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Local Planning Considerations for the Wildland-Structural Intermix in the Year 2000[1]

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Abstract: California's foothill counties are the scene of rapid development. All types of construction in former wildlands is creating an intermix of wildland-structures-wildland that is different from the traditional "urban-wildland interface." The fire and structural environment for seven counties is described. Fire statistics are compared with growth patterns from 1970 to 1985. Potentials for the year 2000 are suggested. California planning law is overviewed in relation to development. Local governments and fire services have underutilized existing authorities in describing and mitigating fire impacts in the intermix. Productive ways of improving mitigation requirements are suggested. A stronger planning-related partnership between fire services and local government is called for. Recommendations are made in the areas of legislative improvements, applied research, and strategic fire pre-planning. The study is presented from the perspective of a retired fire management specialist who is now a County Planning Commissioner.

The presence of structures in wildland areas of California has been a continuing fire problem for over 60 years. As population and development increase, so do the cost and loss impacts of wildland-structural fire. Whether structure fire spreads to wildlands, or wildland fire ignites structures, the complexities of wildland fire management are drastically increased by all forms of development. The problem has mushroomed in seven California "foothill" or "Mother Lode" counties used as a study area. Fifteen years (1970 to 1985) of history confirm that fire trends follow population increases. Those trends indicate that a significant impact has already occurred. Growth predictions to the year 2000 indicate that greater impacts are ahead.

The study area represents a change in character of the wildland-structural relationship from "interface" to "intermix." Former boundary definition between structural encroachment and wildlands has essentially been lost; structures are now present on a random or matrix pattern throughout large areas. The intermix adds another dimension of difficulty to fire suppression, increases costs and losses, and presents additional threat to public safety. Neither local government nor fire services have adequately recognized this problem. Unacceptable adverse impacts will undoubtedly occur in the future unless changes are made in both fire management and local planning procedures.

THE STUDY AREA

Seven counties in the east-central portion of California were chosen as the study area: Nevada. Placer, El Dorado, Amador, Calaveras, Tuolumne, and Mariposa. These are usually referred to as the "foothill" or "Mother Lode" counties. Each contains substantial areas of National Forest land, and Yosemite National Park is located in parts of Tuolumne and Mariposas Counties. Federal lands were excluded from the

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study. Incorporated areas and the western portions of Placer and El Dorado Counties, which are essentially urban in character, were also excluded. About 3 million acres, or 3 percent of California's total land area are in the study area. However, if Federal lands, established urban areas, and all "otherwise dedicated" lands in the state are considered, the study area actually represents about 10 percent of the land available for development in the next 13 years.

Fire Environment

Elevations rise from about 1000 feet in the western or "valley" areas, up to a range of 4000 to 6000 feet where unincorporated areas abut National Forests on the east. Major river drainages traverse each county. Their major and tributary drainages sharply divide terrain in the eastern portions of the area, and flow out to gently rolling hills at the lower western elevations. Slopes are greater than 100 percent over more than half of the area, and slopes of 35 to 50 percent are common over the remainder.

Fuel types begin with annual grasses in the lower elevations and change to oak-woodland, soft chaparral, mixed brush and timber, and mixed-conifer as elevations increase. Fuel loading varies from about 2 tons per acre in grass to over 100 tons per acre in the timber zones. Normally, fire season begins in late April-early May and lasts until October. Daytime temperatures often exceed 100° F, relative humidity drops below 20 percent frequently, 1-hour fuel moisture (at 1400 hours) usually drop below 3 percent, and 10-hour fuel moistures of 4 and 5 percent are common. Local winds vary with topography and diurnal patters; "Red Flag Warnings" caused by strong gradients occur at least twice each fire season.

Population and Fire Trends

Past and present population figures for the study area were obtained from the California Department of Commerce (1985). Predicted populations were taken from the California Department of Finance (1984). Population estimates for the year 2000 are adjusted downward by 30 percent to reflect growing urbanization in the study area.

California Department of Forestry "Annual Statistical Reports" (1970-1985) were used to aggregate fire statistics for the seven counties. Predicted fire incidence is taken from the Department's 1985 draft "Fire Protection Plan."

Table 1 compares fire and population data for the "benchmark years" of 1970, 1985, and 2000.

