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# BENEFITS AND PRODUCTS OF JAPAN-U.S. EXCHANGE - A U.S. PERSPECTIVE -

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SUMMARY: The Japan-U.S. Technical Exchange on Snow, Snow Avalanches, and Landslides has facilitated over 40 exchange visits individually lasting from a few days to two years. Major accomplishments have been made on themes including landslide experimentation, snow physics, and effects of volcanic eruptions on sediment production.

## 1. INTRODUCTION

Over the course of the past decade the Japan-U.S. Technical Exchange on Snow, Snow Avalanches, and Landslides has facilitated over 40 exchange visits of scientists and science administrators between the two countries. This exchange program has been managed under the Japan-U.S. agreement on Cooperation in Research and Development in Science and Technology. The exchange program has facilitated activities in the broad category of physical earth surface processes. Networking through person-to-person contacts among a large group of colleagues has been the main method of promoting exchange visits and cooperative studies.

It is difficult to identify precisely which projects fall under the exchange program; here we take a very inclusive approach in discussing the history of Japan-U.S. exchange activities. Major U.S. sources of support for these exchange activities have been U.S. Department of Agriculture (USDA) Office of International Cooperation and Development, USDA Forest Service (USFS), and U.S. Department of the Interior Geological Survey (USGS). Japanese institutions, especially the Science and Technology Agency and the National Research Institute for Earth Science and Disaster Prevention (NIED), have been important in funding and promoting the exchange program.

In this paper we briefly outline aspects of this exchange program over the past decade in terms of selected publications and other benefits. A companion paper (Tominaga 1992) covers the same issues from the Japanese perspective. These papers are not exhaustive in review of exchange activities and resulting publications, but are intended to show the diversity and productivity of the exchanges.

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## 2. BENEFITS AND PRODUCTS OF EXCHANGE

Results of the exchange program have taken several forms. Probably the greatest, but least tangible, benefit has been to share understanding of the very different emphases in research themes and approaches and the differences in social contexts of landslide and snow issues in the two countries. One can learn a great deal about the strengths, weaknesses, and special aspects of one's home country from the vantage point of another culture.

The direct benefits of the exchange program have come in the forms of publications arising from cooperative research, shared information concerning approaches to dealing with natural disasters, and technical and conceptual guidance concerning design and use of experimental research facilities. Another benefit has been creating forums for exchange of information. Capitalizing on major national commitments to sediment and snow problems and geographic location, Japanese and U.S. researchers have been leaders in organizing workshops and symposia concerning erosion and sedimentation issues in the Pacific Rim. The first major symposium on this theme occurred in Christchurch, New Zealand, in 1981. U.S. and Japan locations of other symposia in this ad hoc series include Honolulu (1984), Tsukuba (1985), and Corvallis, Oregon (1987). Although not directly sponsoring these large gatherings, the exchange program has been a crucial part of the networking activity that underlies such communication efforts.

The following discussion of benefits and products is organized by major themes of exchange activities.

### 2.1 Landslides and debris flows

Landslides and debris flows have been a dominant, long-term theme of exchange activities, involving a variety of approaches. One of the earliest topics of common interest was roles of tree root strength on occurrence of small, rapid landslides. In 1974 and 1975 R. Ziemer (USFS), who was studying this subject, became aware of the need to become more familiar with the findings of Japanese researchers, so he commissioned translation of approximately 1000 pages of Japanese publications. At that time contacts between U.S. and Japanese researchers were much more restricted than at present. Since then Ziemer with K. Abe and his colleagues at the Forestry and Forest Products Research Institute have undertaken a variety of cooperative studies of tree root strength in the U.S. and Japan (Abe et al. 1986, Abe and Ziemer 1991, in press). This example of communications advancing from reading translated literature to direct, personal contact between cooperating researchers is representative of the exchange program overall.

The experimental facilities available in Japan have attracted the interest of several U.S. researchers. R. Iverson and R.LaHusen (USGS), working with T. Fukuzono and M.Tominaga (NIED), conducted experiments in the NIED's large-scale, rainfall facility to examine effects of dynamic pore-pressure fluctuations of high magnitude on transformation of landslides into rapid, destructive

debris flows (Iverson and LaHusen 1989). These fruitful experiments and experiences gained from examining many experimental facilities in Japan have lead Iverson and the USGS to construct a large debris flow flume at the Andrews Experimental Forest in the western U.S. This 80-m-long, 2-m-wide flume on a 31 slope will be used to examine debris flow behavior at all points from initiation to deposition. Construction is expected to be completed in 1991 and the first experiments conducted in 1992. This facility is expected to be a focal point for international cooperative research, thus completing a circle from the first international contacts that initiated the concept.

Distinctive field opportunities in Japan have drawn other U.S. researchers. T. Pierson and W. Stokes (USGS), for example, have worked with Ministry of Construction personnel to install devices for measuring the properties of debris flows in a channel draining Mt. Sakurajima where debris flows are particularly frequent. Unfortunately a debris flow destroyed the instrument. These difficulties, however, have led the USGS to develop less expensive instruments and to construct the debris flow flume so that controlled experiments can be conducted.

The seismic characterization of debris flows at Yakedake, Japan, by H. Suwa inspired R. LaHusen to develop an acoustic debris flow detection system that is now deployed in Yunan Province, China, as well as channels draining volcanoes in Alaska, Washington (U.S.), Ecuador, and the Philippines.

