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## “THE WORD FOR WORLD IS FOREST”:

### A LONG-RANGE FUNDING SOURCE FOR WOMEN IN MATH IN DEVELOPING COUNTRIES

Neal Koblitz

*The Word for World Is Forest* is the title of a classic work of science fiction by Ursula K. Le Guin. Written in 1972 at a time of growing awareness of both the ecological importance of forests and the rights of indigenous peoples — the two themes of the novella — it was republished by Tor Books in 2010 in the wake of the hugely successful movie *Avatar*, which was partly based on Le Guin’s story.

What do forests have to do with mathematics? Not much.<sup>1</sup> However, mathematicians are often lovers of the outdoors. To cite just one example, a long tradition at the Mathematisches Forschungsinstitut Oberwolfach has been that every conference make time for a Wednesday afternoon hike in the Black Forest. In addition, forests are playing a central part in the plans of the Kovalevskaia Fund to provide a source of support for women in the mathematical sciences in developing countries through the 21st century and beyond.

#### Kovalevskaia in Mexico

The mathematician Sofia Kovalevskaia (1850-1891), whose name my wife Ann and I gave to the small foundation we started in 1985 (see <http://kovfund.org>), never traveled to Mexico or anywhere else in the western hemisphere. However, she received fan mail from as far away as El Salvador, and she would have been pleased that a Latin American country, namely Mexico, has the strongest tradition of honoring her memory through activities to promote mathematical research by women. Indeed, in 1991 as far as I’m aware Mexico was the only country to organize a major conference in commemoration of the centenary of her death.

In 2005 the Mexican Mathematical Society (MMS), in collaboration with the Kovalevskaia Fund, started giving annual grants to women doctoral students and junior researchers. The organization, publicity, and selection are handled by a special MMS committee, currently consisting of Drs. María José Arroyo, Carlos Bosch, Begoña Fernández, and Patricia Saavedra.

The grants are of varying amounts and serve different purposes. For graduate students they typically provide “bridge money” in the latter stages of their Ph.D. work so that they

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<sup>1</sup> This is not really true. I am currently collaborating with a mathematician in Jamaica and some researchers in my university’s School of Forest Resources on a project to use mathematical modeling to study carbon sequestration, habitat preservation, water resources, and other ecological variables in Jamaica’s forest preserves.

don't have to drop out for financial reasons. Postdocs often use the awards to finance travel to conferences or to work with a collaborator at a university or research center in Europe or North America.

The grants are awarded every October during the opening ceremony at the MMS National Congress. In 2009 at the Congress in Zacatecas the Kovalevskaia Grant Committee organized a Special Session on women in mathematics in Mexico and other countries of the region. Patricia Saavedra reported on the statistics she had compiled on Mexican women's participation in mathematics at all levels. Among the highlights: women math students have lower attrition than their male peers, so although in the early 2000's women were only 24% of entering Master's students, they were almost 50% of those who have graduated. In 2004, 14 of the 36 math doctorates (about 40%) went to women; this percentage is somewhat higher than in the U.S. and much higher than in Great Britain, Germany, and Scandinavia. There is, however, a "glass ceiling"; and the percentage of women among recipients of Mexican government research grants in mathematics is extremely low, even lower than the percentage in the exact sciences overall.

Another speaker at the seminar was María Luisa Sandoval. She was a Kovalevskaia grant recipient in 2005, the first year it was given. She had had to take time off from graduate school to care for her aged parents, and as a result had passed the age limit for both Mexican and Spanish graduate stipends. In her remarks she emphasized that without the Kovalevskaia grant she would never have been able to complete her doctorate.

Mexico is not the only country where the Kovalevskaia Fund supports awards for women science students and researchers; we also have successful projects in Vietnam, Peru, and Cuba. However, Mexico is the only country where the awards are administered by the math society and are exclusively for the mathematical sciences. And the Mexican grants are also the prototype for the sort of awards we envision the Kovalevskaia Fund making far into the future in many developing countries, particularly if, as we hope, the responsibility for the Fund's projects is eventually transferred to the American Math Society.

#### Fundraising by Powers of 2

The impetus to start the Mexican Kovalevskaia awards came from a donation of \$2500 per year from a former student of mine and his wife, who occupies a high position at Microsoft (and who wishes to remain anonymous). According to company policy concerning charitable gifts by employees, Microsoft matches this donation every year. Soon after the program started, the MMS decided to match the \$5000 it was receiving from the Fund, thereby showing that Mexican mathematicians, male as well as female, are truly committed to the project. Finally, last year some mathematician/cryptographer friends of mine decided to match the \$5000 per year that the Fund was sending to the MMS, and the MMS matches that as well. Thus, at present a total of \$20,000 per year — an amount that goes a long way in Mexico — is being awarded by the MMS Kovalevskaia Grant Committee.

#### And Out to Infinity

The first long-range goal that Ann and I have for the Kovalevskaia Fund is that all projects be funded at their current levels in perpetuity. We believe that after we die our

house, life insurance, etc. will provide a large enough endowment to do this, whether or not other donors make provisions to continue their contributions forever. However, that endowment will not be enough for any major expansion of Kovalevskaja prizes and grants.

We also have a more ambitious plan. Our hope is that investments we are making now will bear fruit later in the century, providing a major boost in the Kovalevskaja endowment. As more money becomes available, the AMS (assuming that that is the organization administering the projects) will be able to collaborate with sister societies in a number of countries in Asia, Africa, and Latin America, adding new grants and increasing the funding in places where the impact has been the greatest.

