

Peter H. Raven, “Engaging North Korea through Biodiversity Protection,” *Science & Diplomacy*, Vol. 2, No. 3 (September 2013\*). <http://www.sciencediplomacy.org/perspective/2013/engaging-north-korea-through-biodiversity-protection>.

**This copy is for non-commercial use only.** More articles, perspectives, editorials, and letters can be found at [www.sciencediplomacy.org](http://www.sciencediplomacy.org). SCIENCE & DIPLOMACY is published by the Center for Science Diplomacy of the American Association for the Advancement of Science (AAAS), the world’s largest general scientific society.

\*The complete issue will be posted in September 2013.

## Engaging North Korea through Biodiversity Protection

*Peter H. Raven*

ONE of the most complex and difficult diplomatic challenges today exists between the Democratic People’s Republic of Korea (DPRK, also known as North Korea) and its immediate neighbors—the Republic of Korea (also known as South Korea) and Japan—and the United States, as the biggest stakeholder outside the region. Even North Korea’s relationship with China, its longtime ally and trade partner, has been strained recently as North Korea continues its nuclear weapons tests. Peace and stability on the Korean Peninsula and in the broader region will rest not only on political resolutions but also on a sustainable future for North Korea with well-managed natural resources and agricultural practices, environmental sustainability, and public health security. Moreover, like its east Asian neighbors, North Korea faces such problems as maintaining clean air and water for public health. This offers an important opportunity for the international community, at the people-to-people level, to support a peaceful and stable future through cooperation and engagement on these issues. North Korea will need the expertise of international scientists in order to tackle these challenges. The biodiversity of the Korean Peninsula is extremely interesting on a world scale; more importantly, from a national or North Korean perspective, it includes the genetic resources most likely to contribute significantly to sustainability in North Korea itself.

## **The Environment**

The DPRK's land area is 122,762 square kilometers; its climate is extreme and highly seasonal, similar to that of northern Wisconsin and North Dakota in the United States. Most of North Korea's territory is mountainous and volcanic, with fertile soils, but on slopes often too difficult to cultivate sustainably. Environmental degradation is widespread.

In 2003, a report was prepared in cooperation with the United Nations to address the environmental problems faced by the country and ways in which they could be alleviated.<sup>1</sup> The report, published by the United Nations Environment Programme, was the product of long-term cooperation between the agency, the DPRK Ministry of Land and Environment Protection, and the United Nations Development Programme. The document constitutes the first comprehensive report on the state of the country's environment. In it, an effort was made to identify key environmental issues that act as barriers to attaining sustainable development and to provide policy settings and options that could mitigate unfavorable environmental trends. The report identifies five priority areas: forest depletion, water quality degradation, air pollution, land degradation, and biodiversity.

Within the DPRK, the population is highly concentrated in the roughly one-sixth of the country that is suitable for agriculture, mainly along the coasts and in river valleys inland. The extensive forests that naturally clothe the country's mountain slopes are heavily used as a source of firewood for energy.

The forests are also often ravaged by fires, landslides, and insect pests. It is probable that global climate change will accelerate the loss of natural forests to pests, as it has done so severely in comparable North American forests. Satellite images reveal that more than 40 percent of the forests in the DPRK have been lost since 1985, most of them converted to low-grade agricultural systems. Firewood from the forests is being used at a faster rate than the forests can support. As everywhere, the depletion of forests—a good proportion of it illegal—leads to flooding and soil erosion, and it is also a major driver of biodiversity loss.

The DPRK has adopted a "Ten Year Plan for Afforestation/Reforestation," intended to rehabilitate two million hectares of degraded forests. The plan explicitly recognizes the need for basing reforestation efforts on sound science, which also should be applied to determine the most efficient ways forests can be used sustainably as a source of fuel and for other purposes.

Against this background, the drive to preserve forest ecosystems and increase their richness and diversity, involving the forestation of the whole country as a state policy, is a very welcome trend that is bound to have highly beneficial effects. Based on the experiences that other countries have had with inappropriate species, native species should be stressed in the new plantings. But the plan overall seems well considered, and the work in the Central Tree Nursery seems to be excellent and of an appropriate scale.

