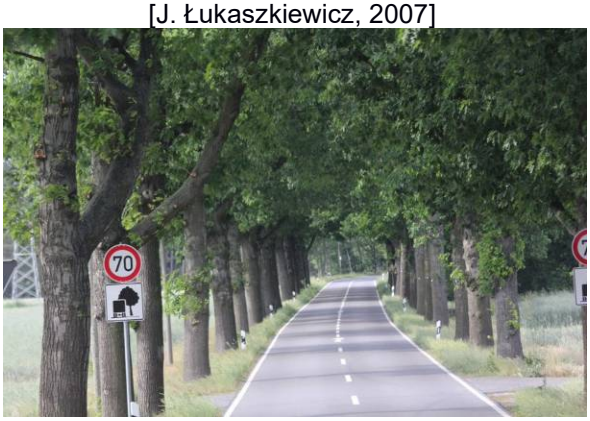


Fig. 6: **Germany, Brandenburg** /the cover of valuable, historical red oaks gives an effective protection along the local road
[J. Łukaszkiewicz, V 2018]

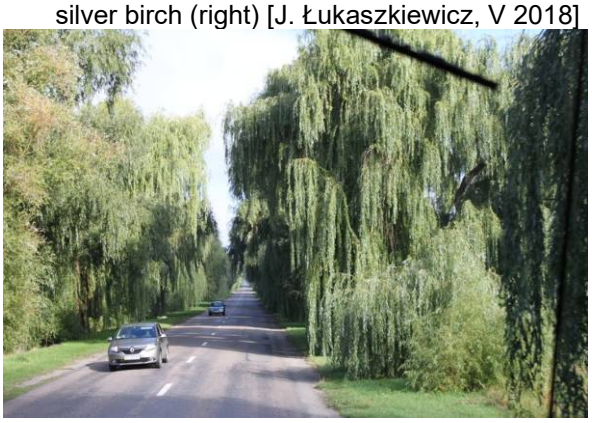


Fig. 7: **Western Ukraine** / local and supra-regional road –representatively planted with weeping willows [B. Fortuna-Antoszkiewicz, IX 2013]

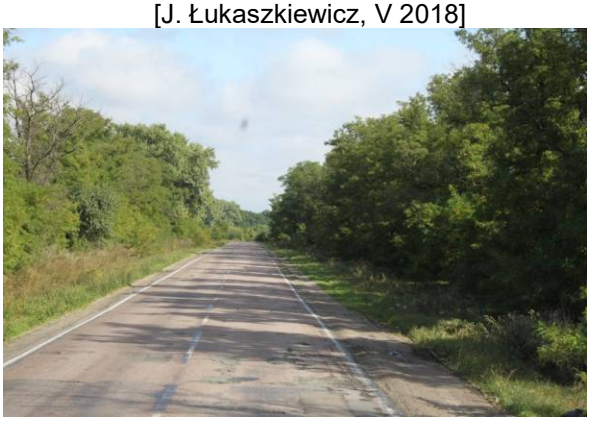


Fig. 8: **Western Ukraine** / roadside woodlots in agricultural areas (field protection) – strip form, double-sided, dense, multi-species [B. Fortuna-Antoszkiewicz, IX 2013]

NATIONAL ROADS

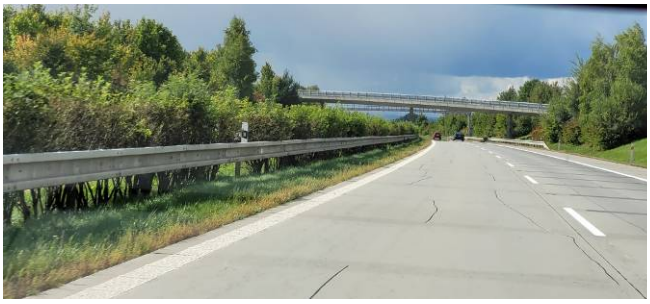


Fig. 9: **Czech Republic, Moravia** / diverse woodlots arranged on slopes along the road and a hedge between the lanes as an anti-glare shield [P. Wiśniewski, IX 2022]

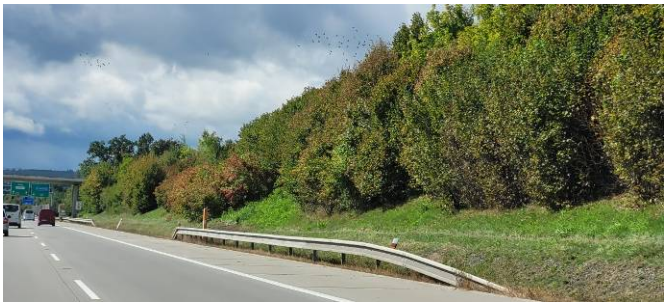
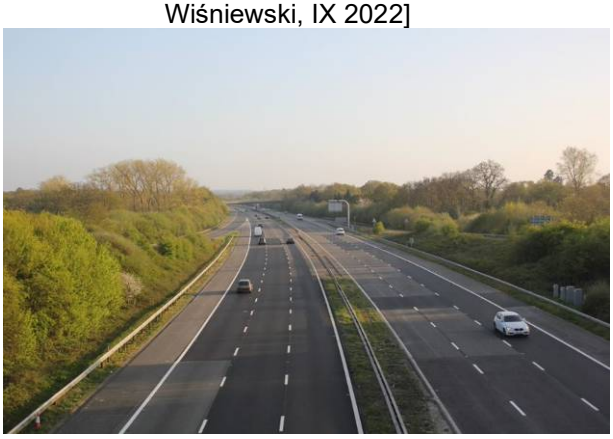


