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Cover Photo: Sara Molden (left) and Annie Esperanza, resource management employees of Sequoia/Kings Canyon NP's, weigh small woody debris (1" to 4" in diameter) as part of the pulse study (See story page 3).

Cross Disciplinary Approach To Complex Park Problems Supplied by 'Pulse Studies'

By Jean Matthews

As environmental problems proliferate and ecosystem functions are increasingly compromised, it becomes both more difficult and more urgent to understand how pristine, or near-natural, ecosystems function. To the resource manager's mind, too often the outside pressures impacting the systems are insufficiently documented, and in any event a mind-boggling number of variables usually is involved.

In the past four years, an innovative approach called a "pulse study" has been applied at strategic places in the West – measuring, monitoring, recording, and hypothesizing – looking for relationships that can lead to more effective management of natural resources.

The cover story of Vol. 1, No. 1 of this publication (Fall 1980) dealt with the pulse study of Olympic NP's Hoh River valley. Three years later, still going strong under the same leadership, another such energetic effort has been made at Sequoia and Kings Canyon NPs in California.

Jerry Franklin, research scientist with the USFS Forestry Sciences Lab in Corvallis, Oregon, is the instigator and prime mover of the pulses . . . a term that seems to refer both to the heartbeat of the ecosystem under study and to the concentrated periods of research that go into "taking the pulse."

Initial Pulse

At Sequoia/Kings Canyon, the initial pulse took place in September 1982. (See Supt. Boyd Evison's enthusiastic endorsement of the pulse in the Letters section of *Park Science*, Spring 1983 issue). The final field phase was conducted June 26 to July 9, 1983. Under Franklin's leadership, approximately 75 researchers examined the interactions between streams and an arid mixed-conifer forest (giant sequoia, white fir, Jeffrey pine, and red fir) and the contribution of riparian vegetation to stream productivity.

The actual study plots were laid out with an eye to answering management questions for the park and to testing concepts suggested by previous pulse studies in the Hoh, at the H.J. Andrews (USFS) Experimental Forest, and at other locations. Researchers examined log decomposition and the roles played by insects and the mountain meadow plant communities associated with sequoias. Permanent sample plots were established in several of the forest types so additional data can be collected on size and age of trees.

Participants are the investigative lifeblood of the pulses; they come from as many institutions and agencies as are needed to make the research picture whole. Team Leader Franklin, however, is the heartbeat – clowning, coaxing, badgering, inspiring his chosen group into a closeknit, interacting unit. It's at night, around the campfire, that Franklin's magic club (no puerile wand for him) beats what could be merely a multi-disciplinary exercise into an inter-disciplinary triumph.

How It Works

Operationally speaking, it works something like this.

All day long the various teams are out in the field, loading up on observations and data, according to their pre-arranged assignments. At night they unload their mental baggage at a Franklin-led, total attendance get-together. As each group reports, all groups pay attention. Light from a dozen different disciplines is brought to bear as hypotheses are proposed, exposed, thoroughly chewed over, sometimes accepted conditionally, more often shot down and disposed of. The process serves to short-cut the usual route of publishing in the journals and then awaiting scholarly response.

The touchstone against which the gold of hypothesis is tested is the variety of education and experience represented by the multi-disciplinary science team, the technicians, and the resource management types who participate. As the discussions proceed, discipline distinctions blend into any number of shadings. The sharp edges of riparian, limnological, geological, or hydrological wisdom tend to soften and interconnect. The result often is a new light thrown into the area being discussed; the resident scientist in that area comes up with an "Ah ha!" reaction.

(Not every idea floated gets such favorable treatment. There are also a lot of "boos" and "no-ways"; hubris and humility live in precariously close quarters at the pulse study campsite.)

Management Interacts

In all this discussion and interaction, management personnel from the host park sit in – interjecting the management perspective into all that transpires.

The team maintains its mission and identity even as its membership changes. Some stay on for the entire pulse; many come and go, lending change and continuity and giving the constantly emerging results a sort of life and longevity of their own. Ecosystems will continue to evolve; problems will change; the vis-



Air sampling set-up is described by Bruce Wiersma (right) to Drs. Yuri G. Puzachenko (left) and Valery A. Petrukhin. Dr. Wiersma is with the national engineering lab EG&G Idaho, Inc.; Puzachenko is from the Russian Institute of Animal Evolutionary Morphology and Ecology; Petrukhin is from the Russian Hydro-metric Survey, Executive Secretariat of Bilateral Environmental Agreement.

itor component of parks and the interpretation and management will continue to evolve also. The whole scene benefits enormously (according to the testimony of both park managers and resident scientists) from such dynamic group efforts to keep abreast of conditions that converge and must be dealt with on human terms. Some of the "pulses" (an interesting anagram of "pulses") were described by NPS Research Scientist Doug Houston, commenting on the Hoh pulse at Olympic NP, which now dates back four years:

"The pulse team generated some very interesting hypotheses about the effects



The pulse's "rotten wood group," (invertebrate people) pursue their quarry in one of the study plots. From left, John Oswald, OSU research assistant; Gary Parsons, research scientist at Sequoia/Kings Canyon, and Jack Lattin, associate dean of science and professor of entomology at OSU.

Cross Disciplinary (Continued)

of elk and other ungulates on old growth forests – their subtle impacts on forest regeneration and plant species composition. They looked into the roles of down trees in the streams and on the forest floor. These are all effects we had not been aware of; we can now look for them and deal with them."

One startling finding in the Hoh study was the result of establishing elk exclosures in the grassy plots.



Ken Cummins, stream team leader, about to go wet suit diving in Log Meadow.