For the preservation of biodiversity, the 2003 report emphasizes the national, regional, and international importance of preserving both the species native to North Korea and their genetic diversity. In 1998 the DPRK prepared a framework for the conservation of ecosystems and species diversity, clearly outlining the significance of biodiversity in helping to advance the welfare of the people. Developing a public understanding of the role of biodiversity in sound development and for future improvement is critically important.

### **North Korean Biodiversity**

The survival of species is important overall because they make up the functioning ecosystems that provide the natural services on which we all depend. These ecosystem services include the regulation of water flow and purity; the protection of topsoil; the determination and moderation of local climates; the provision of pollination services for crops; the control of harmful insects and other pests by birds and other organisms resident in natural habitats; and the many uses of the individual kinds of biodiversity that make up the productive systems as well. The genetic diversity of organisms is of great importance, too, as they must adjust to changing climates in the future. Specifically, the genetic diversity present in the country now is particularly important because it is adapted to present conditions and flourishes in them. In the future, however, as global warming continues and intensifies, it will become progressively necessary for North Korea to identify and grow species and genetic races from areas with more moderate climates.

As to the importance of individual species for the global community, a few observations may be offered. We obtain 90 percent of our food directly or indirectly from just over one hundred kinds of plants, and about 60 percent from just three: rice, wheat, and maize. Rice is the most consequential food plant in the world. Thousands of kinds of plants are being used as food or were used that way in the past, and many more could do well in the conditions of the present if scientists had a better understanding of their potential. In addition, it is essential to protect the genetic diversity of crop plants and their wild relatives, since that diversity may contain the keys to survival and adaptation for the crops in the rapidly changing world of the future. Thus in North Korea whatever land races and traditional forms of cultivated plants exist should be protected and preserved. This in itself constitutes a key argument for international collaboration on biodiversity conservation.

In addition, for more than half of all people living in Asia, plants remain the primary source of medicine, just as they have been for thousands of years. Only about one-sixth of the plant products used as medicines are derived from cultivated sources. The remainder constitute a huge quantity of plants harvested in nature, often with destructive impacts on the source populations. It is notable that even for those of us who rely on prescription drugs, about a quarter of those

drugs are based on chemicals originally discovered in plants or still derived from plants; an equivalent share is derived from fungi or bacteria. It seems obvious that ongoing attention to maintaining the stocks of medicinal plants in nature and bringing more of them into sustainable cultivation should be a priority for the DPRK government. That commercially significant discoveries are also being made worldwide by examining the properties of plants provide additional stimulus for its further development nationally.

Aside from the plains in the southern and western portions, most of the Korean Peninsula is rugged and mountainous. Lower, now mainly secondary, ranges were developed during the Mesozoic era, but most of the present-day mountains, including the highest (Mount Paektu at 2,744 meters) are the result of Cenozoic orogeny and volcanism.

About 3,150 species of vascular plants inhabit the Korean Peninsula, and approximately one-tenth of them are endemic to the area.<sup>2</sup> Seven genera of vascular plants are considered to be endemic to the Korean Peninsula. As stated earlier, the genetically differentiated populations of various species found in North Korea are of key importance also, because they have evolved over the years to thrive, or at least to survive, in the particular conditions where they occur. Plants are much more richly represented on the Korean Peninsula than are terrestrial vertebrates, judged from reported numbers of species of mammals and of breeding birds.