Our investment is in land in yet-to-be-discovered places in the American West. We own about 450 acres (180 hectares); except for a 20-acre (8-hectare) parcel of high desert on a mountain in Arizona, the rest of the land is in the forests of western Washington:

(1) A 240-acre (96-hectare) mountainside just south of the border with Canada. It includes a 2-kilometer hiking trail and 0.5 km of logging roads from which views open up of the border towns and the snow-covered Canadian Coastal Range.

(2) A 43-acre (17-hectare) parcel with frontage on the scenic Mount Baker Highway. It has extensive hiking trails with breathtaking views of the Nooksack River, the South Fork valley, and the Twin Sisters mountains.<sup>2</sup>

(3) A 50-acre (20-hectare) property on a steep flank of Lookout Mountain at the south end of Lake Whatcom. We also have four lots adjacent to the forest that are zoned for residential construction.

(4) A 98-acre (39-hectare) property on a narrow peninsula that juts out into the Hood Canal near Dabob Bay. The views are dramatic, and there are several areas nearby that have protected status due to their importance as a watershed and as animal habitat. As in the case of our other properties, we chose this one in large part because of the biodiversity, vitality, and overall health of the forest.

During our lifetime none of these properties will be put to any economic use. There is an English proverb

He who plants pears [i.e., pear trees]  
Plants for his heirs.

More generally, a recently-logged and replanted forest (this includes most of the acreage we purchased; only about 20% consists of older trees) will not be ready for another harvest for roughly a half-century.

Our best guess, however, is that the vast majority of this land will never again be logged. We think that eventually over 80% will be put in a perpetual conservation easement, and the remaining 10%-20% will be cleared for low-density housing. We are wagering that, one way or another, this land will become quite valuable later in the century.

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<sup>2</sup> This property can be viewed on <http://www.youtube.com>; search for “Elliptic Curve Cryptography: The Serpentine Course of a Paradigm Shift.”

In our opinion the Pacific Northwest is the most beautiful and livable region of the continental United States. This is likely to become more so as climate change causes other places, especially in the Southwest, to become less desirable. Specialists expect the effects of global warming to be less severe in our region than elsewhere, and some are predicting an influx of “climate refugees.” There will be intense pressure to allow residential development on some of the attractive land near Seattle.

At the same time, people in western Washington have a tradition of environmental activism, and the state and county governments have strong anti-deforestation policies. So a compromise will have to be worked out. The logical resolution would be to allow residential rezoning of a small proportion of a landowner’s forest property, provided that the remaining part is made into a preserve. Already some of the upscale, low-density residential developments include extensive forest acreage.<sup>3</sup> Homeowners take pride in their stewardship of that land, and they can boast to their friends of being “carbon-negative.” This trend is likely to grow along with increased public appreciation of the importance of forests.

Current land use policy sees little difference between keeping land in commercial forestry (to be logged at half-century intervals) and putting it in a conservation easement (never to be logged). Both are regarded as preserving the forest. However, this will have to change, because in the long run there is a world of difference, for two reasons. In the first place, the ecological importance of a tree, which is not the same as its value as timber, depends on its biomass, its number of leaves, and the size of its canopy. These grow roughly as a cubic or quadratic (the latter after the tree reaches full height) function of time. In other words, from an ecological standpoint trees reach peak efficiency well after the age at which they would be logged.<sup>4</sup>

In the second place, the timber industry’s model of sustainability — based on the replanting of seedlings after clear-cutting — will start to fail as the climate changes. Established healthy forests are resilient. They can usually withstand temperature increase and reduced rainfall, increased windstorms and wildfires, and new insects and pathogens. A baby forest made up of newly-planted seedlings is much more sensitive, and its odds of survival diminish as the climate becomes less favorable for forest growth. For both of these reasons, in the latter decades of the century mature forests will be far more viable and valuable than young ones.

### In the Meantime

If our calculation is correct, the future directors of the Kovalevskaja Fund will hold onto each property until it can be sold for vastly more than what we paid for it. If we’re

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<sup>3</sup> There have also been projects that combine land conservation and affordable housing; see Kendra Briechle’s study of such initiatives, available at [http://www.conservationfund.org/publications/improving\\_nature\\_of\\_affordable\\_housing](http://www.conservationfund.org/publications/improving_nature_of_affordable_housing)

<sup>4</sup> This is a not-completely-accurate and in any case greatly oversimplified explanation of the importance of old forests. A comprehensive treatment of this and other issues can be found in D. A. Perry, R. Oren, and S. C. Hart, *Forest Ecosystems*, 2nd ed., The Johns Hopkins University Press, 2008.

wrong, then these properties will bring in only modest increases in the endowment and in the Kovalevskaja awards.

In the meantime, the forests serve a different purpose — recreation. Maintaining and improving the forest lands — clearing trails, cutting back invasive species, clearing blocked culverts, hiking all over, monitoring the forest as it matures — can sometimes be hard work, but it's also thoroughly enjoyable. Any readers of *The Mathematical Intelligencer* who are planning to be in the Seattle area are welcome to contact me and arrange to come with us to spend an afternoon visiting one or two of our forests. We like to show them to our friends and colleagues, and we think we can offer you an experience that's at least as stimulating as a Wednesday hike in the woods near Oberwolfach.