“FIRESCAPE ARCHITECTURE"
Landscape Architecture for a Safe & Logical Wildland/Residential Interface
Case Study: Southern Indiana's Wildland

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Before we get started, I would like to take a brief moment to thank all those special people who made, almost, every minute of this comprehensive project enjoyable.

To my fiancé, family, and classmates, I would like to say that all the late night support and motivating conversations were crucial to my sanity.

To my studio professor, Dr Ronald Spangler, I would like to say that your persistent encouragement for me to find an applicable site for "Firescape Architecture" paid off in the end. To my faculty advisor and friend, Professor John R. Russell, What can I say? Your genuine concern in my progress throughout the years has ensured that my "Sponge" is full of knowledge.

Once again, thank you all. Without your personal support and guidance, I would be physically fighting fires today instead of designing for their existence in the future.
ABSTRACT:

5th Year Comprehensive Project:
“FIRESCAPE ARCHITECTURE”
Landscape Architecture for a Safe & Logical Wildland/Residential Interface
Case Study: Southern Indiana’s Wildland

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“Ninety percent of the world’s fires are caused by human beings -- mostly careless of their surroundings” -- Clay, 144.

That’s a scary quote, considering many new housing communities are popping up in remote areas where increasing amounts of uncontrollable forest deadwood, combined with poorly designed wildland/residential interface areas are causing numerous wildfires. What’s a wildland/residential interface, you ask?

Well, the wildland/residential interface is a landmass area where structures intermingle with previously undeveloped wildland. It is the desired area of new housing development for the majority of today’s rural commuters.

The increasing interest in living in these areas is understandable. Nature is calming. The views are inspiring, and removal from the “Big City” is appealing; but, currently “the very presence of a home in a wildland region does threaten wildlands -- not only because people can cause wildfires but because the priority given to protecting life and property could divert fire fighting resources from the surrounding wildland area” -- NFPA, 5. The odd thing is, it doesn’t have to be this way. As in every situation, there is a compromise. In this one, it’s called “Firescape Architecture.”

“I think that many landscape architects, as well as other design professionals, are not aware of all of the do’s and don’ts of protecting structures and life within the wildland/urban interface. The best thing is cooperation from the start. Try to work out the problem areas, identify them, and then work out solutions to those problems as soon as possible” -- NFPA (response by participant in satellite broadcast symposium), 11. This inadequacy in the profession is the main reason for the creation of what this project calls “Firescape Architecture.” Firescape Architecture is the solution to the aforementioned problem. Firescape Architecture is the creation of techniques and standards that enable the Landscape Architect to design wildland/residential interface areas that are fire-safe.
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CHAPTER 1
INTRODUCTION to FIRE
“Weather conditions during the first week of May 1990 across northern lower Michigan,” at the Stephan Bridge Road Fire in Crawford County, “were right for a serious wildfire, and the fire fighters knew it: Temperatures were in the low 80’s; relative humidity was 26%; and winds were out of the southwest at 17-21 m.p.h., with gusts to 42 m.p.h.” “This fire caused more loss of structure in Michigan than any fire since the late 1800’s. A total of almost 6,000 acres burned, 86 residences were lost, along with 126 outbuildings and numerous vehicles, boats, and camping trailers. The preliminary dollar loss was $5.5 million” -- NFPA, 28 (see figure 1).

Wildland fire is one element of nature which exists in many different forms that affect humans no matter where we live. The three main elements of the fire triangle (fuel, air, and heat) exist everywhere. Yet, there are certain questions that must be asked of a specific location; such as, “are the elements where you live in the correct proportion and conditions for wildland fire to occur,” and “are the fuels, weather, and topography in your region favorable for a wildland fire.” When the answer to these questions is “yes”, lookout.

To better understand what it is you are looking out for when it comes to wildland fire, let’s take a basic look at its needs, its forms, and its movement.

Figure 1:
FIRE EQUATION: (see figure 2)

Fire is the rapid chemical combination of fuel, air, and heat. The “Fire Equation” simply states that all three elements must be present, in the right proportions, for a fire to occur. The basic principle of fire suppression is to remove one of the three in the fastest and most efficient manner possible; so, let’s take a quick look at those three elements.

