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INTEGRATING ACADEMIC AND AGENCY RESEARCH INTERESTS AT THE H. J. ANDREWS EXPERIMENTAL FOREST

(see back pg)

Arthur McKee

ABSTRACT: A large number of studies are conducted at the H. J. Andrews Experimental Forest and seven nearby research natural areas (RNA's). During 1983, 63 academic and 21 agency scientists were involved in 56 separately funded projects. In addition, 48 graduate students used the areas. Data from various monitoring efforts were used in 79 of the total number of studies, including 21 studies conducted on RNA's. Several factors appear responsible for the success of the monitoring program that combines academic and agency research interests. The factors are: a vigorous research program, common research interests and goals, a spirit of cooperation among the scientists, a coordinating administrative structure, clearly defined responsibilities, and a centralized data bank.

INTRODUCTION

The H. J. Andrews Experimental Forest was established in 1948 by the U.S.D.A. Forest Service for the purpose of examining the effects of different logging methods on forest regeneration and water quality. Because hydrologic and forest successional studies require long-term measurements, monitoring efforts were started along with the earliest research. During the 1950's and 1960's scientists initiated several meteorological, forest succession, erosion, and nutrient cycling studies.

Many of these studies collected data of a long-term nature, or provided the basis for establishing a long-term monitoring program. The Andrews Forest, by which term the seven nearby research natural areas are collectively included with the H. J. Andrews Experimental Forest, was selected in 1970 as an intensive study site by scientists of the Coniferous Forest Biome (U.S. International Biological Program) because of the existence of the rich data base.

The research program at the Andrews Forest changed dramatically in two significant ways as a result of this selection. The first of these changes was the shift from nearly exclusive use of the site by U.S.D.A. Forest Service scientists to use by a cadre of researchers affiliated with agencies, universities, or both. That shift has continued to this day, with the proportion of university scientists and research projects gradually increasing to where they now predominate (table 1). About two-thirds of all research projects in 1983 were funded through various universities. Concomitant with this shift has been an increasing and substantial use by graduate students (table 2). The second significant change was the development of multidisciplinary ecosystem studies by scientists of the Coniferous Forest Biome project, which integrated both agency and university research. This prompted the creation of a coordinated monitoring program to provide the necessary long-term data sets of common interest to this diverse group.

Large, interdisciplinary research projects are the dominant type of research conducted today at the Andrews Forest. In addition, there are several smaller projects addressing specific problems. Studies of both types contribute to, and rely on, the monitoring program. Since its inception during the Coniferous Forest Biome research, the monitoring program has enlarged in scope and improved in organization. Its success appears to be the result of several factors.

DISCUSSION

The reasons for long-term ecological data collections are manifold and the utility of such data is increasingly recognized. Data collected by a monitoring program provide a measure of the natural variation in an ecosystem and permit an examination for long-term trends and changes. Such data facilitate analyses of ecosystem processes and development of ecological theory. They make possible an accurate assessment of the effects of anthropogenic pollutants. If more data were available, environmental impact statements would have more credibility, and regional and local land-use plans could be more effectively developed by the land manager. For these reasons and others, Gene Likens, past president of the Ecological Society of America, argues that the establishment of long-term studies and high-quality monitoring programs is a major priority for ecological research (Likens 1983).

A significant part of the difficulty in establishing a monitoring program is deciding what factors or components of the ecosystem should be measured. What data sets will be most useful in the future? Several conferences were sponsored by the National Science Foundation in the late 1970's to address that question (Botkin 1977, 1978; TIE 1979a, b). The reports provide lists of suggested measurements but offer little advice on how to establish and maintain a monitoring program. The following discussion

Arthur McKee is Research Instructor in the Forest Science Department, Oregon State University, Corvallis.

Table 1--Number of research projects at the H. J. Andrews Experimental Forest and nearby research natural areas during 1983

Subject area[1/]	Number of research projects			
	University	Agency	Total	Utilizing monitoring program
Animal ecology	6	3	9	3
Ecosystem processes	16	5	21	11
Entomology	17	3	20	3
Fisheries	1	1	2	2
Genetics	1	1	2	2
Geology	3	3	6	3
Hydrology	1	2	3	3
Limnology[2/]	7	0	7	5
Plant ecology	8	4	12	9
Silviculture	6	9	15	10
Soils	0	1	1	0
Totals	66	32	98	51

[1/]Within a subject area, the numbers of university funded projects, agency funded projects and projects utilizing the monitoring program are presented with total number of projects.

[2/]Including riparian ecology.

