Promotion of Road Greening (Roadside Trees and Slope Greening)





Roadside trees planted in road spaces have a wide range of functions, such as providing shade and nice scenery, preserving the living and natural environment, traffic safety, and disaster prevention. In addition, roadside trees are also expected to play a role as carbon dioxide sinks in urban areas because climate change is becoming a more serious issue today.

Every five years, the NILIM surveys and compiles the number and species of roadside trees in order to grasp the current status of road greening in Japan and to provide basic data for road greening projects. Until recently, the number

() Total r 6 6 800 Number of trees per road length (trees/km) Number of roadside trees (ten thousands) 700 679 667 621 600 500 478) 40 400 371 300 200 100 0 1987 1997 2017 1992 2002 2007 2012 Figure 1 Number of roadside trees

of roadside trees had been increasing nationwide because of the active implementation of roadside tree maintenance, but in recent years, the trend has leveled off (see Figure 1. The number of trees nationwide was approximately 6.7 million as of March 31, 2017, but has been repeating a slight increase and a decrease since 2002.)

(2) Roadside tree preservation and rehabilitation

The following problems can be considered for roadside trees that have been planted for a long period of time: large growth of roadside trees in a limited road space causes traffic obstructions, such as obstructed visibility and root systems that lift up the pavement, impeding pedestrian traffic; the declining health of roadside trees due to trimming to reduce the size of the trees; and some toppling and falling branches occur during typhoons and other strong winds. In addition, for roads where the surrounding land use has changed significantly since the roadside trees were planted, there is a need to reconsider whether the trees are needed and change the maintenance policy accordingly. In addition, in recent years, there has been a strong demand for cost reduction in public works projects. Roadside tree maintenance has thus become more important as there have been cases of neglected roadside tree management.

In addition, the road greening technical standards revised in March 2015 indicate the necessity of checking for abnormalities and investigating the health of roadside trees, and the implementation of appropriate response measures, including replacement. In light of this, the NILIM has been engaged in surveys and research on the inspection and diagnosis of roadside trees, countermeasures against falling trees, and conservation and rehabilitation and has developed various guidelines for road administrators.

(3) Promotion of slope greening in consideration of the local ecosystem

In the construction of roads, parks, rivers, dams, etc., it is becoming increasingly important to cover the surface of the slopes with vegetation, not only to prevent surface erosion caused by wind and rain but also to blend in with the surrounding environment and landscape.

The slope greening work can cover bare slope surfaces in a short period time with vegetation to quickly gain the erosion prevention effect. The main way of greening has been the use of foreign grasses because their seeds can be obtained inexpensively and systematically in large quantity. However, the slope greening work has shifted to using seeds of native herbaceous and woody plant seeds. However, because of the lack of a system for mass production of the seeds of native plants in Japan, the majority of plants now used are actually nonnative species or native species produced outside of Japan but labeled as native species that are available at low cost. It was also noted that some native species, even those produced and harvested in Japan, have different genetic characteristics between regions, and that seeds and seedlings from unknown production sites or harvesting sites are being used.

For this reason, the NILIM conducted the following surveys and research on the introduction of slope greening that is friendly to the local ecosystem: (1) method for setting conservation levels and greening targets according to the location environment of the slope surface, (2) how to select a slope greening method according to greening goals, (3) points to keep in mind in greening, and 4) post-greening inspections and vegetation management. The NILIM has also been working to promote and spread the greening that is friendly to the local ecosystem, such as forest topsoil utilization work and natural invasion promotion work as described in the Guidelines for Road Earthworks (2009).

2. Main Research Results

Publication of roadside tree rehabilitation guide

Roadside tree administrators need to respond appropriately to problems caused by roadside trees (such as falling over and falling branches, poor growth, root growth, overcrowding, disease and insect damage, and interference with surrounding facilities) and to changes in the environment surrounding the roadside trees.

In order to address these issues, the NILIM conducted a survey on the current status of roadside trees, greening techniques for conservation and rehabilitation, and methods of cooperation with residents, targeting cases where conservation or rehabilitation was implemented to address problems that had arisen with roadside trees. As a result, the NILIM compiled a guide for roadside tree administrators on how to survey the current conditions of roadside trees, examine policies for dealing with the conditions, conservation, and redevelopment techniques, and build consensus among residents. Along with this, the NILIM is introducing specific examples of initiatives (see Figure 2).