Fuel: Later, we will discuss the two classifications of fuel types (light or fast-burning, heavy or slow-burning). For now, we will just consider it to be any flammable material.

Air: Simply, the oxygen in the atmosphere. Later, we will talk about weather conditions and their effect on air.

Heat: Increased temperature that may be the result of sparks and embers from cigarettes; trash fires; cars, trucks, and tractor exhausts; and lightening -- to name just a few.

Remember: “Fire cannot exist without fuel, air, and heat.”

Figure 2:

FUEL  AIR  HEAT  FIRE
WILDLAND FIRE: (see figure 3)

A wildland is any relatively undeveloped and predominantly forested area of 5 acres or more (i.e., northern lower Michigan). There are four forms of fire that occur in this kind of area; they are as follows:

Ground fires: Burning natural forest litter, duff, roots, and/or some organic soils. This type of fire is hard to detect and control because of its subsurface location, and it's ability to smolder for days -- once visually extinguished it may rekindle.

Surface fires: Quick burning grasses, shrubs (<4' tall), and lower branches of trees (result of ladder fuel). Ladder fuel is not a wildland fire type. It is simply fuel that bridges the gap between the surface fuel and the crown fuel (i.e., a shrub directly underneath a tree). It allows a surface fire to become a crown fire.

Crown fires: Burning tops of tree canopies. This type of fire is hard to control, and wind patterns make it very unpredictable.

Spotting: When crown fires, wind currents, and/or topography allow large burning embers to ignite a new spot fire. Once spotting fires start the wildfire is on the move and extremely hard to control.
WILDFIRE on the MOVE: (see figure 4)

The three main factors that influence the spread of wildfires are fuel, weather, and topography.

**Fuel**: This aspect typically falls into two main subgroups. They are *light/fast-burning* (i.e., dry grass, dead leaves, brush, and young trees that cause rapid spread and act as kindling for other fuel type) and *heavy/slow-burning* (i.e., stumps, logs, deep duff, and mature trees that produce large amounts of heat).

**Weather**: This aspect typically contains three main subgroups. They are *wind* (i.e., stronger the winds, the faster fire spreads; the fire itself causes local air currents; and it causes spotting), *moisture* (i.e., amount in air affects amount in fuel, drier during the day than at night), and *temperature* (i.e., fuels preheated by the sun burn more freely, temperature of ground affects air currents).

**Topography**: This aspect affects spread in two ways; which are preheating fuels and creating drafts. Typically, a wildfire runs faster uphill than downhill -- preheating fuel by convection as it moves.

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**Figure 4:**

- **Fuel**: Grass, Brush, Young Trees
- **Weather**: Sun, Wind, moisture/temperature
- **Topography**: Mountains, Valley

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"FIRESCAPE ARCHITECTURE" Landscape Architecture for a Safe & Logical Wildland/Residential Interface; Case Study: Southern Indiana's Wildland
CHAPTER 2
PROJECT SIGNIFICANCE
“Ninety percent of the world’s fires are caused by human beings -- mostly careless of their surroundings” -- Clay, 144.

That’s a scary quote, considering many new housing communities are popping up in remote areas where increasing amounts of uncontrollable forest deadwood, combined with poorly designed wildland/residential interface areas are causing numerous wildfires. Sound confusing; it really isn’t. Let’s backup.

This trend is not new, and the number of occurrences is not declining. “During the years 1986 through ’89 homes and other structures were destroyed by wildfire at an average rate of 300 to 400 per year. In 1990, the figure jumped to 900. The nation’s loss to wildfire is at crisis level”-- NFPA, 3. It’s expensive too.

“Based on fire records from 1985 to 1994, the average loss per home burned in a wildfire is estimated to be $232,000” -- FSCCAG, 8. Yet, those figures do not assess the intangible values of life, both human and environmental.

You might ask, where is this occurring, and what is a “Wildland/Residential Interface?” The answer is one in the same. The wildland/residential interface is a landmass area were structures intermingle with previously undeveloped wildland. Currently, there are three types of interface areas noticed by the National Forest Service; they are as follows:

1. Mixed Interface: When a few isolated structures are scattered over a large wildland area.
2. Occluded Interface: When an isolated area of wildland is found within an urban area.
3. Classic Interface: When a large number of dense structures border a vast wildland on its fringe.