There is strong correlation in the percentage increases between population, number of fires, and acres burned for the 1970-85 period. Population and fire predictions for the year 2000 indicate that the relationship will continue. No prediction for acres burned is available, but past data suggest that this total will also increase, perhaps by as much as 50 percent. Even if more fires are kept to smaller sizes in the future, a 47 percent increase in incidence will have an escalating effect on acres burned.

Damage figures are "actual year" totals, and are not corrected for inflation. The totals are a combination of natural resource and structural damages. The astronomical (5000 percent) increase between 1970 and 1985, combined with the predicted increase in number of fires is a

Table 1--Study Area Fire and Population Data for "Benchmark Years"

	1970	1985	(percent increase)	2000	(percent increase)
Population	151,000	298,000	(97)	450,000	(51)
Fires	860	1.635	(90)	2,500	(47)
Acres burned	5,600	10,900	(95)	N/A	N/A
Damages	$93,000	$5 Million	(5000)	N/A	N/A

strong indicator of future impact. Natural resource values will increase, and construction costs will follow the same trend. The Department of Forestry study supporting their Fire Protection Plan (1985) states that less than 1 percent of all fires cause about 75 percent of recorded damages. If that same ratio continues, the increase in number of fires and higher values will combine to bring expected damages up to about $10 million (1985 dollars) annually by the year 2000.

This information shows that a clearly "significant fire impact" has already occurred, and that future population increases will bring even more detrimental effects.

Impact of the Wildland-Structural Intermix

Sheer numbers of people adversely impact the fire situation. Where and how they locate complicates the issue and compounds the challenge of effective protection. Both the pattern and type of development influence the fire environment.

In the study area, the observed pattern of development began to take shape in the early 1960's. Widespread availability of land allowed people to purchase homesites anywhere they found them attractive. Planning and zoning procedures of the time made it easy to create parcels, permitted a wide variety of uses, and placed minimal restrictions on access and water-supply requirements. The limited infrastructure (particularly water and road systems) of local government essentially forced scattered development: It was easier to put these developments "on their own" to meet their needs because local government could not. Laissez-faire attitudes of local officials encouraged development with minimal constraints.

As the population increased through the 1970's, the numbers of service and commercial businesses also increased. These were also allowed to locate relatively freely, and although more health and safety measures generally were required, access and water supply standards remained low. The whole process accelerated in the 1980's. However, during the late 1970's and early 1980's, planning, zoning, and fire service procedures matured, and major developers began to improve subdivision design. The 15 years between 1970 and 1985 brought incremental improvement to development of all types.

The study area is now a conglomerate of private, commercial, and industrial development, of old and new, and of good and poor structures. A random, leap-frog pattern of structural types and uses exists. Government infrastructures are only slightly better than they were a decade ago: serious access and water supply problems are still present. All of this exists in a mountainous, heavily-vegetated environment, creating a heterogeneous mixture of wildland-structures-wildland. This wildland-structural intermix is different than the traditional "interface." The intermix is a greater challenge for fire managers because it requires different approaches to fire suppression and fire planning. The traditional interface. for example, implies some kind of boundary or defined perimeter that can be defended along some kind of front. And once the front is defended, the fire becomes clearly structural in character, or clearly wildland. This is not the case in the study area: while some interfaces do exist, they are not "true" or "final" because additional structures are located in close proximity. Structural threat can be dealt with at the interface but it is never eliminated in the intermix.

The wildland-structural intermix creates three impacts that are not totally recognized by local government, and may not be fully appreciated by fire services. First, it requires an increased fire management capability, that of managing both wildland and structural forces at the same time (another "mix"). Second, it materially increases costs: protection of life and property become primary objectives and all nearby structures must be guarded by additional forces, even though they may not be directly or immediately threatened. Finally, defense of structures inevitably results in greater natural resource losses. The priority of life and property defense overrides wildland protection, and acres are sacrificed to save homes.

In the study area, the intermix pattern is firmly established. It will not change in character by the year 2000, despite any local government efforts at "infilling" or consolidating development into more of an interface arrangement. The intermix problem will not be "solved" in any final sense, and the additional costs and losses will undoubtedly continue. However, if both fire services and local governments improve their combined approach to intermix fire planning. those

impacts can be held to much more acceptable levels in the future.

