Letters

West Germany's Science Funds

Walsh's excellent interpretation of West Germany's science policy (22 Mar., p. 1340) could be complemented with the following clarifications and additions:

1) The $1.25 million of new federal science funds for oceanographic research this year (to be increased to $6.5 million by 1971) is a welcome addition to the present $7 million spent annually on ocean research by several Länder, the Deutsche Forschungsgemeinschaft, and various federal agencies. Main target areas of this research are world food problems, deep-sea technology, recovery of minerals, and coast protection.

2) In addition to the $166 million for nuclear research and technology in 1968, $41.75 million have been allocated to EURATOM for cooperative projects carried out in Germany. Also under this heading there is a provision for the first time of $14.25 million to the nuclear research center at Jülich for operation and expansion. Furthermore, an initial $1 million have been allocated for the development of plutonium technology of value in Germany's high-speed breeder reactor program; and a new $600,000 earmarked for the development of processes in direct energy conversions (that is, thermionic diodes as converters for nuclear heat in reactors, and isotope batteries for the generation of electricity).

3) The amount of $81.25 million allocated by the federal government in 1968 for space research also includes Germany's contributions to international organizations. Emphasis in this area is on commercial and research satellites.

4) New funds have been made available for the creation of about eight regional computer complexes.

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Alluvial-Flat Redwoods: Impact of Flood Control

In the article "Preservation of coast redwood on alluvial flats" (12 Jan., p. 157), Stone and Vasey have done a splendid job of summarizing the growth characteristics of the coast redwood and describing the effect of fire and silt deposition in eliminating competing forest species. They conclude that the survival of the giant redwood groves is threatened by the proposed construction of flood control dams unless man employs such tools as herbicides, fire, and chainsaws as a substitute for floods and resultant siltation.

Whether any of these tools should be used for park or forest improvement is beside the point. The facts do not support the conclusion that floods and siltation are necessary for the survival of these magnificent redwood groves in the Eel River basin.

Since minor differences in soil, exposure, and precipitation often result in major variations in the species composition of a forest, I will confine my comments to the redwood forests of the Eel River basin.

First, it should be noted that large or "giant" redwoods, that is, over 150 cm in diameter at breast height, are not confined to the alluvial flats that are subject to flood and silt deposit. They are found in almost solid stands in this basin wherever the following conditions coexist:

1) Adequate soil depth for nutrition and prevention of windthrow.

2) Benches, flats, and slopes sufficiently moderate to prevent soil creep or excessive erosion.

3) Adequate summer moisture to substitute for this region's deficient rainfall. This substitute moisture is provided by either moderate depth of water table (alluvial flats), underground seepage from higher slopes, or condensation of ocean summer fogs. Most of these groves and forests are above maximum flood level and many of them show no evidence of fire scar or fire-blackened bark.

The survival vigor of the solid stands of redwood is based on the fact that although fire and siltation may help,

On Manly's Less Stately Jargon

Although I had no trouble following Merton's paraphrasing of Scriptures, I had an awful time understanding Manly's criticism (15 Mar., p. 1185) as expressed in one nine-line sentence. Perhaps paraphrasing Manly might help other equally baffled readers:

Manly	*paraphrase*
Objective consideration of style	At cocktails last night
preference among a small but carefully selected	my buddies and I,
subset of the literate scientific readership	*Scientific American* readers,
would tend to indicate that	thought
the language of the gospels in the King James version	the New Testament
demonstrates a comprehensibility and clarity	was
not inconsiderably in excess	better
of that exhibited	written
by the less stately jargon of Professor Merton.	than Professor Merton's article.

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neither of these agents is necessary. The redwood, given proper growing conditions as previously outlined, has weapons and competitive advantages that enable it to become a climax species as against its competitors in this region —Douglas fir, tan oak, and bay. (Grand fir will not be discussed since it is not a major competitive species in the Eel River basin.)

The bay tree is slow of growth and only partially shade-tolerant. Even when given an equal start on cleared land, it is, in a few decades, shaded out by the redwood and reduced to the status of a scattered understory of weak growth.

The tan oak, like the bay tree, cannot compete with the redwood in height. Although it sprouts from the stump after a fire and is vigorous in reproduction, it has a short life on sites suitable for redwood, and usually succumbs to heart rot. It does, however, compete vigorously with the redwood for a longer period than the bay tree.

The Douglas fir, if sprouted on cleared land at the same time as the redwood, will live to maturity as a large competing tree, finally yielding to the redwood because of its shorter lifespan. But in an established redwood forest, Douglas fir, because of low shade-tolerance plus vigorous root competition by the redwood, seldom succeeds in reaching the region of sunlight.

It should also be noted that, in a dense climax forest of redwood, the mat of redwood roots in the top 15 cm of soil deprives all seedlings of moisture sufficient to survive the first summer. Floods and resulting silt deposits on alluvial flats do eliminate most of the tan oak and Douglas fir. This favorable factor in the continued survival of mature redwoods is more than outweighed by the three undesirable effects of flooding:

1) The silt deposit produces a new seed bed without a surface mat of redwood roots. For several years, depending on the depth of silt, this deposit is free of competition from redwood roots and permits competing trees to survive beyond the critical initial years.

