

Perspectives of Managing Mediterranean-Type Ecosystems: A Summary and Synthesis¹

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One of the principal objectives of this symposium was to provide a forum for exchange of information on a multinational scale. The purpose of this session, held on the opening day of the symposium, was to provide the participants with an overview of how Mediterranean-type ecosystems are being managed around the world. Each of the speakers in this session represented a different region; together, they covered the Mediterranean-type ecosystems on five continents. The speakers were asked to relate the following information for the regions they represented: (1) Object of Management, (2) history of Vegetation and Perception, (3) Constraints on Management, and (4) Role of Research.

Although some of the speakers did not address these four issues directly, all spoke on management issues they felt were important in their regions. It was possible, then to extract from these presentations some, if not all, of the important management objectives, constraints, and research interests in each region.

Management Objectives

Maintenance or improvement of grazing land was one of the management objectives mentioned most often by our speakers (Bolander, Canas and others, Carrera and others, Kruger, Naveh, Tyrrel, these proceedings). Most mentioned problems with overgrazing and some mentioned efforts at type conversion to increase pastureland acreage or cultivation to increase productivity. The other most often mentioned objective of management was recreation (Bolander, Carrera and others, Naveh, Shea, Tyrrel, these proceedings). Surprisingly, recreation was mentioned more often even than watershed protection (Bolander, Carrera and others, Kruger, Shea, Tyrrel, these proceedings) although most speakers implied that watershed maintenance was of utmost importance. Aesthetics (Kurger, Naveh, Shea, Tyrrel these proceedings), nature conservation (Kruger, Naveh, Shea, Tyrrel, these proceedings), and site rehabilitation (Canas and others, Carrera and others, Naveh, and Shea, these proceedings) were considered important enough to be mentioned by four of the seven speakers. within

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the area of nature conservation, Kruger, Naveh, and Tyrrel expressed the need to maintain or increase species diversity. Also in the interest of nature conservation, Kruger discussed the need to control invasive exotics and to limit commercial wildflower harvesting in South Africa. Timber (Shea, these proceedings), fruit (Canas and others, these proceedings), and energy (Naveh, Tyrrel, these proceedings) production and mining (Bolander, Shea, these proceedings) were objectives to be managed in some regions.

Land Use history

The histories of the Mediterranean-type ecosystems discussed during this session make an interesting comparison. The conditions of the ecosystems seem to be related to the length of time since settlement of the land and the extent of population pressure on the land. The ecosystems in the Mediterranean countries are in perhaps the most altered condition. The mountains and hills of Spain for example, have been grazed by sheep and goats for 3,000 years. Many forests there, long ago harvested and repeatedly burned, have been eliminated or degraded (Carrera and others, these proceedings). Mediterranean-type ecosystems in the United States, South Africa, and Australia, on the other hand, have been occupied by European settlers for much shorter periods of time and show less severe ecological effects. However, the nineteenth and twentieth centuries have been a time of rapid change and booming population growth around the world. During this period, fire regimes have been altered, plant material has been exchanged between continents, and large-scale lumber harvesting and mining have taken place. There is the potential for bringing about severe ecological change in much less than the 3,000 years it took in Europe.

All of our speakers seemed to be well aware of the effects of past land use practices on the ecosystems in their regions and in others. Theoretically, at least, some important lessons have been learned. The speakers also noted the importance of determining possible ecological effects of new or current management techniques such as frequent low intensity prescribed burning (Kruger, these proceedings), type conversion (Bolander, these proceedings), and thinning (Shea, these proceedings).

Constraints on Management

The speakers in this session discussed social, political, biological, and informational constraints to managing the Mediterranean-type ecosystems in their regions. Land ownership patterns (Canas and others, Naveh, Tyrrel, these proceedings); urban, industrial, and recreational encroachment (Carrera and others, Naveh, Shea, Tyrrel, these proceedings); and public ignorance and attitudes resulting in overgrazing and wild-fires (Carrera and others, Naveh, these proceedings) are some of the social constraints experienced by resource managers. Political

constraints included overlapping jurisdictions by public agencies (Tyrrel, these proceedings), legal constraints (Carrera and others, these proceedings), and lack of financial support (Bolander, Carrera and others, Naveh, these proceedings). Factors affecting plant establishment and growth were fire (Carrera and others, Naveh, Shea, Tyrrel, these proceedings), air pollution (Naveh, these proceedings), pests (Naveh, Shea, these proceedings), and the already degraded condition of some areas (Carrera, Naveh, these proceedings). All speakers acknowledged that lack of scientific information limits management success.

