achieved. A tentative outline for a position paper, to be submitted to Science, was completed in June 1991. Currently we are writing a preliminary draft which should be completed in early 1992. A final draft of the manuscript will be submitted to the USGA Green Section on or before May 1, 1992.

This has been a rewarding and enlightening project because there is a need for it, and because our perspective has evolved concerning the environmental issues challenging the golf course industry. This position paper, and other USGA projects, are needed first steps. We agree, however, that the lasting solution will be achieved from the golf course industry and environmental groups working together to achieve common goals and objectives.

Dr. James Beard

The Earth Fund

On Course with Nature

This project will adapt information on eco-regions across the United States for use in naturalizing landscapes around golf courses. By increasing the natural areas around the golf course, it is hoped to increase or preserve wildlife habitat.

Earth Fund researchers look at golf courses as valuable green space within the urban environment. Golf courses, however, are not regularly cited in scientific literature concerning wildlife habitat, and more often receive negative attention in popular press. This project has surveyed the literature on natural areas and established woodland size, vegetation structure, and other information to encourage wildlife usage of golf courses. The United States is already divided into natural eco-regions and the book developed from the project will describe how to recreate or manage the natural vegetation previously on the site.

An outline of the book contents was developed and an extensive literature review was completed during the last three to four months. Lists of native plant species and nurseries in the United States that produce these materials will be incorporated into the book. The landscape side of the problem, or the "how to do it" principles, will be a major portion of the book. Careful attention to recommendations on adapted plant materials for a region will be emphasized. A detailed map of the United States indicating the natural ecoregions and plant communities was developed in 1991. Landscape architects and horticulturalists can use this map and then go to a nursery to select suggested plant species. Currently, native plant species do not have something similar to this approach, and the project will help a great deal to meet this need.

The Green Section will help select photographs of golf courses that are already utilizing some of the principles the book will develop. From an urban planning perspective, the book could help develop scenarios for natural corridors through urban areas by linking golf courses, parks, and larger tracks of land. The concept of 'sustainable development' and 'quality of life' will be covered.

Dr. Donald Harker

Institute of Wildlife and Environmental Toxicology

The Effects of Golf Course Activities on Wildlife

The Institute of Wildlife and Environmental Toxicology (TIWET) at Clemson University has conducted numerous studies on the environmental effects of pesticides used on golf courses. TIWET, with USGA funding, initiated research in golf course management practices to institute environmentally sound approaches based on knowledge of chemical use, fate and effect. Attempts will be made to determine those products and management procedures which reduce non-target wildlife exposure to pesticides. Resulting information will aid in the development golf course management practices that provide satisfactory playing surfaces, without damage to the environment.

The pilot study on the Ocean Course, Kiawah Island, began in July, 1991. This investigation has focused on two areas: 1) developing a thorough water sampling program to measure the quantity of pesticides reaching adjacent marshes; and 2) assessing the potential for exposure of wildlife on the Ocean Course and adjacent habitats.

The development of Kiawah was conducted with environmental foresight, resulting in a residential and resort community endowed with diverse habitat and abundant wildlife. The Ocean course, constructed with an innovative drainage

system that captures runoff from rainfall and irrigation, is situated in a sensitive ecosystem of sand dunes and tidal marsh. Chemicals used on the course are deterred from entering adjacent wetlands and the water can be recycled.

TIWET efforts during the first year have concentrated on gathering background information on the Ocean Course and on substantiating irrigation and chemical application procedures. Maps and diagrams were developed and used to describe the flow of irrigation and drainage water on the course. Turf management practices and pesticides used on the Ocean Course were documented. Chemical application records were collated and the irrigation schedule was recorded. Water samples have been collected for preliminary analysis of pesticide residues.

Dr. Ron Kendall

Texas A&M University

Human Benefits of Golf Course Views: Emotional Well-Being, Stress and Performance

While golf courses are an important type of land use in most American cities and suburban areas, there is little scientific evidence regarding the human benefits that golf courses make possible. More specifically, there is virtually no sound, convincing research regarding the "influence of golf courses on the psychological and physical well-being of people." The absence of research on these issues is not a problem for the avid golfer, for whom the benefits of golf courses and the game are intuitively self-evident. The great majority of Americans, however, are not golfers, and accordingly lack the direct experience that is probably necessary for an intuitive appreciation of the benefits of golf courses and the game.

The lack of research on golf course benefits can be a major problem both from the standpoint of communicating or marketing the benefits of the game to the non-golfing public, and/or conveying the benefits of a proposed golf course to either a planning commission, a zoning board, a city council, or a group of environmentalists. The reality is that intuitively-based arguments about the human benefits of golf courses, however commonsensical to golfers, carry little or no weight in the face of the more publicized or tangibly documented issues such as pesticide runoff, consumption of scarce water resources in semi-arid areas, or membership polices based on racial or ethnic criteria.

A major feature of the two proposed studies is the emphasis placed on state-of-the-art *physiological* and *behavioral* measurement techniques, in combination with self-report techniques such as questionnaires, for examining the effects of golf courses on human well-being and cognitive performance. For reasons related to scientific validity, we strongly favor using a combination of physiological, behavioral, and self-report measurement instruments in the assessment of human responses. Such a research strategy avoids relying solely on widely-used verbal measures such as "aesthetic preference" and "satisfaction" and thus circumvents a potential criticism of such measures based on recent empirical demonstrations that preference ratings for natural environments may neither be correlated with improved emotional well-being, nor be consistently linked with such human benefits as recovery or restoration from stress or mental fatigue.

The specific objectives of these studies are to: 1) identify and measure the physiological and emotional effects of off-site views of golf courses, and compare these effects with those resulting from viewing other common types of urban land uses (i.e., commercial strips, residential areas and parks, etc.); and 2) identify and measure the effects of viewing golf courses (relevant, for instance, to views from workplace windows) on the performance of cognitive tasks relevant to the productivity of administrators and other employees. Performance on these tasks will be diagnostic of our capacity to either monitor or reject incoming information and to either analyze or synthesize diverse information. For example, a significant part of the project will focus on whether viewing a golf course elicits a positive mood, that in turn enhances performance on tasks related to creative thinking.

The anticipated benefits of the research will include: 1) the potential positive consequences of golf course location for off-site users will be identified, assessed, and made accessible for practitioners involved in land use decisions; 2) a precedent will be established for the training of graduate students in landscape architecture on the indirect health