2) The physical undermining and toppling of several thousand large trees such as occurred during the 1955 and 1964 floods are an intolerable loss.

3) The power of streams to move boulders and large cobbles increases exponentially with the volume of the flow. The Eel River bed in many places was raised a meter or more as a result of these recent floods; the raised bed

was normally confined to gravel beds adjacent to the alluvial-redwood flats. This resulted in the raising of the water table and the death of many mature redwoods from what is locally known as "sour root."

If the facts and conclusions stated above are sound, there is only one answer to the basic question. The construction of flood control dams on the Eel River and its tributaries would aid in the preservation of the giant redwood groves on the adjacent alluvial flats.

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The greatest threat to the alluvial-flat redwoods may, in the long run, turn out to be the lay conservationists. This is ironical because they were largely responsible for getting these redwoods placed under park protection in the first place. Unfortunately, however, they have failed to fully appreciate the dynamic character of the ecosystem involved. They have focused their attention on preserving the trees now standing, ignoring the rest of the ecosystem which was responsible for these redwoods being present and upon which their replacements must depend. Protection from man, fires, and floods has been their goal. They have attached little importance to the fact that fires and floods were critical elements in the system under which the alluvial-flat redwoods developed and have actively opposed any man-generated substitutes.

It is essentially from this position that Robinson writes today. For 31 years as a director of the Sierra Club and an active conservationist, he is protection-oriented and is a strong advocate of flood control because he wants to keep the alluvial-flat redwoods from being washed away. He has dismissed as insignificant the impact such action might have on the functioning of the alluvial-flat ecosystem of which these redwoods are only part. The crux of his argument is that, because there are big trees on the slopes and benches where flooding does not occur, siltation per se is not necessary in order for the redwood to maintain its competitive position on the alluvial flats; he even goes so far as to suggest that siltation, by creating a competition-free seedbed, aids the survival of competing species and is therefore undesirable. Apparently, he is unaware that he cannot readily extrapolate from one ecosystem to another.

We are fully aware that nearly pure stands of large redwoods exist off the alluvial flats. But the ecology that has contributed to their development is not the same as that which has contributed to the development of the alluvial-flat redwoods. It was the ecology of the alluvial-flat redwood that we considered in the paper to which Robinson takes exception.

Robinson argues that because the potential competitors of redwood are short-lived they could not possibly replace redwood. Obviously he is not familiar with the facts. In the absence of floods and fires, seedlings and saplings of bay, tan oak, and grand fir will actively maintain a suppressed understory on the alluvial flats. Only an opening in the canopy is needed for these species to develop into full-fledged competitors. Thus when a redwood falls —as some do each year—these waiting competitors are on hand ready to take its place. Not always will there be a redwood seedling in the right place at the right time to compete for space when an opening occurs. It is in this way that the alluvial-flat redwoods will eventually be replaced with a mixture of bay, tan oak, and grand fir if flooding and fire are removed from the ecosystem and man fails to actively intervene. It is unimportant how big or for how long redwood can grow when once established on the alluvial flats. The im-

portant fact is that periodically a redwood tree falls and there are competing species ready to take its place.

All the evidence we have been able to collect to date suggests that time is running out for the alluvial-flat redwoods and that flood control could be the final blow unless man actively intervenes with herbicides, the ax, or the chainsaw. Strong support behind a program of active intervention is urgently needed. Our hope is that it will not be too late in coming.

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Defeated by Bad Calculus Text

Regarding the article "Shortage of mathematic teachers" (8 Mar., p. 1082), I wonder if the Committee on the Undergraduate Program in Mathematics might not do well to examine the undergraduate curriculum as well as the graduate degree requirements. As a parent, I have watched a budding mathematician nipped and changing her major in her sophomore year as the result of a disastrously planned course in calculus. She had not only been highly interested in mathematics since grammar school, but had scored extremely well in all the standard battery of aptitude tests and was, in fact, placed in an "advanced" math group on the basis of her aptitude and background in math. There seems some evidence that the student was not wholly at fault. Her textbook was new, published, in fact, so recently that hers was the first class to use it. Though it is not my field, I know enough math to recognize that it was poorly conceived for teaching purposes —a number of the signs and processes needed to understand early chapters, for instance, were not explained before the second half of the book.

I was close to this experience but I am also aware of other students, in both high school and college, who are shunted away from a math career by a combination of incomprehensible texts and teachers who, however brilliant they may be at learning math, seem unable to explain the why and how of the more abstract processes. (I have been informed by one expert that "There *are* no good calculus texts.") The student referred to above understood more calculus from a weekend's intensive reading of the article in the *Brittanica* than from 2 months of class work.

Obviously, if fewer students were discouraged from finishing undergraduate majors in math, at least the potential pool for graduate study would be greater.

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Erratic Scores by the Computer

It may be that "The future of scientific journals" (1 Dec., p. 1153) will involve computer selection of information of personal interest to each reader. If such a computer system could act as my alter ego, so that I got a stream of information similar to, but, hopefully, much more complete than, that which I now select in my journeys through the journals, it would be utopian.

The present computer capability for information selection falls far short of this ideal, however. My most recent skirmish with a computer information retrieval system gave the following results: 154 total references listed; 12 references with close connection to my area of interest; 131 references with only distant relation; and 11 references