About 12,300 species of insects have been reported from the Korean Peninsula.<sup>3</sup> The number of plant species recorded there constitute about 9 percent of the roughly 350,000 plant species known worldwide. Based on the number of plant species, the actual number of insect species that probably occur on the Korean Peninsula as a proportion of the total estimated to exist worldwide (5-6 million) must be at least several hundred thousand and may be considerably more. The majority of the undiscovered insect species would be small in size, with many of them unknown to science. For other poorly known, species-rich groups, such as nematodes, fungi, and mites, the state of knowledge of North Korea's biodiversity must be much poorer than for insects. At the same time, only 124 species of terrestrial mammals and 515 species of birds have been reported from the Korean Peninsula, about 3 to 5 percent of the world totals.<sup>4</sup> Of amphibians, twenty-two species are known in the region, along with thirty-seven species of reptiles and about two hundred species of freshwater fishes. Taking all these figures into account, it is probable that other than bacteria and viruses, no more than one in twenty of the species of organisms that actually occur in North Korea have been reported from the region.

For most north temperate regions with biota that have been studied in more detail, 10 to 20 percent of the kinds of organisms are usually found to be of conservation concern. Hard figures are difficult to obtain, and this is particularly true for the Korean Peninsula, where estimates of the numbers of such species have generally been low. It is probable, though, that with additional study, at least

five hundred species of plants in North Korea will be found to be of conservation concern.

Considering the many benefits of biodiversity to human beings, it would seem important to try to gain a better appreciation of the Korean Peninsula's representation of different groups of organisms in order to help manage them sustainably and conserve them efficiently. Organizing the information about these organisms in databases would be in line with one of the nation's overall objectives, that of developing a high-quality information technology system. Such an effort would enable effective inventories of different groups to be carried out and their results made readily available. The concepts of "parataxonomists" or "citizen scientists"—training people to recognize and collect organisms systematically throughout the country—seem to be applicable to the possibilities in the DPRK.

Identifying these specimens, however, is another matter. No country has active specialists dealing with and capable of identifying the members of all groups of organisms. Therefore, only international collaboration offers the hope of achieving a high level of knowledge for the region as a whole. Decisions about the amount and kind of collaboration that will be possible are fundamentally political ones, but the need for such collaboration certainly exists if the region's organisms are to become better understood.

Such understanding would have important economic and environmental impacts both regionally and throughout the world. With global climate change accelerating the rapid movement of destructive or disease-causing organisms around the world, scientists need to know a great deal more than they do now to understand what is happening. New kinds of pests that are devastating forests and other natural communities in other parts of the Northern Hemisphere often originate in Asia. However, even for relatively well-known groups such as beetles, there are often no relevant specialists in the entire east Asian region. Could North Korea play a part in remedying this deficiency, while helping itself at the same time?

## **Recommendations and Opportunities for Cooperation**

An appropriate level of understanding of regional biodiversity could be addressed by the establishment of a national DPRK biodiversity institute with many of the characteristics of CONABIO, the very successful Mexican Consejo Nacional de Biodiversidad. CONABIO maintains all records of the occurrence of Mexican organisms that the organizers have been able to gather. These records are computerized using geographical information system technology, along with information about the functioning of ecosystems, emerging problems, the effects of natural disasters on biodiversity, and the characteristics of proposed natural areas. The fact that CONABIO's funding has been increasing over the years demonstrates the importance Mexico places on these activities for the proper functioning of the

nation's ecosystems in relation to human activities. Its council, consisting of the heads of the relevant ministries, is officially chaired by the Mexican president. A similar institution in the DPRK could provide real benefits even with a modest level of funding, and its existence would help raise the national level of consciousness about these matters. It certainly could be useful in better understanding the medicinal properties of organisms and in identifying other products of potential commercial value.

A very important product of such an organized body of information and its analysis would be the conservation of individual organisms and their genetic diversity. These elements, which are rapidly eroding, are essential for the future development and sustainability of the country. An ongoing survey of the species of conservation concern could then be put in place, often with citizen scientists playing key roles. Those organisms that are gathered in nature as food or medicine should be given special consideration. Additionally, there should be an examination into possible means of working toward their sustainable production. The establishment of monitored plots would be an excellent way to monitor the changing conditions on the Korean Peninsula and to deal with them as effectively as possible. Past collaboration with the Chinese Academy of Sciences' Institute of Botany in the formation and monitoring of the plots on Mount Paektu (known in China as Changbai Mountain) provides an example of efficient monitoring of a particular place in such a way as to provide important information for managing the whole environment. Those plots could logically become the basis for forming a system of monitoring stations in the DPRK, a highly desirable development in view of the rapidly changing world conditions.

