of which conservation measures work best, and which additional factors, including natural ones and unintentional human contributions, can also help threatened species.

Protecting and restoring habitat, such as wetlands for wading birds and rivers for beavers and many other species, clearly has had a positive effect over the last six decades, as the report shows. Legal protection from hunting and persecution also helped many of the species covered in the report.

"The case studies of wildlife comeback in this report show the results of decades of conservation efforts in Europe," says Ariel Brunner, head of policy at BirdLife Europe. "Sound legislation, such as the EU Birds and Habitats Directives, have led to better hunting regulation, species and site protection and focusing of conservation investments. They show that, with sufficient resources and appropriately targeted efforts, species can be brought back, even from the brink of extinction."

Other factors that allowed wildlife recovery include the abandonment of land that is inefficient to farm with modern methods. Similarly, the decline of heavy industries, which often turned small rivers into wastewater channels, has made space for the restoration of river habitat.

Ultimately, the most important factor may be for the people to learn to live together with the returning wildlife. "For many of us, the current population levels of these comeback species seem unprecedented — they are often the highest that we have experienced in our lifetime," says co-author Monika Böhm from the ZSL. "This may lead to some negative perceptions about these species, i.e. people may think populations are too large now, that they cause damage to property and so on. Yet some of these species are still well below their historical population sizes and are not yet viable in the long term. This makes dealing with negative perceptions and human–wildlife conflict all the more important — by turning challenges of wildlife comeback into opportunities. We humans originally hunted or persecuted these species to the brink of extinction — it is ultimately up to us if we allow wildlife to come back."

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Q & A

Keiko U. Torii

Keiko Torii was born in Tokyo, Japan and grew up in Yokohama, Japan and Scarsdale, New York. She received her BS and PhD from the University of Tsukuba, Japan. Currently she is a Professor at the Department of Biology, University of Washington (UW), Seattle, USA, holding the title of the College of Arts and Sciences Endowed Distinguished Professor of Biology since 2011. She is one of the fifteen Investigators of the Howard Hughes Medical Institute-Gordon and Betty Moore Foundation (HHMI-GBMF) since 2011. Starting in 2013, she is also one of the three Overseas Principal Investigators at the Institute of Transformative Biomolecules (ITbM) at Nagoya University, Japan. Her group studies how plant cells coordinate proliferation and differentiation during organ morphogenesis to generate beautiful, orderly patterns, using development of stomata as a model system.

Why study plants and plant development? I was always fascinated by developmental biology and could spend hours looking through a microscope. Around the time I was a college student, genetic transformation of plants became a viable technique. Shortly after, *Arabidopsis* emerged as a model to identify key developmental mutants and their causal genes. I was struck by the beauty and elegance of the ABC model proposed by Elliot Meyerowitz *et al.* and decided to pursue my postdoctoral career to study the mechanism of plant development.

Plants, of course, are the fundamental producers of our ecosystem supporting our life and sustenance. At the same time, for me plants are like 'beautiful strangers' — they are so different from us. They don't have neurons or brains, yet they cleverly sense the surrounding environment, defend themselves, and prosper. Plant (and plant–pathogen) research has provided amazing tool kits and knowledge to advance not only plant sciences and agriculture, but also biomedical research. Recent examples include the discovery of siRNAs, plant photoreceptors that

Photo courtesy of Nagoya University.

can be used to manipulate gene expression in mammalian cells, and TAL effectors for genome engineering. I am very grateful to the HHMI for recognizing the importance of plants and also to the Institute of Stem Cell and Regenerative Medicine (ISCRM) at UW for including me as a stem cell researcher of 'other systems'. As a plant developmental biologist, I am most fascinated by the question of how plant cells, constrained by the lack of cell migration, process positional cues to regulate polarity, stem cell state and differentiation within the context of multicellularity, and hope that our research will provide insights into development and regeneration for the broader field of biomedical science.

How did you decide on your current research topics? As I mentioned, I am interested in unraveling how plant cells communicate with each other during development. So, returning to my earlier work on ERECTA, a receptor-like kinase that promotes plant growth, was a natural choice when I started my tenure-track position. I must say that serendipity played a role in my research breakthroughs. My former postdoc, Elena Shpak, and I made triple loss-of-function mutants of ERECTA and its two related receptors. When we looked at the mutants under the microscope we were struck by the unexpected phenotype, stomata all over the epidermis! At that moment it was clear to me that this would be very

big. Stomata, small valves on the plant epidermis for efficient gas exchange, are essential for plant growth and survival, but not much was known back then about how stomata develop. The simplicity of stomata as a binary cell fate specification model and the accessibility of the plant epidermis for live imaging hold incredible promise and potential. We used a sensitized genetic background (where two out of three receptors are missing) to look for new components. Another former postdoc, Lynn Pillitteri, then identified a stomataless mutant having a gorgeous epidermis with rosette like patterns of asymmetric divisions, each harboring an arrested stem cell in the center. This phenotype was due to a mutation in a master regulatory transcription factor, which we named MUTE.