FIRE NEEDS MORE EMPHASIS IN LAND USE PLANNING

The California Government Code establishes a hierarchy of planning law. At the top of the ranking is the requirement for local government General Plans (Section 65300). Several legal judgements declare that General Plans are the "Constitution for local development," indicating their primary position in the planning process. General Plans are required to have seven elements describing how the legal jurisdiction will manage planning and development for the general health and welfare of its citizens. A Safety Element is one of the mandated seven, and must describe local policies for the protection of the community from "fires, seismic, and geological hazards."

The Safety Elements for the seven counties in the study area were reviewed with specific attention to wildland fire and the wildland-structural intermix. A wide range of quality was found. Some plans displayed a good grasp of the wildland fire problem, but most were weak. None of the plans demonstrated an understanding of the intermix problem, and none had any preventative or mitigating policies oriented toward reduction of the intermix fire challenge.

A "profile of benign neglect" for the intermix developed around five characteristics common to all plans.

1. Relative Importance Given to Fire Versus Other Hazards

Although the study area is one of the more seismically-stable areas of California, the seismic component of all Safety Elements vastly outweighs the consideration of the annual impacts caused by wildland fire. Serious flooding occurs about every 15 to 20 years, but it too is better documented than the annual fire problem. Fire receives about 20 percent of the attention given to the other hazards. Earthquake and flooding descriptions are supported by considerable scientific data. With one notable positive exception, fire is not supported by anything more than cursory discussion. Fire issues that are mentioned in Safety Elements are strongly oriented toward the structural concerns that can be addressed through application of the Uniform Fire and Building Codes.

2. A "Case-by-Case" Perception of Development

All of the plans treat fire on a "single-project" basis. Individual development policies are cited throughout: "the project" and "the development" are terms used exclusively. Only two of the plans mention fuelbreak requirements. Otherwise, there is no narrative awareness that any project impacts (or may be impacted by) a larger fire environment.

3. Omission or Abuse of Fire Hazard Severity Classification

Only three of the counties include the Fire Hazard Severity Scale developed by the California Department of Forestry. One county politically and arbitrarily reduced all levels of hazard, eliminating the "Extreme" rating altogether, and probably violating the legal requirements of its Safety Element. The absence or abuse of fire hazard data places citizens in some rather dangerous situations, and further compounds the intermix dynamic.

4. The "Intermix Paradox"

To a large extent, the intermix pattern of development was entrenched before General Plans were mandated in 1971. The random characteristics that existed then (and have continued since) were essentially encouraged by local governments for a variety of reasons. In the early 1980's most of the study area plans were revised or reissued. The random developments had to be recognized as legal in the "new" plans, regardless of the fire safety of the structures involved. However, in what appears to be a well-intended but misguided approach, the current plans encourage further intermix. All plans contain policies to "maintain low density in high fire hazard areas" or "limit development to one dwelling unit per 20 acres (or 10 or 5 acres)."

The apparent logic behind these policies is to limit potential for structural conflagration in areas of limited fire defense capabilities. The end result, however, is to escalate the fire problem in the wildland-structural intermix.

5. General Plan "Diagrams

The law mandating General Plans does not require "maps," only "diagrams." This distinction was a conscious legislative act to provide local government a degree of freedom in "approximating" planning rather than forcing exact precision of parcel delineation, zoning. and land use classification. The distinction is valuable and efficient for general planning purposes, but it has drawbacks from the fire safety standpoint. For example, the study area plans all had some kind of actual maps (soil-vegetation surveys, fire jurisdiction boundaries, and others). These were used as reference data only, in support of the fire components of their plans. The actual "working documents" presented and used in final planning decisions were the diagrams.

The diagrams present a "flat earth" character: they are planimetric, color-coded in ways that obscure fire information, and most were on map bases of 1970's vintage. The average citizen, developer, planning commissioner, or elected official cannot grasp any realistic concept of the fire environment from these diagrams. Without that ability, final planning decisions tend to be less than adequate, if not detrimental, to fire protection interests.

