INTERNATIONAL NEWS

Australian Arid Zone Research Conference

The second Australian Arid Zone Conference was held at Alice Springs September 12 to 17, 1965. A 4-day pre-conference tour visited the Ayres Rock-Mt. Olga area, a round trip of about 700 miles with stops to observe various plant communities.

About 125 delegates registered. The various subjects were covered by a review speaker who presented both published and unpublished materials, and a discussion leader who summarized the contributed papers. One-third to half the allotted time was usually allowed for discussion. A copy of the condensed papers had been mailed to each delegate 3 or 4 weeks beforehand to permit time for preparation of questions and discussion. The following were subjects covered with some of the points of interest to the author.

Arid zone animals — adaptive mechanisms — native animals. The individual problems of existence center around environmental requirements such as nutrition, cover, toleration of heat, and prolonged water shortages. Animals generally adapt behaviorally or physiologically. For example, there are as many species of frogs in arid areas of Western Australia as in more humid areas. They have survived 5 years of severe drought. They are adapted to arid areas behaviorally (they have deeper burrows) and physiologically (they can rehydrate more rapidly). When the nitrogen content of the diet is low, the euro (a kangaroo) recycles urea instead of excreting it.

Arid zone animals — adaptive mechanisms — introduced animals. During summer, the hair of camels, horses, donkeys, and most breeds of cattle is short from the photoperiodic spring shedding and there is reflection of solar energy from the shiny surface. However, the hair and skin of dark-colored animals in the sun is hotter by 3 to 5 C than that of lighter colored animals. When deprived of water, sheep and cattle continue to pass relatively large amounts of urine for 2 or 3 days, whereas camels promptly reduce urine flow. Sheep and camels conserve intestinal water, and so fecal water may be reduced to 45% of total weight. Water content of cattle feces is rarely less than 60%; *Bos indicus* reduces water loss in this way more than *Bos taurus*. At Rockhampton, Queensland, English breeds of cattle perform better in summer than Brahmans, but this is reversed in winter when feed is of low quality.

Arid zone plants—adaptive mechanisms. Several shrub species effectively increase soil water recharge around their bases by channelling a substantial proportion of the incident rainfall down their stems. The soil near the base of these plants often has a higher infiltration rate than soils away from shrubs. During drought periods, leaf water potentials as low as 140 bars have been measured in hard spinifex *(Tridens basedowii)* and mulga *(Acacia aneura)*.

Utilization of local water resources. In arid areas, the catchment area for surface runoff should be at least 30 times as large as that in a temperate zone. A possibility for suppressing surface evaporation from open storage would be to use the South African technique of constructing sand-filled storages.

Range management. Arid zones have been defined by Meigs as "areas in which rainfall is not adequate for crop production." In Australia it is that area bounded by the 10-inch isohyet in the south, the 15-inch isohyet in the southeast, the 20-inch isohyet in the east, and the 25-inch isohyet in the north. Thus, 1,800,000 mi² of the total 2,900,000 mi² in Australia are in the arid zone. This area supports 2,000,000 cattle and 27,000,000 sheep. The mitchellgrass areas in Queensland support about half the cattle and sheep in the arid zone. The use of American methods of evaluating range condition and trend were reported to be of limited use in Australia for the following reasons: (1) Australian ranges, and the stock industries, are much less productive per unit area of land than American ranges, thus, the methods may be too expensive in relation to income; (2) Australian ranges are grazed year-long, whereas many American ranges are used for seasonal grazing and condition is determined prior to the grazing season; (3) with few exceptions, American methods are concerned with perennial plants whereas on Australian ranges much of the production is from annual plants; and (4) American range managers can draw considerable background knowledge of individual sites and plant species which is not available for Australian ranges.

Twenty-six papers were discussed in the range management session. In the Alice Springs District of the Northern Territory (144,000 mi²), 69% is non-grazing land because of poor quality vegetation. The 88 properties in the area occupy 95,000 mi² and include 92% of the grazing land. To include such a high proportion of the grazing land, large areas of non-grazing lands are included in the properties. On the average, only 44% of the leased land is grazing land; 68% of the grazing land is within 5 miles of water; and 40% is within 3 miles. Because of severe drought since 1956, the cattle numbers in 1965 were down to about 50% of the high.

In Western Australia, burning soft spinifex *(Tridens pungens)* in late spring and deferring grazing for two growing seasons resulted in the growth of useful grasses. Since soft spinifex reinvades those areas, they must be burned every 6 to 8 years. Woody plants are likely to increase at the expense of grasslands. An alternative to long-term grazing management studies would involve computer simulation, based on analytical studies of the various processes.