Fig. 10: **Czech Republic, Moravia** / diverse, dense belts of trees on slopes effectively reduce traffic pollution [P. Wiśniewski, IX 2022]



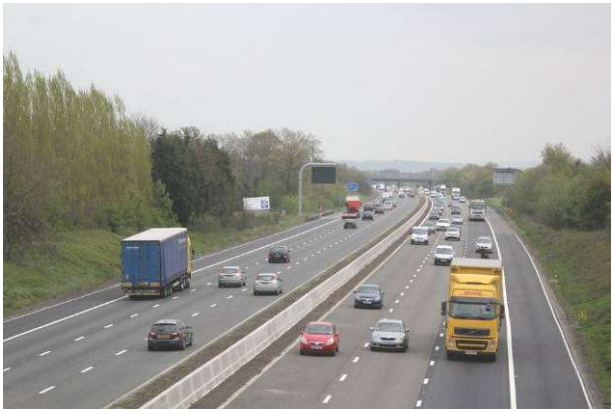


Fig. 11-12: **UK, Surrey county** / diversified arrangements of woodlots instead of linear screens along the M25 motorway, aimed for → traffic pollution's reduction, noise shielding and "blending" the road into the surrounding landscape [J. Łukaszkiewicz, IV 2015]

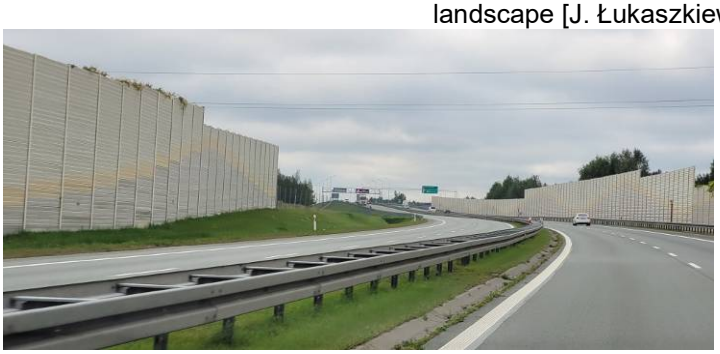


Fig. 13: **Poland** / currently an increasingly typical situation - many kilometers of noise barriers along highways and expressways - limited view and the visual monotony [P. Wiśniewski, IX 2022]

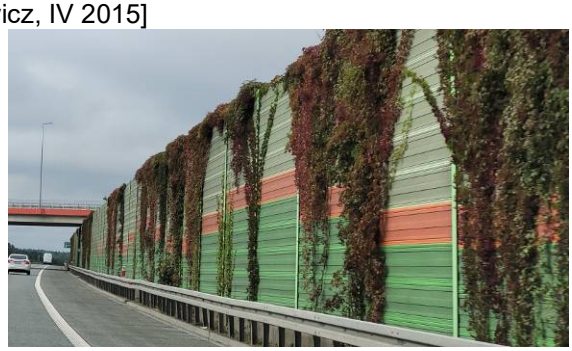


Fig. 14: **Poland** / typical situation - screens located right at the edge of the road - vines (occurring fragmentarily) as the only option for the roadside vegetation [B. Fortuna-Antoszkiewicz, IX 2022]

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Souhrn
Výsadba stromů doprovázejících komunikace plní několik technických, estetických a ekologických funkcí. V minulosti ve volné krajině vizuálně vyznačovaly trasu komunikace (identifikace místní komunikace v krajině díky pravidelným stromům - důležité v zimě), chránily před nepříznivými povětrnostními podmínkami (nadměrné slunce, silný vítr, husté sněžení), zdůrazňovaly význam prostoru (reprezentativní komunikace, hlavní vstupy do obcí, měst, sídel). Vhodně tvarované (správná struktura a přizpůsobení prostorovému kontextu) umožňují utvářet krajinné interiéry, exponovat atraktivní prostorovou scenérii nebo zakrývat neatraktivní objekty a pohledy. Obměna a rozmanitost výsadeb podél komunikací ovlivňuje bezpečnost jejich uživatelů - zabraňuje monotónnosti a únavě z jízdy. Mají zřetelný vliv na životní prostředí (chrání okolí před hlukem a znečištěním), zejména pokud jsou součástí uceleného systému středoplošných dřevin. Staré aleje jsou zásadním a cenným prvkem kulturní krajiny. V Evropě mají stromořadí u silnic dlouhou tradici jako trvalý krajinný prvek. V některých zemích zrychlený rozvoj silniční sítě v posledních letech změnil zavedený řád organizace prostoru podél rychlostních silnic a dálnic.

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