

### **SL501** Experimental Techniques for Evaluating the Success of Restoration Projects

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The ecological background of a restoration project is complex and difficult to determine without experimentation. A useful context for experiments is the well-studied process of natural succession, because the factors that drive or inhibit succession are also at work during reclamation (a form of primary succession) and restoration (which often resembles secondary succession). Using experimental studies on urban wasteland reclamation, we have tested for factors that stimulate or inhibit succession during early phases of woodland development in the Northeastern United States. The emphasis has been on mutualisms (seed dispersal, pollination, and mycorrhizae) and microsite limitations in the recruitment, growth, and reproduction of woody plants. Using plantings of seeds, seedlings, and clusters of reproductively mature plants on abandoned landfills, we have observed that (1) soil microsite deficiencies lead to very poor germination (<0.1%) and seedling survival (<0.01%) of most native species; (2) seed dispersal by birds is a significant and reliable source of woody plant recruitment; however (3) proximity effects are strong, with most (up to 95%) of seed rain falling in the vicinity of planted clusters that are closest to putative seed sources; and (4) remnant natural woodlands are critical components of the recruitment process. To emphasize the last point, in one case, we

found that the destruction of approximately 50% of nearby natural woodland vegetation led to a commensurate decline in seed rain. In another case, we found that the species richness of recruits was strictly limited by the species composition of nearby source plant communities, with no evidence of community enrichment by long distance dispersal over 5 years. In contrast, we have found in other studies that pollination and mycorrhizal formation occur even in highly isolated plantings, indicating that these mutualisms may be less dependent on the size or proximity of remnant natural populations.

### **SL502** Rehabilitation ecology by revegetation:

#### Approach and results from two Mediterranean countries

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Human activities greatly affect the environment causing its degradation. Urban development and road networks construction cause main impacts on ecosystems and particularly on vegetation cover: Road constructions induce complete degradation of the vegetation cover and often leaves a bare land sometimes without even a soil cover. Reconstitution of vegetation cover is necessary to limit surficial erosion and land slipping on the road, towards a reintegration of the site in the neighbouring landscape. Many approaches have been studied over the last 30 years aiming at this reconstitution of vegetation cover. At first, the main purpose of land reclamation was to create a new ecosystem. At this time, the environment

created was rather a garden with a new soil adapted to the plantation of decorative species. Then, in early 90s many studies on the restoration ecology concept rather focused on adapting the vegetation to the existing conditions on the site, as in a side road embankment for example. Nowadays, we notice a large tendency towards the use of such adapted native species instead of industrially produced seeds. In southern France, our team have led research on the potentials of those local species for their use in revegetation processes with hydro-seeding. We therefore developed an approach combining the use of different types of species: Industrially produced, native and wild cultivated species. This method integrates the benefits of using available low costing seeds that are already used on large scale projects with better adapted species, issued from the cultivation of native species and seed production for their use on smaller scale and more costly but more effective results. The use of wild cultivated species seeds was developed in order to limit the cost and reduce harsh natural seed withdrawal in the natural environment in the case of the use of native species. Besides the use of such seeds allowed a larger geographical scale of use than with local native seeds. In addition, our team began two years ago

**SL503** Traditional agricultural landscape as an important model of ecological restoration in Japan

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Industrialization and urbanization of the last century has been accompanied by rapid degradation of natural environment in Japan as in most countries. The degradation is affecting the future life of all living things

as well as the present our life. People have been increasingly aware of necessity for maintaining and restoring the natural environment. In order to achieve a rich and attractive natural environment, the extant natural areas should be thoroughly understood and maximized. The first step in this process was to clarify the current status of existing natural habitats and flora and fauna. Next, important habitats and areas must be identified for conservation, protection or preservation. In addition, restoration works, including improvement, reconstruction and creation of natural habitats, should be implemented in areas where the habitats have been destroyed or degraded by human activities. This basic approach to the natural environment is a combination of maintenance and restoration. A sustainable land-use planning, based on ecological inventories of the target area, is desirable. To implement this approach, each target area must first be evaluated in terms of stage in natural succession or artificial degradation. Next, the goals of maintenance or restoration, in terms of the final form of the desired natural environment, must be established. Generally speaking, three choices are available: allowing the natural succession to proceed on its own, checking or stopping the natural succession at its current stage, and artificially promoting the natural succession. Once a target area has been placed in a restoration work, management goals and directions should be set, followed by detailed on-site research and environmental evaluation. Finally, a blueprint and management plan, including zoning plan, key species and communities, maintenance techniques and schedules, facility layout and utilization regulations and a continuous monitoring system, should be designed and implemented. In some cases, changes in the

traditional land ethic, can also serve as field for nature and environmental education. Traditional farming techniques have formed

an ecosystem in which nature and human activities are well harmonized. In the traditional agricultural landscape and its farming system, there are many things our ecologists and restorationists have to learn and apply to the implementation of maintenance and restoration of natural environment. Thus, its landscape must be an important model of ecological restoration in Japan.

**SL504 Landscape ecological approach for the ecological restoration of Seoul Metropolitan area, Korea**

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Ecological diagnoses were carried out by analyzing soil physico-chemical properties, vegetation structure and land use pattern and a restoration plan on the basis of the results was suggested. Soil pollution was evaluated by analyzing soil samples collected in each grid on the mesh map divided by 2km x 2km intervals. Soil samples were collected in forests or grasslands escaped from direct human interferences. Soil pollution evaluated from pH, Sulfate, Ca, Mg and Al contents of soil was severer in the urban outskirts and mild in urban center differently from the former results. That is, soil acidification was severer in the urban outskirts than in the urban center. Those soil environmental factors showed significant correlation with each other. Vegetation in the urban area was different in species composition from that in suburban areas and showed lower diversity compared with that in the suburban areas. Sccessional process investigated by population structure of major species also showed a difference. That is, successional trend was normal in suburban area but that in urban area showed a

retrogressive pattern. Landscape ecological map of Seoul indicates that urban center lacks vegetation. Such uneven distribution of vegetation caused specific urban climate and thereby contributed to aggravation of air and soil pollution and vegetation decline. From this result, it was estimated that such uneven distribution of vegetation played a role of trigger factor to deteriorate the urban environment. I suggested, therefore, a restoration plan based on landscape ecological principle, which emphasizes connectivity and even distribution of green area to solve the synthesized environmental problem.