Role of Research

Regional differences were more evident among our speakers on the subject of what questions should be addressed by researchers. The subject of ecosystem structure (past and present) including plant and animal interactions was emphasized by Canas and others, Kruger, and Naveh (these proceedings). Naveh, of Israel, was quick to point out that he considered "classical", down-to-earth field studies of greater value than "pretentious, expensive and, alas, mostly very theoretical, far-fetched ecosystem studies aimed at creating the very fashionable, not very realistic, mostly deterministic, 'ecosystem models'." Some areas in which he saw a need for practical research were in (1) developing "ecotechniques" for managing existing plant cover; (2) finding suitable plants and methods for afforestation projects; and (3) quantifying landscape values.

Several speakers in this and other sessions indicated the need for more research involving the socioeconomic factors affecting management of Mediterranean-type ecosystems (Carrera and others, Fuentes, Naveh, Tyrrel, these proceedings). New approaches are needed in which the conservation, rehabilitation, and use of these ecosystems can be reconciled with socioeconomic advancement of the population (Naveh, these proceedings). This is especially important in developing countries such as Chile where the welfare of the people is tied so directly to the land. It is also important in highly populated areas such as southern California and southern Europe where demands for wildland products often conflict.

Other research areas mentioned were patterns and trends in land use (Carrera and others, Kruger, these proceedings), hydrological or nutrient cycling or both (Bolander, Carrera and others, Shea, these proceedings), fire behavior (Kruger, these proceedings), ecology of invading species (Kruger, these proceedings), meteorology (Carrera and others, these proceedings), site classification (Shea, these proceedings), desert control (Carrera and others, these proceedings), and development of safe, effective herbicides (Bolander, these proceedings). In Chile, research efforts are being focused on improving both natural and cultivated pasturelands (Canas and others, these proceedings).

RECURRING THEMES

Although the Mediterranean climate regions of the world differ in some significant botanical, sociopolitical, geologic, and climatological features, they obviously have a lot in common. It is these common features that justify an international symposium such as this one. Several recurring themes appear in some or all of the papers of this session. The remainder of this summary paper will be a discussion of some of these shared concerns and interests. I have taken the liberty of including and interpreting parts of each speaker's contribution.

Human Population Pressures

The problems brought on by too many people and not enough resources are evident in southern California, Chile, and the European countries bordering the Mediterranean Sea. Although competition among land uses also occurs in Australia and South Africa, population pressures on the land are not nearly so acute in these regions. The problem in Arizona has been relatively minor in the past, but is increasing rapidly as more people move out into the wildlands.

In southern California, 13 million people live in, adjacent to, or in the valleys below chaparral-covered hills and mountains. These people require protection from fire and resulting floods. They also need fresh water, varied recreational opportunities, and protection for native wildlife. The aesthetic value of southern California's wildlands to its urban population is difficult to assess, but based on recorded visitor use of public lands, it is high (Leisz, these proceedings). The "people" dimension of chaparral management is becoming more and more important in southern California.

The ecosystems of the southern European countries have been subjected to centuries of excessive tilling, grazing, timber harvesting, man-caused fire, and numerous wars. The result is that the soils are heavily eroded on many sites, and the plant communities are drastically changed. Increases in rural and urban populations, road building, tourism, and mass recreation continue to take their toll. Efforts are being made to improve the situation through reforestation, public education, and regulation, but improvement is difficult where serious site degradation has already occurred (Carrera and others, Naveh, these proceedings).

In Chile, the principal use of the drier upland ecosystems is grazing. As a result of Agrarian Reform (1965-1973), the land has been divided into many small ownerships, making traditional movement of stock between ecosystems at different times of the year impossible. This has caused overgrazing of the annual grasslands and grazing during the time of year when seed should be produced. Overgrazing favors development of the matorral (brush) rather than the more palatable annual herbs.

Chilean researchers recognize the human need to protect and improve the pastureland of their region (Canas and others, these proceedings).

Need to Understand Fire behavior and Effects

Fire is an important factor in most Mediterranean-type ecosystems. Low rainfall, strong winds, steep terrain, and highly flammable vegetation generate some of the world's most dramatic wildland conflagrations. Many Mediterranean-type ecosystems are characterized by a fire cycle and depend on fire to retain long-term vigor. However, fire seems not to have been part of the natural situation in Chile (Fuentes, these proceedings).

