Catchment Experiments in Fluvial Geomorphology. Edited by T. P. Burt and D. E. Walling. Proceedings of a meeting of the International Geographical Union Commission on Field Experiments in Geomorphology, Exeter and Huddersfield, U.K., August 16–24, 1981. Norwich, England: Geo Books, 1984. ix + 593 pp. Paperback £28.50 (U.S. $70.00). ISBN 0-86094-137-X.

Catchment Experiments in Fluvial Geomorphology is composed of 33 articles presented at a symposium organized by the International Geographical Union's Commission on Field Experiments in Geomorphology. The chapters describe current research concerning runoff processes and erosion dynamics (10 papers), sediment and solute yields (13 papers), and hillslope and channel processes (8 papers). None of the papers pertain specifically to arctic or alpine environments. The symposium theme addresses the present state of catchment experiments and the need to apply more rigorous scientific methods in fluvial geomorphology. This is a worthwhile endeavor and deserves more attention. The number of geomorphic investigations that lead to unequivocal results are disappointingly few.

All geological research needs to struggle with major obstacles that deter controlled, laboratory-like experimentation. The difficulties go beyond the issues of posing the right questions and artful design of experiments. With rare exceptions, a large number of variables need to be considered. Rates of geomorphic processes are typically slow compared to human life as well as extremely variable. Furthermore, the spatial extent one needs to consider typically is large. Attempts to simplify systems by studying just one landform, a single process, or a small plot may remove essential complexity and lead to erroneous conclusions. A fine concluding article by Michael Church discusses these and related issues in some detail. Although the prospects for overcoming these difficulties are not promising, there is a great deal that can be done.

An integrated catchment investigation that considers the pertinent processes, temporal-variability of the rates, and spatial extent, necessarily involves collecting and analyzing a large quantity of information. Recent advances in data processing are substantial and have outstripped measurement techniques currently available to geomorphologists. New instruments for measuring flow velocities, rates of sediment transport, and the dimensions of landforms may well revolutionize the science of geomorphology. One such example is the use of high-speed photography to study the dynamics of debris flows. Symposium reports by Japanese and Chinese scientists describe refinements of this technique. Adaptation of techniques already utilized in other fields of geology also hold promise. A paper presented to the symposium by D. E. Walling and P. Kane described a detailed investigation of the geochemistry and mineralogy of suspended sediment and the geomorphic implications. Much wider application of such techniques, no doubt, are possible and will be worthwhile.

Long-term, integrated catchment investigations are an essential part of geomorphology. The scientific value of experimental watersheds appears to increase with time, especially when results are analyzed frequently, hypotheses are evaluated, and the approach is redirected. All too often, it seems that study areas are abandoned when enough is finally known about them to consider some of the critical geomorphic problems. Some of the fine studies described in this volume may be in this category. The careful reader will gain a good overview of current research in fluvial geomorphology. One has the feeling, however, that most of the experimental catchments described still have significant opportunities for additional, and perhaps critical investigations.

Drs. Burt and Walling have done an admirable job editing the volume. It is nicely printed and reasonably priced. All things considered, *Catchment Experiments in Fluvial Geomorphology* is a bargain.

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Past and Present Vegetation of the Far Northwest of Canada. By J. C. Ritchie. Toronto, Buffalo, London: University of Toronto Press, 1984. xi + 251 pp. $35.00. ISBN 0-8020-2523-4.

Why an entire book on the vegetation of such a sparsely populated corner of Canada? Simply, this is probably the most interesting spot in the entire North American Arctic for students of Quaternary science. The area has long been of botanical interest ever since Hultén (1937) proposed that it was a glacial refugium for arctic and boreal plants. It was here that the Laurentide glacial ice met the Richardson Mountains, leaving the western part of the region as the only significant piece of mainland Canada that was not glaciated during the Pleistocene. Topographically, it is a very diverse region that includes the floodplains of the Mackenzie River, numerous mountain ranges, basins, a vast gently rolling glaciated platform, and a flat coastal plain. Climatically, the region has one of the steepest summer temperature gradients in the world, which creates a distinctive compression of the standard arctic vegetation zones with a narrow forest-tundra transition.

Ritchie presents the first summary of fifteen years of research in the paleoecology of northwestern Canada. This complements the older heritage in Alaska which has recently been thoroughly reviewed by Hopkins et al. (1982). Although the book is small (179 pages of text), it is a comprehensive treatment of the large volume of material regarding the modern vegetation and paleobotany of this region. It is a very important contribution because it addresses so many current questions regarding the history of Beringia.