Economic aspects of the pastoral industry—problems of adaptation of pastoral businesses to the arid zone. No one knows positively whether an economically viable cattle industry, as constituted at present, is compatible with the maintenance of the range resource. Some of the features of the arid zone that make decision-making processes more complex than those in more humid zones are: (1) rainfall is extremely variable; (2) the production period in the cattle enterprise is long; (3) some ranches are poorly organized; (4) fixed costs are high relative to variable costs; (5) the existence of only a single enterprise limits the scope of drought-evading tactics; and (6) space is a big factor in many managerial issues. The strategies which may be adopted by ranchers in the arid zone in an attempt to reduce the effect of climatic hazards on their businesses include: (1) adoption of flexible livestock systems; (2) moving livestock to take advantage of local rain storms; (3) feed reserves, particularly in situ; (4) use of areas reserved exclusively for drought periods; and (5) accumulation of financial reserves. History suggests that the greatest obstacle to the adjustment of a people to its particular physical environment is probably a lack of understanding of that environment.

Animal production. A 10-year study in Queensland, including 6,500 breeding ewes, revealed that one-third failed to lamb, and one-third of all lambs born alive died before attaining marking age. There are indications that reproduction can be influenced by selection against skin wrinkle and for certain hemoglobin types. Since 1910, the sheep population in arid Australia has fluctuated with seasonal conditions and has shown no long-term trend toward increase. In northwest Western Australia, flocks are now unable to maintain themselves. Grazing has probably reduced the diversity of the main plant communities which support sheep. This has resulted in the following changes: (1) increasing dominance of plant species that can withstand stocking; (2) reduced fertility in soil; and (3) reductions in the vigor of grazed plants. In some areas annual species formerly occurred between the tussocks of *Tridens* and *Plectrachne*. Injudicious grazing has denuded extensive areas of these annuals, thereby creating a habitat favorable for the euro; the area is virtually worthless for livestock. Many of the native plants in arid zones produce sparse amounts of forage for each unit of water used. From 60 to 180 tons of precipitation may be required for sheep to produce 1 lb. of greasy wool.

In northwest Western Australia, where summer maximum temperatures are commonly between 105 and 110 F, a comparison between rams imported from the southern part of the state and locally bred rams showed the following: (1) all rams were producing viable sperm during the winter months; (2) one-third of the first generation locally bred rams, and two-thirds of the imported rams were virtually useless from January to April; and (3) all rams initially showing a good semen sample were useless after 15 days of work (local rams recovered after several weeks of rest, but most imported rams did not recover until cooler weather).

Animals in arid areas must survive, produce, and reproduce. In adapted livestock, the feces has a lower moisture content, and the urine is more concentrated. Work at Rockhampton indicates that zebu and zebu crosses have a higher nitrogen conversion rate than English breeds of cattle.

Human adaptation. In most animals, physiological adaptation (acclimatization) is associated with behavioral adaptation. It is important to realize that the extent of physiological adaptation is limited, and that it is incumbent on men living in desert conditions to adapt their behavior to the maximum practical extent, including utilization of all available protective devices. The acute and chronic effects of skin exposure to the ultra-violet portion of the spectrum can result in sunburn or skin cancer. The Australian tropical zone is characterized by having probably the highest incidence of skin cancer in the world. The risk of any individual developing skin cancer is determined by the same factors as for sunburn, and as skin pigmentation is genetically determined, it seems that the specially susceptible light-complected, blue-eyed individuals are unsuited for life in the hot, arid regions.

When exposed to cold on winter nights, aborigines of central Australia had a reduction in blood flow to their skin, thus increasing their body insulation, and consequently reducing their heat loss. Caucasians reacted to the same situation by increasing their metabolism. When measured in terms of food intake the superiority of the aboriginal response is obvious; as an adaptation, it could well have survival value.

The combined demands of sweating and vasodilation mean that in the heat, the burden of temperature regulation is on the cardiovascular system. Acclimatization to heat results in a reduction of this burden. In hot-room experiments, acclimatization to heat is typically accompanied by an increase in sweat secretion. But in some recent experiments, aboriginals with a heat tolerance at least equal to the fully acclimatized Caucasians living in the same area secreted far less. Economy in water turnover would seem to be the desirable response. Sweat secretion involves the loss of sodium chloride from the body, and acclimatization to heat is always accompanied by a decrease in the concentration of salt in the sweat. Therefore, salt tablets are not needed. On the other hand, water intake cannot be restricted without loss of efficiency, or, in the extreme case, danger to life. Thirst is a poor guide to water requirements; many people in the outback probably spend their lives in a state of low-grade, chronic dehydration. Humans working in arid areas may need 4 to 5 gallons of water daily. There is a higher incidence of kidney stones in people living in hot, arid areas. Apparently there is no difference among the human races as to tolerance to heat.

Tourism in the Australian Center is increasing. One of the main factors impeding development of the Australian arid zone is the tremendous isolation (particularly difficult for women) and the lack both of available schooling and good transportation facilities.

A half-day mid-conference tour visited the Amoonguna Aboriginal Settlement and the Animal Industry Research Institute farm.—*Carlton H. Herbel,* Research Range Scientist, Jornada Experimental Range, Crops Research Div., Agric. Res. Serv., USDA, Las Cruces, New Mexico.