Development of machines for diagnosing roadside tree decay

When roadside trees are affected by wood rotting disease, the wood cells decompose, and the trunk becomes spongy and hollow, increasing the risk of breakage from strong winds and other forces. It is thus important to understand the internal condition of the trunk during tree diagnosis.

To address these issues, the NILIM has developed a decay diagnostic machine that uses γ rays to measure the decay status of trees without damaging the trunks (see Photo 1).



Figure 2 Roadside Tree Restoration Procedures



Photo 1 γ-ray tree decay diagnostic machine

◆ Publication of a guide on how to prevent roadside trees from falling over

Fallen roadside trees and fallen branches are often caused not only by weather damage but also by a combination of factors, such as decay and withered branches due to tree physiology, requiring countermeasures that respond to the factors causing the problem.

Therefore, the NILIM clarified the factors that lead to the occurrence of toppling and fallen branches and compiled a method to

control the occurrence of toppling and fallen branches in the design, planting, and maintenance phases of roadside greening. The NILIM also organized inspection and diagnostic methods, which are positioned to prevent toppling and fallen branches. In addition, the second edition includes new explanations on how to identify abnormalities of roadside trees during road management patrols and inspections, the use of information provided by road users, and considerations for road greening to prevent toppling based on the clarified causes (Figures 3 and 4).



Figure 3 Focus of inspection and diagnosis of roadside trees



Figure 4 Greening method to control the occurrence of toppling and fallen branches (example)

Publication of guidelines for slope greening that conserves local ecosystems

In areas where a favorable natural environment exists, there may be concerns about the impact of construction projects and other activities on the ecosystem, including local flora and fauna. In such cases, it is necessary to mitigate the environmental impact through greening using native species from local strains.

Based on the results obtained from construction experiments and vegetation monitoring surveys at case study sites, the NILIM has compiled a list of methods for setting greening targets and implementation methods for introducing slope greening that is friendly to the local ecosystem (see Figure 5). The list also introduces the status of vegetation establishment at case study sites throughout Japan and provides explanations of plant species commonly found on post-construction slopes by using many photographs.



(1) Collection of topsoil, (2) Mixing the topsoil with vegetation base material and spraying



(3) Immediately after the topsoil application, (4) Six years after the topsoil application

Figure 5 Example of slope greening using topsoil application

3. List of related reports and technical documents

1) The Roadside Trees of Japan VIII (in Japanese). Technical Note of NILIM No. 1050. November 2018. http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn1050.htm

2) Street tree restoration manual (in Japanese). Technical Note of NILIM No. 885. March 2016.

http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0885.htm

3) Manual of the countermeasures for tree failure of street trees (in Japanese). Technical Note of NILIM No. 669. January 2012. http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0669.htm

4) Manual of the countermeasures for tree failure of street trees, Second Edition (in Japanese). Technical Note of NILIM No. 1059. February 2019.

http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn1059.htm

5) Manual of the slope revegetation method for conservation of regional ecosystem (in Japanese). Technical Note of NILIM No. 722. January 2013.

http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0722.htm

6) The Technical Report of Vegetation Method Using Native Plants (in Japanese). Technical Note of NILIM No. 1014. February 2018.

http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn1014.htm

7) Road Greening Technical Standard (in Japanese). Road Bureau and City Bureau, Ministry of Land, Infrastructure, Transport and Tourism. March 2015.

https://www.mlit.go.jp/road/sisaku/ryokuka/index.html

8) Road Greening Technical Standards and Commentary (in Japanese). Japan Road Association. March 2016

9) Guidelines for Road Earthworks, Cutting, and Slope Stabilization Works (in Japan). Japan Road Association. June 2009.

4. Future Outlook

A certain number of years have passed since the introduction of root exposure control measures for roadside trees, and there are more findings and examples available for studying. Therefore, the NILIM will be presenting specific root exposure prevention measures in the future. The NILIM will also organize methods of rehabilitating not only tall trees but also medium-height trees and low shrub plantings, as well as efficient and effective weed control methods.

In addition, the effectiveness of the slope greening work that has been carried out to date while preserving the local ecosystem will be verified to ensure compatibility with the guidelines for road earthworks. At the same time, the NILIM is going to summarize measures and considerations at each stage of design, implementation, and maintenance for the enhancement of slope greening methods that take into account the environmental characteristics of the region.

It is necessary to continue working on road greening, including the issues mentioned above because vegetation is one of the important elements of roads, in order to create roads that are desirable destinations and places to be (from "Road landscape will change in 2040").