Because fire is such an intimate part of most Mediterranean-type ecosystems, researchers and managers recognize the need to better understand its role. They want to know how fire behaves under various fuel, weather, and topographic situations. They also want to know what effects fires of various intensities and frequencies, taking place during various seasons of the year, have on the ecosystem. There is research of this type going on all over the world (Albini and Anderson, Barber, Delabrazze and Valette, Green, Kruger, Trabaud, Vélez, these proceedings).

Interest in Prescribed Fire

The Australians were the first to recognize that a policy of strict fire exclusion and suppression would not work in a Mediterranean-type ecosystem adapted to fire. In the early 1950's, they began a program of periodic low-intensity prescribed burning to reduce fuels in the jarrah forest (Shea, these proceedings). Shea suggests that a change in the prescribed burning regime in the jarrah forest may now be wise. Moderate-to-high intensity fire would reduce the density of the understory species banksia grandis, replacing it on some sites with leguminous species. Banksia grandis is highly susceptible to and is a major contributor to the spread of the soil-borne fungus Phytophthora cinnamomi which causes "Jarrah Dieback."

Prescribed burning in South Africa's fynbos began in the late 1960's. burning rotations range from 10 to 20 years depending on site and vegetation characteristics (Kruger, these proceedings).

Chaparral managers in southern California have recognized for some time that a policy of fire exclusion and suppression has contributed to the buildup of wildland fuels, but with southern California weather, fuel, and population conditions, prescribed fire was considered by the Forest Service to be too risky a method of reducing fuels. Although ranchers have been burning with permits for some 30 years, not until the last 5 years or so with the development of more sophisticated equipment such as the helitorch and more refined prescribed burning directions (Green 1981)

has the practice of prescribed burning become acceptable on National Forest lands. There is now a widespread interest in continuing development of safe, low-cost burning techniques for use in the chaparral (Bungartz, Green, Rogers, these proceedings).

In the Mediterranean countries of Europe, uncontrolled burning in the past is credited with the degradation of many ecosystems. This is one reason why prescribed fire has not been used routinely in some of these countries. But, as fuel buildups increase, these countries too are showing an increased interest in controlled burning. At least limited burning, for research purposes or to maintain fuelbreaks, has been done in France (Delabrazze and Valette, these proceedings), Italy (Susmel 1977), Greece (Liacos 1977), and Israel (Naveh, these proceedings), and Spain (Velez, these proceedings).

No matter what the extent of prescribed fire use in the various Mediterranean-type regions of the world, there is a continuing interest in improving its use. Answers to problems such as how often to burn, with fires of what intensity, and during what seasons require refinement even in Australia and South Africa.

Attempts at Type Conversion

The highly flammable sclerophyllous shrubs characteristic of many Mediterranean-type ecosystems have not endeared themselves to land managers. In some areas such as Chile and Spain, the shrubs have invaded abused grassland or forests making them less useful for grazing or wood production. In other areas such as the chaparral ecosystems of southern California, shrubby vegetation is the fire climax type. In every region, attempts have been made or are being made to convert less desirable vegetation types to more desirable ones. The desirability as well as the success of these attempts are subjects of debate.

In Israel, controlled burning of shrubs followed by reseeding with perennial grasses has been carried out to increase grazing potential. However, maintenance of these areas by frequent fire or chemical treatments tends to be either too expensive or not ecologically sound.

To stabilize badly depleted upland sites. Israeli foresters began several years ago to establish Pinus halepensis plantations. Although these plantings have provided wood fiber and recreation, the economics of such plantings are questionable. Fire prevention and suppression expenses have increased, and many trees have been lost to fire (Naveh, these proceedings).

The current trend in Israel is toward establishment of "multilayered, seminatural park-forests, resembling the richest semiopen maquis in structure and stability but being of much greater ornamental, recreational, and economic value"

(Naveh, these proceedings). Time will tell whether this seemingly more natural approach to vegetation manipulation is successful.

In the province of Almeria in southeastern Spain, ICONA foresters are attempting to reestablish holly-oak (Quercus ilex) forests on highly eroded sites where cutting and grazing have reduced the oak to a bushy form (Carrera and others, these proceedings). They are regenerating the stands by a combination of sprouting and, in the areas without bush, planting and seeding. Carrera and his coauthors gave no indication of how long this project has been underway, but apparently it has been successful thus far. Many pine and Quercus suber plantations have also been established in the southern provinces of Spain.

In his discussion of the jarrah forests of Australia, Shea (these proceedings) did not discuss type conversion attempts. He did mention, however, the thus far unsuccessful attempt to locate a salt-tolerant tree species suitable for planting in forest areas where the native jarrah has succumbed to dieback. The introduced species would need to be resistant to the disease-causing fungus Phytophthora cinnamomi Rands.