Measuring a trout from one of the numerous deep streams that were completely masked by meadow growth, are Stream Team Leader Ken Cummins (left) and high school volunteer Colter Hessel.

Without grazing, in only four years these plots are filling in rapidly with shrubs and ferns. No grass. A future *Park Science* will describe these findings and the management implications stemming from them.

The work of Bruce Wiersma, an air quality scientist now working for private industry at the international level, demonstrates two distinct ways in which the pulse approach functions as an integrator and synthesizer. Wiersma's own work involves tying air quality network to network – NPS air quality programs, state air programs, university programs, individual park programs, and the pulse study group with its broad science and agency composition – all different sets of sensors focusing on one small slice of ecosystem. Wiersma brings these insights to the pulse study, whose way of functioning is almost exactly the opposite. Where Wiersma concentrates on getting *one* kind of reading from all over the world (air quality), the pulse study concentrates on getting as *many* readings as possible from one small slice of the ecosystem, with the goal of gaining new insights into how all (or any of) the components act, interact, and *work*.

This kind of information is well-designed to address overall park management problems.

Sierran Pulse

The first pulse at Sequoia/Kings Canyon took place from Sept. 12 to 24, 1982 and involved 41 researchers from eight different institutions and organizations. This included seven individuals from the research and resource management staffs at Sequoia NP. Disciplines represented were plant ecology, geomorphology, hydrology, entomology (aquatic and terrestrial), aquatic biology, forestry, and geography.

Focus of the first pulse was largely on collections of basic descriptive data on the stream, riparian, and forest systems at the selected study sites. These included four stream segments associated with mixed-conifer forest (Suwanee and Dorst Creeks), giant Sequoia forest, and a meadow. Over 400 m of stream reaches were analyzed and mapped. Characteristics studied included channel morphology (including cross-sections), woody debris, retention features other than woody debris, flow patterns, retention characteristics (based on leaf release study), and biomass and composition of the riparian vegetation. Four hectares of adjacent forest were analyzed with



New woody debris in Suwanee Creek is typical of the interaction taking place at Sequoia/Kings Canyon NP.



Dynamic Group Leader Jerry Franklin, exhausted from excessive whistle-blowing, "takes five" at the foot of a towering sequoia.

stem mapping and measurement of all live trees, snags, and down logs and descriptions of the understory vegetation. Material was collected for construction of biomass equations for the major riparian species and for biomass estimates in Log Meadow.

Long-term Plots Established

Other accomplishments included establishment of long-term snag decay plots, collection of data on de-

One peculiarity of the Sequoia/Kings Canyon area is the fact that no "cobbles" (as in Oregon streams) can be found. The rock outcrops tend to disintegrate directly into sand-size particles. The Oregon and Washington cobble/pebble stage is one in which benthic life abound.

The tongue-in-cheek suggestion of one observer at an evening campfire:

"It would be interesting to run an empirical test on how many people fall into a stream when trying to cross it in the Pacific Northwest as opposed to the Sequoia/Kings Canyon environment."

The critical factor, presumably, would be the slippery life forms that make footing chancy in the Northwest, as opposed to the lack of such slimy life on logs and stream bottoms in the Sequoia/Kings Canyon area.

composition of down logs (including the role of insects), establishment of an upland mixed-conifer reference stand (area of mapped and measured forest), collection of increment cores for an age-structure analysis of the Suwanee mixed-conifer stand, and extensive sampling of meadow vegetation within the mixed-conifer zone.

Data bases for the establishment of volume equations for local trees and on litter fall (leaf and fine woody debris) were developed in mixed-conifer and giant Sequoia stands and littertraps were set up in

Crescent Creek. These are being collected by NPS personnel at three to four week intervals. Data will be valuable for both this study and the baseline studies for appraisal of effects of acid precipitation. Stream, air, and soil temperatures are being monitored at Crescent Creek using two dual-probe, 31-day Partlow thermographs.

The June/July phase of the pulse involved 50-odd scientific personnel, including four Russian scientists. Work concentrated on aquatic process studies (e.g. production), aquatic insects and fish in the selected streams, and establishment of additional upland forest sample plots (reference stands) for study of forest composition, structure, and function. Other work included additional analyses of log decomposition (especially invertebrate roles), extension of

meadow analyses, fungal ecology, vertebrate use of riparian zones, and physiological studies of riparian plants.

Publication Underway

Currently in production is a single large document, data-rich, with maps, covering all aspects of the work. Individual publications (mostly in refereed outlets) have been assigned, and major participation in the 1984 spring NPS Regional Science Conference in California has been arranged.

In typical Franklin style, the memo that ties all this work into retrievable form and makes it publicly available reads:

"No bent noses, please, over omissions. This is just an effort to get your minds rolling."



Pulse leaders enjoy a good laugh over some heartbroken hypothesizer's ruined construct. From left, Art McKee, ecologist and manager of the Andrews Experimental Forest; Pulse Leader Jerry Franklin; Dana Abell, ecologist from Davis, California; and Dean Taylor, OSU forestry research associate.



Stan Gregory (left) of OSU Fish and Wildlife Department, and Jim Brock, biologist from Idaho State University, listen as Karen Luchessa, principal investigator for stream channel mapping, outlines the day's work.



On a Sierran bald at about the 7000-foot level, an atmospheric group inspects the precipitation event collector for chemical analyses. From left, Dan Drisco, Sequoia/Kings Canyon NP resource management specialist; Kirill D. Zykov, Ray Herrmann, NPS Water Resources Lab Chief; Yuri A. Starikov, Valery A. Petrukhin, and Yuri G. Puzachenko. The Russian participants in the pulse study were there courtesy of the U.S./U.S.S.R. Bilateral Environmental Agreement.