Major regulators of stomatal development have been identified by now, but it is not clear how the signaling components and cell-fate determinants fit together to create spatial patterns. We are taking cross-disciplinary approaches using engineering techniques, biochemistry, synthetic biology and mathematical modeling to understand the regulatory circuitry for self-organized stomatal patterning.

How do you run your lab? My lab has always been relatively small, usually around 4–6 members. With my family duties, I cannot compete with those large groups who publish huge volumes of cutting-edge research. Instead, I try to find my own niche, and publish unique stories with high-quality data that will be memorable to others. I know that I am not productive in terms of amount, but this is the only way for a scientist like me to stay recognized. Each researcher in my group has his/her own research, initially designed and guided by me. As they advance their projects, I let them pursue their own directions of interest, and encourage collaboration. I think it is important for them to take part of their projects with them when they become independent.

What is your favorite research article? Research articles that challenge existing ideas or reveal counterintuitive concepts are always my favorites. As a geneticist, I am fascinated by the beauty of genetic screens that uncover unexpected new insights. Within plant research, for example, Joanne Chory's first report of the *det1* mutant in 1989 struck me. Back then I was a beginning grad student. I felt that it was rather intuitive to screen for seedlings that looked etiolated in light, as I had seen such seedlings in nature, in my garden under foliage, for instance. In contrast, it did not occur to me to look for seedlings that develop as light-grown seedlings in the darkness! Her similar set of screens then opened a whole new world of steroid hormone signaling in plants. Around the same time, I was fascinated by Jen Sheen's paper describing sugar, a major nutrient, as a signaling molecule, since it was a novel and unconventional concept to me. More recently, I got excited by the beautiful screen by Niko Geldner's group that led to a discovery of the regulators of casparian strip formation. Although they don't determine my own research direction, papers like these make a great contribution to my continued learning and excitement about basic plant research.

What is the best advice you've been given, and what career advice would you offer? Recently I have been increasingly asked two questions: (i) how did you succeed in academia in the US as a Japanese woman; and (ii) how do you balance your career and a family? Let's answer the former one first. My background was anything but promising. For example, I did three postdocs, one in Japan and two in the US, each time changing my research project, for a total of almost seven years. Every time, I was struggling to find the next position to support myself. Currently, many of the top institutions in the US, including the University of Washington, do not allow a researcher beyond the 5th year after their PhD to maintain a postdoc appointment. So, with the current standard, I would have had to drop out of academia. When I realized that I would have no position in Japan and decided to pursue my second postdoc in the US in 1994, my advisor back then told me that I was just a dreamer, like those young Japanese girls who want to be Hollywood stars. Now I am an HHMI Investigator. So the lesson here is that you never know what will happen. No one can predict your future or be responsible for it. You should follow your own passion. And, if people helped you along the way, thank them. Be proud of yourself but be humble at the same time. Since then many scientists have helped me along my path — I am truly grateful for them, and now it is my turn to support young talented scientists who strive to succeed.

Then what advice would you offer for balancing a career and a family? Having a family or not is a personal choice, and individual decisions should be honored. If I am asked when would be a good time to have children, I would say whenever you are having a child is the best time for you. I started out my family rather late — I have two children; one was born during the fourth year of my tenure track and the other shortly after I became tenured. But that is only because I met my spouse after I became a tenure-track faculty at the UW. Having a family is a formidable task with a huge responsibility for anyone, so instead of choosing the 'best time', try organizing your work schedule so that you can continue your career while you are nursing your little one. For instance, you could plan to finish your experiments before maternity leave and start drafting a manuscript or writing review articles to crystalize your thoughts while on leave. This way, in the long run, you can avoid gaps in your publication record. It is also important to develop mutual trust with your lab mates and collaborators, so someone can grow your plants or do some experiments for you in your absence. For instance. I wrote a research article (published in *Development*) while I was on leave for my first child. The second child was born on the day I published a *Nature* article, perfect timing for taking a few weeks off. Most importantly, be sure to share your family duties with your partner, other family members, and/or professional childcare/nannies. Don't be shy to ask for help. Check if your institution has some support structure — I was fortunate to have support from the NSF-UW ADVANCE Center for Institutional Change during my first maternity leave. The director, Eve Riskin, provided me a laptop, a laser printer, and 5 months of support to hire a postdoc, Lynn Pillitteri, so that I could effectively work remotely at home and that my lab would run smoothly in my absence.

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