Global climate change is proceeding rapidly, and its effects are being felt strongly on the Korean Peninsula, which has experienced droughts, floods, violent weather events, and rising temperatures. Although the DPRK cannot do much on its own to ameliorate the activities that drive global warming, it should still make a contribution to efforts to reduce emissions. North Korea can only gain by deploying alternative forms of energy as extensively and rapidly as possible. Certainly no reforestation program could be conceived properly in this era of change without taking climate change into account, and the same is true of effective, long-term conservation of species.

Education about sustainability is critical for the general public and especially for children. Museums, educational institutions, zoos, and botanical gardens all have important roles to play, and they should be supported in those roles and for their direct conservation efforts as well.

In summary, North Korea with the support of the international scientific community should (1) establish a national center for biodiversity; (2) apply the information directly to conservation and the sustainable management of the natural resources in the DPRK; (3) expand a system of plots for continuous monitoring of changes in vegetation; (4) project and monitor the effects of global

climate change and take steps to adapt to it, as well as contribute what is possible to limiting greenhouse gas emissions; and (5) emphasize education, especially for children, to ensure that people will continue to understand and respond to the environmental trends that will increasingly dominate their lives.

The world is now actively managed by human beings, with the characteristics of individual living systems being either enhanced or degraded as time goes by. It is important to stress our mutual interdependency in a world where a huge and rapidly increasing human population is consuming more on an ongoing basis than the world can provide sustainably. We must work together if we are to avoid going down together. While some problems may seem to be problems for the DPRK alone, they are really problems with which we must all contend. **SD**

#### Endnotes

1. *DPR Korea: State of the Environment*, United Nations Environment Programme, 2003, [http://www.unep.org/PDF/DPRK\\_SOE\\_Report.pdf](http://www.unep.org/PDF/DPRK_SOE_Report.pdf).
2. Yongbae Suh, Chong-Wook Park, and Byung-Yun Sun, "Biodiversity assessment of Korean vascular plants: Current status in the nation," in *Taxonomy and Biodiversity in East Asia: Proceedings of International Conference on Taxonomy and Biodiversity Conservation in East Asia*, eds. Byung-Hoon Lee, Jae Chun Choe, and Ho-Yeon Han (Seoul: Korean Biodiversity Council [KOBIC] and Korean Institute for Biodiversity Research of Chonbuk National University [KIBIO], 1997) KIBIO Series 2: 126–36.
3. Yong Jung Kwon, "Insect diversity in Korea and its management strategy," in *Taxonomy and Biodiversity in East Asia: Proceedings of International Conference on Taxonomy and Biodiversity Conservation in East Asia*, eds. Byung-Hoon Lee, Jae Chun Choe, and Ho-Yeon Han (Seoul: Korean Biodiversity Council [KOBIC] and Korean Institute for Biodiversity Research of Chonbuk National University [KIBIO], 1997) KIBIO Series 2: 31–57.
4. Ministry of Environment (Republic of Korea), *The Biodiversity of Korea*, 2011.

*This paper was adapted from a presentation by the author at the International Seminar on Forest and Landscape Restoration held in Pyongyang, North Korea (DPRK) in March 2011. With financial support from the Richard Lounsbery Foundation, the seminar was organized by the American Association for the Advancement of Science (publisher of Science & Diplomacy), the Environmental Education Media Project based in China, and the Pyongyang International Information Center for New Technology and Economy, and involved some eighty DPRK scientists and fourteen western scientists from seven countries, including five scientists from the United States. In addition to three days of presentations, field trips were arranged to a collective farm, a tree nursery, the Pyongyang botanical garden, and a mountain forest park. More information can be found at <http://www.aaas.org/news/releases/2012/0328dprk.shtml>.*