In the late 1960s R. D. Guthrie, judging from the high percentage of grazers in the mammal fossil records, proposed that the interior of Alaska must have been a large grassland during the Pleistocene. This gave rise to the concept of a "Beringian steppe-tundra" which was supported in part by mid-Pleistocene pollen spectra from many areas in Beringia that contained high percentages of grass and *Artemisia* pollen. The exact nature of this vegetation has been the subject of endless controversy ever since. Ritchie challenges Guthrie's grassland hypothesis, at least with regard to northwestern Canada. After describing the modern-day vegetation of the region, he carefully leads the reader through ten pollen profiles from the Tuktoyaktuk, Inuvik, Travaillant Lake, and North Yukon areas to his conclusion that the late Pleistocene vegetation of northwestern Canada was most likely a discontinuous herb tundra with a mosaic of other vegetation types, including wet tundra in the lowlands and willow thickets along the rivers. Ritchie believes that the best modern analog to this vegetation is found today in the mid-arctic climatic regimes of southern Banks Island and southern Victoria Island. He examines the primary productivity of this vegetation and concludes that it could have supported diverse small herds of large mammals.

A major contribution of the book is the convincing evidence for an early Holocene thermal maximum, indicating that this area provides documentation of the period of maximum summer radiation at high latitudes according to the Milankovitch theory. He also traces the advent of several of the major components of today's vegetation (including *Picea, Populus, Larix, Betula,* Ericads, *Typha, Myrica, and Alnus*), and presents the evidence for and against several hypotheses to explain each event.

The book is an extraordinarily complete and well-organized document. There are seven chapters (Introduction, Physical Setting, Vascular Plant Floristics, Modern Vegetation, Vegetation History, Paleoenvironmental Reconstruction, Current Problems and Future Trends), four appendices (a list of vascular plants from the region, tabular summaries of the main plant community types, field and laboratory methods, and a list of relevant radiocarbon dates from the ten pollen sites), 28 black and white plates mainly of the vegetation types, an invaluable list of references, and an index. Ritchie presents a convincing scenario for the vegetation history of northwestern Canada. Although his conclusions are limited to the easternmost part of Beringia, he nonetheless asks us to reassess our vision of Beringia as a whole.

REFERENCES CITED

Hopkins, D. M., Matthews, J. V., Jr., Schweger, C. E., and Young, S. B. (eds.), 1982: *Paleoecology of Beringia.* New York: Academic Press. 489 pp.

Hultén, E., 1937: *Outline of the History of Arctic and Boreal Biota during the Quaternary Period.* Stockholm: Bokforlags-aktiebologet Thule. 168 pp. + 43 plates.

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RASTITELNOST POLIARNYKH PUSTYN SSSR [Vegetation of the polar deserts of the USSR]. By V. D. Aleksandrova. Leningrad: Nauka, 1983. 143 pp. 2 Rubles 30 kopeks.

Aleksandrova delimits polar deserts thus: In North America she includes only the northernmost parts of the Queen Elizabeth Islands, Ellesmere, and Greenland. In a Barents Sea group are northeastern Spitzbergen with Franz Josef Land and the northern tip of Novaya Zemlya, while a Siberian group includes Severnaya Zemlya with Cape Chelyuskin on the Taimyr Peninsula plus the DeLong Islands. In the DeLong Islands, Bennet Island has tundra oases related by Aleksandrova to föhn winds off the 426-m-high ice cap. The history of all the islands is affected by their position on the shallow continental shelf. Relative amounts of present ice cover are >85% for Franz Josef Land but only about 50% in the Siberian area.

With net radiation <10 kcal cm^{-2} a^{-1} (<420 MJ m^{-2} a^{-1}), climates should be humid overall given precipitation of ca. 200 mm a^{-1}, one-third of which falls in the summer months. Other ecological factors are also well illustrated and discussed: low summer temperatures of air and soil in various habitats; short growing seasons of only 60 to 70 d, and consequently an inhibitory effect of snow accumulation on vegetation; cloudiness; wind; the flora (very poor in numbers of species, many of whose circumpolar ranges are mapped); microclimates; soils.

The vegetation has been described and documented by means of 14 stand surveys (relevés) from Severnaya Zemlya (Korotkevich) plus 5 from Cape Chelyuskin (Matveeva), and here Aleksandrova adds and discusses 70 unpublished ones from Franz Josef Land. More cursory vegetational observations are available from the other areas, where emphasis has been first on the flora.

In an exemplary diagram (p. 32) Aleksandrova shows the relationships between the ecological position and amplitudes of 12 kinds of plant aggregations and 12 individual species (all cryptogams) as functions of types of substrate (rock heaps, sand and gravel, stones and clay, polygons and their cracks, and wet sites) and date of snow disappearance. Not all combinations of the habitat factors have vegetation. Plant aggregations are not distributed evenly over the environmental field. For example, rocks and sand-plus-gravel have the widest range of snow-cover duration and support the widest range of vegetation, while wet sites have the least and support the narrowest range. She also shows the direct relationships between date of snow melt, length of the vegetative season, and sums of positive average daily temperatures of air and soil. This ordination is unique in that it is backed up by stand surveys, as well as quadrat charts, cross sections, and photographs.

An earlier book edited by Aleksandrova and Matveeva (1979) is a fine supplement to Aleksandrova's 1983 work exclusively on polar deserts. Their book discusses floras (including lichens and mosses), vegetation, soils, soil organisms, and invertebrate communities. As in Aleksandrova's polar desert book, the vegetation descriptions are