LOCAL PLANNING CAN BE IMPROVED

The study found no evidence that these neglected or weak elements were the results of any conscious effort on the part of planners or governments. (The arbitrary modification of the Fire Hazard Severity Scale may be an exception.) Most planners were satisfied with the way their Safety Elements recognized local fire issues, and none perceived the weaknesses. Any feelings of dissatisfaction were focused on the need to refine existing policies rather than on improving recognition of the intermix problem in their Safety Elements.

Fire personnel also reported general satisfaction with current situations, especially as compared with the conditions that existed in the 1970's. Most concerns of the fire discipline focused on gaining political acceptance for strengthening specific requirements such as roofing materials, fire flows, and project access. All fire managers reported a strong awareness that they were approaching the limits of capabilities. Some spoke of reaching a "lower threshold of suppression effectiveness." However, this perception seemed to be based upon being overwhelmed by sheer increase in numbers rather than in basic inadequacy of the planning process.

Both fire and planning disciplines saw the basic problem as the need to do better with what they had, to improve the "here and now," and to become more effective in dealing with specific issues. The weaknesses that exist in the planning framework, or the fact that reduction or correction of those weaknesses could improve the total fire environment were not initially recognized.

However, there is strong reason to believe that much of the weakness could be corrected by providing legal and technical guidance to both fire managers and planners. For example, the preponderance of seismic data is in the Safety Elements because the California Division of Mines and Geology developed guidelines for planners. The flooding background data is in the plans because hydrologists designed ways for that data to be included, and the legislature directed its inclusion. In both cases, description and technical proof of general public hazards were provided to local governments. To date, fire services (at all government levels) apparently have concentrated their inputs case-by-case on issues. However, new effort to improve basic input to local General Plans can change that. A new planning framework can be developed that will provide local government with stronger guidelines for fire safety. California planning law already provides statutory direction, supported by court decisions, to make positive change.

General Plan Guidelines

California's Government Code. Section 65025, directs the Governor's Office of Planning and Research (OPR) to give priority to the development of land use policies "in areas which require special development regulations because of hazardous conditions" (OPR 1985. p.9). Section 65040.2 authorizes OPR to "revise General Plan guidelines" using professional recommendations (op cit p. 16). Section 65400 requires local governments to "develop effective guides ... for the preservation of ... natural resources---and the efficient expenditure of public funds" (op cit p.53). The wildland-structural intermix has been shown to

be a "hazardous area", prone to annual wildfire and threatening to life, property, and natural resources. The significant predicted impacts present fire services and planners with the obligation to improve General Plan guidelines through these legal avenues.

Scientific Data

Section 15064 of the Administrative Code calls for public agencies to base environmental decisions "to the extent possible on scientific and factual data" (Tuolumne County 1983, p. 23). The amount of currently available, scientifically valid fire and fire behavior data far outweighs that now present in General Plans. Much of that data could be included (as with the seismic information) to support planning decisions. Fire behavior modeling could be applied on a macro-environmental basis to depict large-scale local conditions related to general planning, and on a micro-environmental (case-by-case) basis to suggest individual mitigation measures. Such applications would make it difficult for local governments to ignore or misuse the information.

Off-Site Improvements and Protection Networks

Sections 66410 and 66498.1 of the Government Code encourage local government to develop a broad and external perspective of individual projects. Protecting the health and safety of people in the "immediate community" and considering the "relationship to surrounding areas" is required (Curtin 1986. pgs. 63, 74) (OPR 1985, p.260). Section 65560 which authorizes open space zoning to protect public health and safety specifically allows their "linking" to connect "areas requiring special management because of hazards ... such as fire risks." Several legal decisions and an Attorney General's opinion in 1984 indicate that areas dedicated for public purposes (e.g. zoning for fuelbreak, fuel reduction, or other suppression activities) can require "proper improvement by the subdivider so that they not become a burden" on the general taxpayer (Curtin, p. 63). These points provide an opportunity to plan integrated fire protection networks and improvements in a cost-effective manner. Fire safety requirements can be extended beyond single project boundaries, and overcome the case-by-case limitations that are prevalent today.

Upgrading Visual Understanding

Foregoing examples have cited legal bases for improvement. With the exception of "Scientific Data" as noted above, no laws or legal judgments support use of more descriptive tools, such as computer-compatible aerial photography and mapping. However, use of such tools would improve understanding and communications concerning the intermix fire situation. Most environmental disciplines have used them as state-of-the-art for years. Acquisition and use of modern photography and mapping by local governments should be encouraged by fire services and planners. Better understanding of the fire environment and better fire planning decisions in the intermix should result.