In regard to the occurrence of wildfire issues, a mixture of Mixed & Classic Interface types is where levels of concern are increasing (see figure 5). Unfortunately, this is not simply the result of increased human inhabitation in forested areas. It is, also, the result of poor design practices in regard to wildland/residential interface issues. Yet, the public views this increase solely as a result of “stupid people living in places they shouldn’t” and “an inadequately funded national wildland fire response effort.” As is usually the case in this type of media educated public, they are ill-informed. They correctly understand the basic natural importance of letting wildfires cleanse the environment, yet they do not understand the feasible idea of living safely among nature by design.

Figure 5:
The increasing interest in living in these areas is understandable. Nature is calming. The views are inspiring, and removal from the “Big City” is appealing; but, currently “the very presence of a home in a wildland region does threaten wildlands -- not only because people can cause wildfires but because the priority given to protecting life and property could divert fire fighting resources from the surrounding wildland area” -- NFPA, 5. The odd thing is, it doesn’t have to be this way. As in every situation, there is a compromise. In this one, it’s called “Firescape Architecture.”
CHAPTER 3
GOAL & OBJECTIVES
"I think that many landscape architects, as well as other design professionals, are not aware of all of the do's and don'ts of protecting structures and life within the wildland/urban interface. The best thing is cooperation from the start. Try to work out the problem areas, identify them, and then work out solutions to those problems as soon as possible" -- NFPA (response by participant in satellite broadcast symposium), 11. This inadequacy in the profession is the main reason for the creation of what this project calls "Firescape Architecture." Firescape Architecture is the solution to the aforementioned problem and its subproblems. Firescape Architecture is the creation of techniques and standards that enable the Landscape Architect to design wildland/residential interface areas that are fire-safe.

PROJECT GOAL:
To create an inclusive set of "Firescape Architecture" techniques and standards for the profession of Landscape Architecture, which enable the designer to create a safe and logical framework for achieving a well designed fire-safe wildland/residential interface.

OBJECTIVES:
A. To select a site in southern Indiana as an area for technique application.
B. To use a wildfire aftermath location as an area for technique application -- a logical time to rebuild with "Firescape Architecture" in mind.
C. To use site design guidelines which recognize factors that increase or decrease wildfire occurrence and safety.
   1. Infrastructure guidelines for:
      a. Road widths
      b. Roadside vegetation management
      c. Road surfaces
      d. Road grades
      e. Roadway radius
      f. Road turnarounds
      g. Road turnouts
      h. One-way roads
      i. Driveways
      j. Gate entrances (if desired by residents)
      k. Access
      l. Bridges
   2. Size of plots and proximity of houses.
   3. Topography
   4. Fire season winds
   5. Water assistance
D. To use zonation guidelines that sets up "Defensible Space" (i.e., four boundaries around the development which define the "do's and don'ts" based on distancing from the structure).
   1. Zone 1: 30'
   2. Zone 2: 30-50'
   3. Zone 3: 50-100' (depending on site slope)
   4. Zone 4: 100' and beyond

E. To use vegetative species which possess certain qualities:
   1. Fire resistance and resilience
      a. Lack of aromatic oils
      b. Drought tolerance
      c. High water retention
      d. Low duffage -- deadwood
      e. Extensive seed banks

   2. Unique adaptations to wildfire problems

F. To use landscape materials that are fire resistant.
CHAPTER 4
ASSUMPTIONS & LIMITATIONS
1. The actual types of building materials for a fire-safe structure (i.e., slate roofs) are the responsibility of the Architect, not the Landscape Architect.

2. In order to have an aftermath situation, the project assumes that a natural wildfire has already occurred on the site as a result of the deadwood accumulation by the past tornado.

3. In order to create a demand for "Firescape Architecture" close to home, the assumption is made that Indiana's increasing population will create a need for wildland/residential interface areas.

4. The actual site in southern Indiana is part of the Hoosier National Forest. Therefore, it is not for sale or development.