Table 2--Number of graduate student projects at the H. J. Andrews Experimental Forest and nearby research natural areas during 1983

Subject area[1/]	Number of graduate student projects			
	University	Agency	Total	Utilizing monitoring program
Animal ecology	2	1	3	2
Ecosystem processes	8	0	8	4
Entomology	5	0	5	2
Fisheries	4	0	4	2
Geology	1	2	3	2
Hydrology	0	2	2	2
Limnology[2/]	3	0	3	3
Plant ecology	7	2	9	4
Silviculture	4	2	6	3
Soils	2	0	2	2
Tree physiology	3	0	3	2
Totals	39	9	48	28

[1/]Within a subject area, the numbers of university funded projects, agency funded projects and projects utilizing the monitoring program are presented with total number of projects

[2/]Including riparian ecology.

offers some advice based on the experience gained in developing the monitoring program at the Andrews Forest. Although each site will have its own unique needs and problems, there appear to be some common factors or key ingredients in a successful program. By fostering the development of these common factors, a group interested in long-term monitoring will be a long way toward resolving what to measure and how to maintain the program.

The common factors of a successful monitoring program are: (1) a diverse and vigorous research program; (2) common research goals or interests; (3) a spirit of cooperation or willingness on the part of researchers to share responsibilities and data; (4) an administrative structure to coordinate the monitoring activities; (5) clearly defined responsibilities for collection and maintenance of data; and (6) a central data bank. Stable financial support is a major factor, but if all the other ingredients are there, the financial issues become largely a matter of coordination.

The first factor listed--a diverse, vigorous research program--is perhaps the most important ingredient for success. The mixture of research projects at a site will, to a large extent, determine the measurements to be made and should provide the basis for the logistical and financial support. By coordinating the needs and resources of the various research projects, economies of scale emerge and responsibilities can be delegated. Monitoring activities that are not integral parts of research programs and have to stand on their own accomplishments will have a more difficult time competing for limited research funds.

The research program at the Andrews Forest is large and diverse. During 1983, 63 academic scientists, 21 agency scientists, and 48 graduate students worked in 56 separately funded projects. The varied nature of the research is shown in table 1, which divides the 56 separately funded projects into subprojects by subject area. Table 2 shows the variety of graduate student projects. The existing monitoring program at the Andrews Forest (table 3) has been determined by the long-term research needs of previous and current scientists. That it is an important part of the overall research effort is obvious from tables 1 and 2, which show that 51 of the 98 research projects and 28 of the 48 graduate students utilized data from the monitoring program in 1983. Twenty-one of the 79 projects that used data from the program were located on research natural areas. The components or factors presented in table 3 include all those recommended in the TIE (1979b) report listing core requirements for a long-term ecological research program. The monitoring program at the Andrews Forest has grown in step with the increased diversity of research projects and would be far less complete with a smaller research effort.

Table 3 also shows the relative responsibility of agency and university research projects for the different components. Many factors are being measured by both groups and the data sets merged. This reveals the degree to which research interests are held in common by agency and university scientists. It also indicates the spirit of cooperation among the scientists because the data collected become freely available to all.

A large monitoring effort clearly needs to be coordinated. The coordination of monitoring activities at the Andrews Forest was first done in an informal manner with principal investigators pooling resources and data from their own research projects. The research activities had increased so much by the mid-1970's that this informal type of coordination was proving impractical. In 1977, the administrative structure shown in figure 1 was established and has since proven effective. The site manager has primary responsibility for the coordination of the monitoring program. The questions of what components or factors to measure, methods to be used, and frequency of sampling are addressed by the Local Management and Policy Committee. This committee is composed of both university and agency scientists who have research projects at the Andrews Forest. The committee also provides the continuity necessary to maintain a long-term ecological measurements program derived from research projects that ordinarily have a limited time span.

The Local Management and Policy Committee also helps define who is responsible for the different measurements. This is important in a program of this magnitude where several projects may have an interest in a data set, but for reasons of efficiency just one or two projects may be conducting the sampling. Along with the site manager, the committee helps maintain quality control by specifying the standards to be met.

The last of the common factors for a successful monitoring program is a central data bank. Other terms sometimes used for central data bank are data management center or quantitative services group. All data sets collected as part of a monitoring effort should be well documented, carefully edited, and readily available. The experience at the Andrews Forest has been that a well supported data bank, staffed with qualified people who are dedicated to data management, is essential. The monitoring program at the Andrews did not work well during the period when individual investigators were responsible for editing and archiving their own data. The standards of documentation varied greatly from researcher to researcher but generally were inadequate. Delays were common in obtaining requested data. A gradual appreciation of the benefits of having a central data bank resulted in the development and establishment of our current facilities.

