Acceptance speech
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Mark Westoby, awardee in the Ecology and Conservation Biology category (13th edition)

Good day to everyone. First, let me express warm thanks to the BBVA Foundation, for their creativity in establishing these awards. Thanks also to the expert committee that somehow lighted on us. It's especially an honour to be sharing the award with Sandra Diaz and Sandra Lavorel – they are superwomen.

I want to remember also my late wife Barbara Rice, who was a field botanist. Without her, my life would have been poorer in every way.

So, what is the frontier of ecological science? In ecosystems there are a lot of things going on. Energy is being captured and processed. Water is being pumped. Mineral nutrients are being cycled. Species populations are increasing or decreasing, and influencing other populations. Temperatures and windspeeds are being modified by the canopy and by the litter of leaves and twigs that have fallen to the ground.

For all of this complicated machinery, species are the working parts – they're the cogs, and wheels, and link-rods. But there are a lot of species – for plants on land, about 300,000 species worldwide. If we study each of them one at a time, progress will be slow. In this context there's a famous remark that ecology feels the way chemistry must have felt before the periodical table of the elements was discovered. "Each fact ... had to be discovered by itself, and each fact had to be remembered in isolation."

So we are trying to build a periodical table for ecological strategies. Actually though, it isn't a table and it isn't periodical. Rather, species are spread along dimensions or spectra. It's more like personality spectra as they're used in psychology, or for astronomers, maybe it's like the colour-magnitude diagram for stars.

Let me tell you about one dimension by way of example. A plant is a manufacturing business where the machines are green leaf area. The leaf area intercepts light and draws CO_2 out of the atmosphere, making a profit for the plant. Then the profit is reinvested to deploy more green leaf area. If instead they make a loss, then their DNA-lineage is removed from the world. There is no insurance, there are no apologetic speeches to the shareholders with promise to do better next year. The invisible hand of natural selection is quite relentless.

A key number for summarizing a plant's investment strategy is the cost of constructing a unit area of light-catching surface. High-cost leaf area is thicker, or it's made of denser tissue, you can feel the expensive quality between your fingertips like feeling heavy cloth.

Leaf construction cost varies widely between species – about 30-fold even among species coexisting on one patch of ground. Some species are getting 30-fold more light-capture surface from a given investment. Why don't they have an enormous competitive advantage, and drive the others out?

The answer turns out to be that leaves live for longer if they are constructed more expensively. Although their return on investment is lower per month, their revenue stream continues longer. So this trade-off is familiar: it's the choice between expensive machines that last a long time, versus cheap ones that are written off sooner. As applied to plants, it's become known as the leaf economic spectrum. It explains quite a large share of variation in leaves worldwide. And it involves other leaf traits besides construction cost and lifespan – for example expensively-constructed leaves release the mineral nutrient in them more slowly after they fall to the ground, what we call an afterlife effect.

The point of the leaf economic spectrum is this: we need to understand the working parts of ecosystems. In a world of climate change, we cannot be focused only on conservation. We need to learn how to construct the ecosystems of the future.

Thank you for your attention, and once again warm thanks for this signal honour.