Extensive landslide data developed by Japanese researchers have proven useful to U.S. researchers. F. Swanson (USFS), N. Oyagi (NIED), and M. Tominaga (NIED), for example, examined records of landslide dams in Japan, proposed a classification of such features, and interpreted effects of landslide size and drainage area above the dam on the potential for dam failure (Swanson et al. 1986).

Abundant landslide and earthquake data are being used by Ed Harp (USGS) and K. Tanaka (NIED) to establish the strong motion threshold of earthquakes necessary to trigger landslides and rockfalls. Additional data are being sought in both the Izu Peninsula and southern California to develop techniques for predicting distribution of landslides triggered by earthquakes of different magnitudes and geologic settings.

2.2 Snow avalanches and other snow processes

Technical exchange activities on the theme of snow avalanches date from 1972 when Dr. T. Nakamura visited P. Martinelli (USFS). Subsequent cooperative research efforts include the work of R. Tabler (Tabler and Associates, Niwot, Colorado) and M. Takeuchi (Civil Engineering Research Institute, Hokkaido) on blowing snow and T. Lang's (Montana State University) work at the Shinjo Branch of NIED on avalanche dynamics, including computer simulation modeling of avalanche runout distances, velocities, and impact pressures and loads (Lang et al. 1985, Nakamura et al. 1985). In 1988 R. Schmidt (USFS) teamed with A. Sato (NIED) in development of a snow

particle counter for use with blowing snow. R. Decker (University of Utah) teamed with T. Nakamura (Nagaoka Institute of Snow and Ice Studies) on studies of data sets on snowpack structure and use of remote sensing of snow properties. Several additional projects are now in the proposal stage (Nakamura 1990), including establishment of a permanent snow study site in Alta, Utah, because of the area's heavy snowfall, frequent avalanches, and extensive, well managed avalanche control program.

## 2.3 Channel morphology and sediment transport

Accomplished Japanese researchers and fine experimental facilities have attracted U.S. researchers to Tsukuba for studies of sediment transport and processes controlling development of channel structures. For example, G. Grant (USFS) and T. Mizuyama (Public Works Research Institute) conducted flume studies of the origin of step-pool sequences in high-gradient streams (Grant and Mizuyama 1992). T. Lisle (USFS) and W. Dietrich (University of California, Berkeley) have worked with H. Ikeda and F. Iseya (Tsukuba University) on numerous studies of relations among sediment supply rate, channel bedforms, and stream bed armoring (Dietrich et al. 1989, Iseya et al. 1990, Lisle et al. 1991, and numerous other papers).

## 2.4 Effects of volcanic events on sediment and debris flow production

From a U. S. perspective the major eruptions of Mount St. Helens beginning in 1980 have made sedimentation associated with active volcanoes a major theme for U.S.-Japan collaboration. The extensive experience of the Japanese with eruptions and associated sedimentation problems at Usu, Sakurajima, and other volcanoes in Japan and elsewhere in the world have proven valuable to U.S. researchers and engineers. An important event initiating these interactions was the Symposium on Erosion Control in Volcanic Areas held in Seattle and Vancouver, Washington, in July 1982, and organized by members of the Sabo Society and U.S. colleagues (Public Works Research Institute 1983). Following this symposium personnel of the U.S. Army Corps. of Engineers visited various sabo works in Japan to get ideas for long-term sediment control structures on the Toutle-Cowlitz River system draining Mount St. Helens. R. Janda (USGS) has been a major U.S. contact point for the continuing exchange of information on this theme and a leading synthesizer of such information (Janda 1984a, b).

Several exchange visits have focused on comparison of rockslide-avalanches and debris flows at Mount St. Helens, Mt. Rainier, and Mt. Shasta with those at Bandai, Ontake, and other volcanoes in Honshu. U.S. participants were H. Glicken, R. Janda, C.D. Miller, and B. Voight.

## 2.5 Ecological considerations in management of sediment and landslides

Japan and the west coast of the U.S. have some strong similarities in the physical processes and settings of erosion problems, but vast

differences in the social, legal, and economic settings of those problems. Consequently, approaches to erosion control differ greatly between the two countries. The Japanese system emphasizes engineering approaches, especially concrete structures; land use zoning and use of vegetation management are more typical practices in the U.S. Increased environmental concerns of the public globally and increased population pressures may force some convergence of views and an opportunity to develop new practices that represent a balance between engineering and environmental objectives. This has been a theme of a number of exchange activities in both early days of the exchange (Ziemer 1981) and more recently by F. Nakamura (University of Hokkaido) working with Grant and Swanson (Swanson et al. 1992). This theme is likely to increase in the future.

## 3. CONCLUSIONS

The number, diversity, and importance of results for activities in this exchange program reflect the extensive areas of common interest and the highly complementary scientific programs in U.S. and Japan in these fields. Japanese researchers have emphasized an experimental approach and development of facilities to conduct those experiments. The U.S. emphasis has been on analysis of field data on populations of events. Together there has been development of technology and shared responsibilities for disaster relief in developing countries. Each of the themes of past technical exchange work will continue to be important in the future; some themes will probably increase in significance, such as ecological considerations in sediment and landslide management.

We foresee that this exchange program will continue to be highly beneficial to both countries in the coming years and could play an important role in bilateral actions in the International Decade for Natural Disaster Reduction. This can occur through exchanges of data, instruments, and publications, and through collaboration in providing crisis assistance to developing nations, even when budgets limit travel between the U.S. and Japan.

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