Canas and others (these proceedings) discussed the advantages of converting natural annual pastures to cultivated pastures. Five or more times as much dry matter can be produced on seeded and irrigated land than on natural pastureland. At present, 85 percent of Chilean pastures are natural. Canas and his coauthors did not indicate to what extent irrigation might be feasible in Chilean pasturelands or where the water for irrigation would come from. They did note, however, that farms in the lowlands with better access to irrigation had converted from stock production to the more profitable production of fruits or other crops.

The concept of removing southern California's chaparral and replacing it with grasses was developed and began to be implemented in the late 1950's. These type conversions were designed to reduce the amount of wildland fuel, to increase watershed productivity, and to increase grazing land. The high costs of converting to grass and increasing concerns about the use of herbicides for brush control have contributed to a decrease in type conversion activities in southern California. Bolander (these proceedings) indicates that conversion of chaparral to grass and forbs may be feasible in Arizona. There, rainfall occurs in the summer as well as the winter providing a more hospitable environment for grasses and forbs than in southern California.

Attempts have also been made to convert southern California's chaparral to forest. Many of these plantings have failed. Even those trees able to tolerate the drought conditions and poor soils have often been killed by the frequent wildfires of the region (Radtke 1978).

Some small-scale site conversions in southern California and Arizona have been carried out to grow jojoba (for oil production), guayule (for rubber production), and other useful plants.

The increased pressures brought on by populations increasing in number and mobility, the need to better understand fire and vegetation relationships, the increased interest in prescribed fire, and the desire to make changes in the vegetation type are just a few of the common concerns or interests expressed by the international speakers in this session. Others were: (1) an interest in the history of the land; a desire to know what the "natural" fire frequency and vegetation type should be; (2) a recognition of the environmental movement that became vocal during the 1960's and has continued to influence land management activities; and (3) an emphasis on the need for integrated and planned resource management involving input from many disciplines; an interest in modeling.

CONCLUSIONS

The world we live in becomes smaller every day. Long distance communication and travel become faster and simpler.

A shrinking world offers advantages and disadvantages to our international efforts to understand and manage Mediterranean-type ecosystems. Managers in Australia's jarrah forests have learned already the disadvantages of international exchange--they must deal with the imported pathogen Phytophthora cinnamomi. In Arizona and California, native perennial grasses and forbs are commonly not able to compete with imported annuals. A similar battle with exotics is going on in South Africa. Damaging photochemical air pollutants produced in Europe, California, and other regions of the world cannot be expected to respect political boundaries.

But, there are advantages to our increased mobility and communicative abilities too. New technology, such as that relating to prescribed fire, developed in one part of the world can be made available to other countries without lengthy delays. There should be less duplication of research activities and fewer repeated mistakes. Beneficial exchanges of plant material will continue. For example, in their search for a salt-tolerant, disease-resistant tree to plant in areas where "Jarrah Dieback" is occurring, the Australians are not limited to a native Australian species. They may find an exotic species best suited to their needs.

It is important that we work towards a goal of improving management of Mediterranean-type ecosystems and recognize that the world is small. We must be ready to take advantage of the opportunities that improved communications and mobility can bring, and be ready to cope with new problems as they arise.

LITERATURE CITED

- Green, Lisle R. Burning by prescription in chaparral. Berkeley, Calif.: Pacific Southwest Forest and Range Exp. Stn., Forest Serv., U.S. Dep. Agric.: 1981; Gen. Tech. Rep. PSW-51. 36 p.
- Liacos, Leonidas G. Fire and fuel management in pine forest and evergreen brushland ecosystems of Greece. In Mooney, Harold A.; Conrad, C. Eugene, eds. Proceedings of the symposium on environmental consequences of fire and fuel management in Mediterranean ecosystems, August 1-5, 1977, Palo Alto, California. Washington, D.C.: Forest Serv., U.S. Dep. Agric. Gen. Tech. Rep. WO-3; 1977; 289-298.
- Radtke, Klaus. Wildland plantings native and exotic 1911-1977. Los Angeles: County of Los Angeles Department of Forester and Fire Warden; 1978; 135 p.
- Susmel, Lucio. Ecology of systems and fire management in the Italian Mediterranean region. In: Mooney, Harold A.; Conrad, C. Eugene, eds. Proceedings of the symposium on environmental consequences of fire and fuel management in Mediterranean ecosystems, August 1-5, 1977, Palo Alto, California. Washington, D.C.: Forest Serv., U.S. Dep. Agric. Gen. Tech. Rep. WO-3; 1977; 307-317.