Revising Input To General Plans

Planning law requires "internal consistency" in General Plans. In the case of intermix fire problems, that consistency begins with more thorough description of the conditions and impacts created by structural intrusion into wildlands. The fire component of Safety Elements needs expansion based upon the generations of knowledge and scientific data available to fire services. Revised input to general planning, and Safety Elements in particular, is required before significant change for the better can come about in the intermix. Local planning procedures flow from general planning. The impacts, conditions, and possible mitigating requirements are all described based on the overall "picture" developed in the "Constitution" or master document. Failure to adequately describe impacts and justify protection measures in the Safety Element probably preclude implementation of any opportunities for improvement. The fire input to General Plans must be increased in both quantity and quality before they can be improved significantly.

THE SUBDIVISION MAP ACT

The Subdivision Map Act was not originally planned to be a subject of this study. However, its presence and its consequences were pervasive, particularly to fire services. The Act has long standing in California law and the manner of its application has great bearing on development patterns (and fire challenges) over much of the study area. Essentially, the Act

establishes different procedural requirements for land divisions of four or fewer parcels, and for those of five or more. The smaller divisions historically have been easier to create, and fewer planning or public safety conditions have been mandated for those parcels. The study area contains thousands of small (1 to 5 acres) parcels, which were once parts of much larger holdings. Those original holdings were "split" into four parcels, split again into yet smaller ones, and many times those were divided again. The process is termed "lot-splitting" and the parcels are called "four-by-fours".

The long history of lot-splitting and the absent or limited controls applied to them make structural developments on these parcels a serious fire suppression challenge. Access is poor and water systems, when present, are of pioneer design and capability. Most of the developments are located in topographic and fuels situations that preclude effective suppression during high fire danger. The presence of vulnerable structures in these areas represent a threat to themselves and to other developments in the vicinity. When such parcels are associated with major fire, either as ignition site or in the path of fire spread, they are most likely to be the point(s) where containment will be most difficult. These sub-standard developments are "the Achilles' Heel" of suppression efforts in the wildland-structural intermix.

Current law allows local government to apply some controls over old and new lot splits, provided they have implementing ordinances for that purpose. The same planning procedures recommended for improving general planning can probably be used to reduce the fire problems presented by lot-splitting. The key actions are more complete and accurate description of the hazards, prescription of coping policies in General Plans, and design of fire protection improvements. As a minimum, fuelbreaks or fuel reduction requirements could be included in zoning, or incremental upgrading of access and water systems could be made a condition of future sale of any properties.

THE CALIFORNIA ENVIRONMENTAL QUALITY ACT

The California Environmental Quality Act (CEQA) was designed to identify the environmental effects of proposed activities, ways that damaging effects can be avoided or reduced, and to prevent environmental damage by requiring changes in projects. The Act requires the preparation of an Environmental Impact Report (EIR) for any project that may significantly affect the environment. Guidelines for implementation of CEQA are published as part of the California Administrative Code (Section 15000 et seq).

From the standpoint of identifying and mitigating fire impacts in the wildland-structural intermix, three sections of the implementation guides are important. Section 15355 states that cumulative impacts "can result from individually minor, but collectively significant projects" that take place "over a period of time." Section 15358 defines "effects" to include "indirect or secondary impacts caused by the project" even though those impacts "may be later in time or farther removed in distance." Section 15041 gives public agencies the authority to require changes "in any or all activities of a project" to reduce impacts.

If these Sections are considered in context with earlier discussion (ability to require off-site improvements, "linking" open space dedications for public protection, and reviewing projects in relation to adjoining areas), planners and fire services apparently have underutilized their applications. Clearly. more energetic application of these existing legal prerogatives would improve fire protection systems in the intermix. Also, the same efforts required for general planning improvements and the incremental upgrading of lot-split problems apparently would serve to enhance CEQA applications.

