

Restoring Rich Nature of *Satoyama* (Countryside Forests)

Initiatives for Conservation of Precious Plants

Narita International Airport is located in the northern area of Chiba Prefecture. This area has a unique natural habitat called *yatsuda*, consisting of paddy fields below hill slopes, and a wide variety of animals and plants inhabit it. NAA runs various initiatives to preserve this rich environment of the *satoyama*, which was partially lost due to the construction of the airport. This special feature introduces our efforts to preserve precious plants, such as the golden orchid (*kinran*) which are listed in the Red List published by the Ministry of the Environment.*1



The *yatsuda* habitat nurturing a rich and diverse fauna and flora

Narita International Airport implemented a northern extension development of a parallel runway (Runway B) from 2006 to 2009. During this project, it became necessary to fell trees including a species of the beech family known locally as *konara*. A preliminary field survey found that the planned construction site contained a number of protected species, including the golden orchid (*Kinran*, *Cephalanthera falcata*), and another species of orchids called *ebine* (*Calanthe discolor*), both of which are listed in the Red List*1 published by the Ministry of the Environment, as well as Japanese buckthorn (*Kuroumemodoki*, *Rhamnus japonica* var. *decipien*), which is listed in the Red List of Chiba Prefecture.*2 To preserve these precious plants, we transplanted them under the guidance of experts. The transplantation of golden orchids, which was considered the most difficult, is described below.

*1 Red List of the Ministry of the Environment (list of endangered wildlife species) was compiled by experts on the wildlife inhabiting or growing in Japan, based on the scientific evaluation of the risk of extinction from a biological perspective.
*2 Red List of Chiba Prefecture is a table that summarizes the state of wildlife in danger of extinction and the measures for its protection.

Local Orchid in Need of Protection

Golden Orchid with Bright Yellow Petals

The golden orchid or *kinran* (*Cephalanthera falcata*) is a perennial herb that is found in well-managed mixed forests in *satoyama* (countryside forest) areas. They wake up from winter dormancy in early spring, and their yellow flowers bloom around the airport in early May. This flower's beauty makes it a popular target of observation during nature walks, but its ecology is also special. In addition to photosynthesis, *kinran* is nourished by symbiotic soil fungi (ectomycorrhizal fungi) that reside on its roots. These symbiotic fungi include members of the Thelephoraceae family and the Russulaceae family, and coexist

in a symbiotic relationship on the roots of trees of the beech family such as the *konara* (*Quercus serrata*). In other words, the *kinran* orchid gets part of its nutrients from the roots of trees via fungi, and may not survive on photosynthesis alone. Gardeners consider *kinran* to be difficult to cultivate owing to the complex interactions required for their growth. In recent years, due to the destruction of *satoyama* forest areas, which is their habitat, *kinran* has been designated as an endangered type II (VU) species in the Red List of the Ministry of the Environment, and as an organism under general protection in the Red List of Chiba Prefecture.



Kinran

Transplantation of Golden Orchids

Golden orchids (*kinran*) have a symbiotic relationship with soil fungi and the roots of trees, and digging up the tubers breaks this relationship established over many years. Further, it is necessary to reestablish a new symbiotic relationships in the soil at the transplantation destination. If this relationship does not recover after transplantation, the plants will have to rely solely on photosynthesis, and eventually wither due to lack of nutrition. To reduce this risk as much as possible, we devised various means for transplantation.

Digging Up Tubers

To maximize the chances that the dug up material would include also the symbiotic ectomycorrhizal fungi, we dug up tubers with the surrounding soil along a circumference of 20 centimeters and a depth of 30 centimeters. Moreover, for some of the bulbs, we secured the soil around the roots with a transplantation container with diameter of 30 centimeters and depth of 40 centimeters, and dug up the whole container. In all cases, the dug up plants were transported carefully to prevent the soil around them from falling away.



Forest where plants were transplanted



Transplantation container

Transplanting to New Location

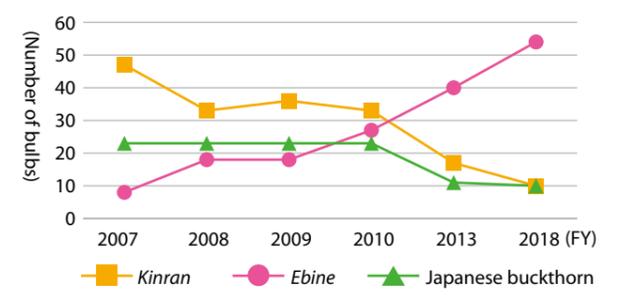
To minimize the burden on the plant during transportation, we looked for a new spot near the current location. We selected an environment with *konara* trees offering similar conditions in terms of solar radiation and soil moisture. A *konara* forest was expected to supply *kinran* with the necessary ectomycorrhizal fungi to reestablish a symbiotic relationship. In the selected forest, planting holes were made to keep soil alteration at a minimum, then filled with the brought-in bulbs.



Transplantation spot

Post-Transplantation Monitoring

Our work continued even after the transplantation. Until the third year after the transplantation, monitoring and maintenance such as removal of deciduous branches and grass cuttings were carried out every year. This work was conducted in the sixth and 11th year of transplantation as well.



The graph above shows the number of bulbs monitored over the past 10 years or so.

Ebine have been reproducing steadily, and the number of bulbs is now nearly seven times the initial value. Growth conditions are satisfactory, with stable flowering and seeding. On the other hand, the number of Japanese buckthorn plants has fallen by close to 40% from the original number. However, the remaining plants have grown big, their growth continues to be good, and they are even producing fruits.

Kinran were expected to be the most problematic. Indeed, their number declined significantly after the third year due to the difficulty of reestablishing their symbiotic relationships. However, even now more than ten years later, about 20% of the orchids are growing satisfactorily, and they have been observed to flower and seed. Further, they are propagating, with new *kinran* being observed away from the transplanted locations. The spontaneous appearance of *kinran* could indicate that the environment at the transplanted locations is indeed suitable for its growth. Based on this, we believe that the surviving plants have reestablished new symbiotic relationships in the soil at the new locations.



Transplanted *Kinran*



Transplanted *Ebine*



Transplanted Japanese buckthorn

In Conclusion

Narita International Airport has been conducting environmental assessments as the airport considers further functional enhancements. The assessment results made us realize the necessity to protect various precious plants from the effects of functional enhancements of the airport through transplantation and other means.

Each target plant such as *kinran*, *ebine*, and Japanese buckthorn, has its own character. Utilizing the knowledge gained from the conservation initiative described above, we will pursue the conservation of precious species by careful treatment according to their ecological characteristics.