Table 3--A summary of the monitoring program at the H. J. Andrews Experimental Forest and nearby research natural areas showing relative responsibility of agency and university research projects for each component

Component or factor monitored	Collected or measured by agency	university
Site description and background:		
Historical record	A	U
Geologic maps	A	U
Soils maps	A	u
Flora	A	U
Fauna	a	U
Meteorological and physical:		
Shortwave radiation	a	U
Net allwave radiation	a	
Air temperature	a	U
Water temperature	A	U
Dewpoint		U
Wind speed		U
Wind direction		
Precipitation	A	U
Snow depth and duration	a	U
Soil water content	A	u
Groundwater level	a	U
Watershed discharge	A	U
Erosion and sediment load	A	U
Stream morphology	A	U
Streamwater transparency		
Ice cover of stream		
Chemical measurements:		
Atmospheric--		
Wetfall	a	U
Dryfall		U
Particulates		
Gases		
Terrestrial--		
Vegetation	a	U
Litter (including heavy metals)	a	U
Soil	A	U
Soil solution	A	U
Aquatic--		
Streamwater	A	U
Litter	a	U
Vegetation		U
Invertebrates		U
Primary production and decomposition:		
Terrestrial--		
Leaf area index	a	U
Standing crop (including phenology)	A	U
Litterfall		U
CO_2 release from soil		
Carbon Retention	a	U
Aquatic--		
Phytoplankton		u
Periphyton	a	U
Macrophyte		U
Carbon retention	A	U
Population records:		
Terrestrial--		
Plants	A	U
Amphibians		u[1/]
Birds		u[1/]
Mammals	a	u[1/]
Aquatic--		
Zooplankton		u
Benthos		U
Fish	a	U

Capital letters denote a greater responsibility than lower case. The listing includes all components recommended by TIE, Institute of Ecology (1979b) for a long-term ecological measurement program.

[1/] Component is not being sampled at frequency or level recommended by TIE (1979b) report.

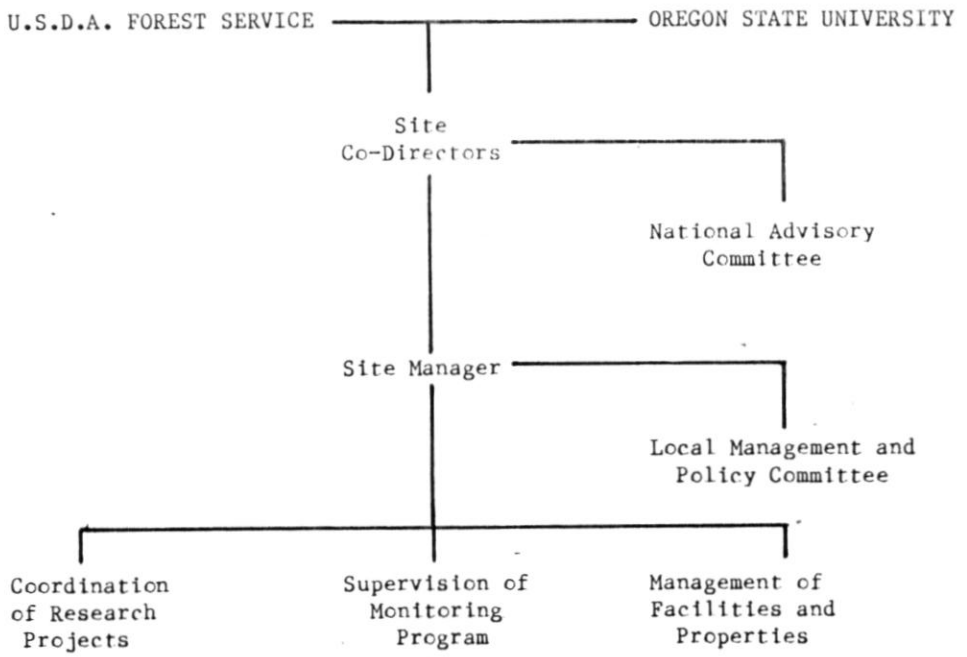

Figure 1.--The administrative structure of the research program at the H. J. Andrews Experimental Forest and associated research natural areas.

Data are now readily available, with the assurance they have been carefully edited and are well documented. The data management people also provide statistical analyses, assist in experimental design, and help the scientists with a variety of quantitative services.

The data bank has grown beyond the immediate needs of the scientists working at the Andrews Forest and is now a center for data management of several departments at Oregon State University. Its own success is a reflection of the value of the services it performs. This is not meant to suggest that each site needs such a large investment in a data bank. The message is clear, however, for any monitoring effort: do not ignore the needs and costs of maintaining quality data and have someone in charge of documenting, entering, and editing the data.

CONCLUSION

The monitoring program at the Andrews Forest developed over several decades, evolving from a sampling program that was quite limited in scope to the large, coordinated program of today. Research interests have always determined the monitoring program that has provided the long-term ecological measurements of common interest to scientists.

Several factors have contributed to the successful establishment of the program. These are probably common to any similarly successful monitoring effort. The factors are: a vigorous research program, common research interests and goals, a spirit of cooperation, a coordinating administrative structure, a clear definition of responsibilities, and a centralized data bank. Some of these are intangibles and difficult to establish. A spirit of cooperation and common research goals are not off-the-shelf items. They require considerable care in nurturing and, once established, require continual attention. In a program of this magnitude coordination would be impossible without cooperation.

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Jerry F. Franklin, Pacific Northwest Forest and Range Experiment Station

Richard G. Krebill, Intermountain Forest and Range Experiment Station

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