IMPLEMENTING CHANGE THROUGH STRATEGIC FIRE PLANNING

Strategic Fire Planning is the process of developing area-wide (i.e., major watershed, local jurisdiction, or critical community) systems of fire defense improvements. Improvements would include--but not be limited to fuelbreaks, other fuel reduction areas, greenbelts, and necessary facilities such as helispots and fire stations. Improvements should be integrated and interrelated in complete systems where possible and not be designed as individual projects. Primary goals would be to provide maximum public safety, property, and resource protection with the fewest possible suppression forces. Design will

vary with terrain and development conditions, but the improvements should provide perimeter defense capabilities for areas no larger than 300 acres; some conditions could require designs to protect as little as 10 to 30 acres.

Strategic planning is not a new concept. The intent and practice of strategic planning have existed for over 50 years; however, those efforts were not always successful. Landowner resistance, government inertia, budget and personnel limitations frequently debilitated improvement implementation. The combined resisting forces, compounded by accelerated development in the wildlands, has led fire services to view the concept with pessimism. Past and present failures create strong suspicions that future efforts will also fail.

There are two significant differences between past failures and what is suggested here. The first difference is the process of implementation. Past fire service efforts started at the end of the local planning process rather than at the beginning. Fire agencies designed their projects and then attempted implementation "on top of" existing local planning and zoning regulations. Agencies were forced to appeal for approval of their projects because they were not integrated into the planning processes authorized by law. Local government was not a partner in implementation. If the legal opportunities described in this paper are used, this difficulty can be overcome. Strategic planning can be integrated into the body of the planning process, starting with analysis of General Plan and Safety Element situations and impacts, and proceeding through zoning and environmental mitigation.

The second difference is between past and potential funding. With the exception of some successful case-by-case applications (acquisition of land for facilities, and some lesser fuelbreaks, primarily) fire agencies have assumed almost total responsibility for financing construction and maintenance of all strategic improvements. Lawmakers have resisted funding the ever-increasing workloads with public monies, and the agencies find themselves far behind in both building and maintaining improvements. Most smaller agencies (fire districts and local departments) have not even considered strategic improvements because of the problems encountered by their larger colleagues. This paper has shown that fire protection improvements need not be the exclusive burden of the fire services. With the proper impact analyses and local planning ordinances, developers and landowners can and should take over the majority of costs.

Strategic planning is the key to mitigating the wildland-structural intermix problem. But the strategic planning in and of itself is not enough. The entire local land use planning process must be used as the initiation and implementation vehicle.

RECOMMENDATIONS

Coordinated action in three areas of endeavor is needed. The action is needed now, to assure that the rapidly increasing wildland-structural intermix fire problems can be held to acceptable levels in the future. The three areas are described below.

1. Legislation--The basic legal authorities for much of the needed improvement already exists, but legislative recognition of the intermix problem is needed. The California Environmental Quality Act should be clarified to recognize the intermix and to include further definition of off-site and adjoining community impacts. Local governments need the same direction for General Plan guidelines on fire safety as has been given for earthquake and flooding. The State Board of Forestry, Board of Fire Services, Fire Marshal, and the California Fire Chief's Association should be enlisted to assist the Office of Planning and Research in the development of new guidelines. Goals of the effort should be more accurate situation assessment in Safety Elements and preparation of consistent coordinating policies in Land Use, Conservation, and Circulation Elements.

"New" legislation may be needed to correct past omissions and improve fire safety requirements of the Subdivision Map Act. The critical presence of substandard developments justifies strong efforts to amend existing law. As a minimum, incremental improvements to water systems and emergency access should be required whenever substandard properties are sold.

2. Research--Socio-political-economic research is the the most important contribution that could be made in support of fire safety improvements. Lawmakers at the state and local levels need more objective data before they can support positive change. Data must be collected (and presented) on real costs and losses, mitigation and suppression trade-offs, and

policy formation for fire prone areas. In addition, applied, not basic, research is needed to assist fire services and planners with implementation of fire behavior modeling, orthophotographic mapping, and other products that are now resting "on the shelf."

3. Strategic Planning--This effort, supported by legislative change and applied research, needs to begin now to be effective by the year 2000. Fire protection planning must be oriented to the total wildland-structural intermix environment as well as the case-by-case approaches now emphasized. The strategic planning must be integrated into local planning, from General Plans through mitigation requirements.

No other action taken by fire services will be as effective as strategic planning in reducing future fire impacts.

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