5. The site is in southern Indiana. Although the future need for this type of design in Indiana may be justifiable; presently, it's found mainly in California.

6. The field of fire response design, "Firescape Architecture," is so new that it doesn't even have an official title. Thus, the amount of time-tested researched information on the subject is limited.

7. Also, these areas of current research must wait on an act of nature to lend a testing ground for the theories. This can take some time.
CHAPTER 5
CLIENTS & USER
CLIENTS:
The clients are homeowners wishing to live in rural forested communities in southern Indiana, yet they have reservations in regard to the currently designed safety practices of living in wildland/residential interface areas. The project will helped to inform those who wish to live in a fire-safe wildland/residential interface area of their new "Firescape Architecture" option.

USER:
The user is the current planning and design professionals of Landscape Architecture. The project demonstrates planning and design principles, called "Firescape Architecture", for the occupation to use as guidelines for a fire-safe wildland/residential interface in rural forested areas of southern Indiana and relevant areas throughout the country.
CHAPTER 6
THE PROJECT
HISTORICAL BACKGROUND:

Fire has been a part of southern Indiana's recorded history as far back as 1823. Early Indiana Pioneer W. Faux talked of "the day-long smoke of 'Indian Summer,'" produced by fires that "crossed both prairie and forest" near Princeton, Indiana -- Olson, 249. "'Indian Summer' was typically a time from mid-October through early November after the first killing frost" -- Olson, 249.

On a more recent note, "Hoosier National Forest boundaries are known to have burned regularly," at 5 to 7 year intervals, "as recently as the 1970's, until they were acquired by the federal government" -- Olson, 250. Is this a good outcome? Some would say, "this sudden change in the fire regime has resulted in the loss of diversity in the region. To regain the former diversity of the central hardwoods, fire should be reintroduced to the ecosystem in a controlled manner" -- Olson, 255. The results would be immediate on a natural scale (see figure 6). Yet, people don't want to live in an area where controlled burns are a common practice. From their point of view, what keeps their family's dreams from going up in smoke?

Figure 6:
SITE SETTING:

Remember the Stephan Bridge Road Fire in Crawford County, Michigan on May of 1990, well parts of southern Indiana have recently fallen into the same category of wildfire concern. The summer of 1996 was a turbulent one for a large section of wildland in southern Indiana known as the Hoosier National Forest. This area was hit by a rather large tornado that contributed a considerable amount of new deadwood to the area. The extent of damage is unknown at this time, but the conditions for a wildfire are favorable. For the purpose of site application of Firescape Architecture techniques, this project uses a portion [one (1) mile square] of this forested area as a site location. It’s U.S.G.S. Map legal description is Sec.2, T.6N., R.2E. of the Norman Quadrangle (see figure 7).
OBJECTIVE INVENTORY:
In order to better understand the site, let’s take a look at a few images of the sites existing conditions (see corresponding figures and site map on the next pages).

Figure 8: Main rural dirt road on the site -- 20’ wide with dense brush at roadside.
Figure 9: Gas company pipeline clearing -- 70’ wide with 12” high grass groundcover.
Figure 10: A typical area home -- existing Wildland/Residential Interface.
Figure 11: Tornado aftermath on site slope -- huge amounts of new deadwood in rows layed upslope.
Figure 12: Exploded pine stand -- 400’ x 200’ area that, now, looks like a bomb went off.
Figure 13: State Highway 446 -- major vehicular access route.
Figure 14: Roadside debris -- clumps of wind blown understory and overstory vegetation (multiple locations).

What else is on the site -- see figure 15 (next pages, also).

As far as hydrology goes, the site contains several ephemeral and perennial creeks and a few perched retention ponds. The major overland flow is into the Starnes Branch of the South Fork of Salt Creek on the northwestern portion of the site. Which leads to topography.

The site has an elevational change of approx. 252.00’ (high point = elev. 861.50 & low point = elev. 609.50).

Steep ravines are not uncommon.

Presently, the site vegetation is a thick oak/hickory successional canopy with a beech/maple successional understory (see figure 16 on next pages). The only clearings are the result of the pipeline, gravelroads, trails, natural retention ponds, streams, and last summer’s major tornado; but what if all that excess deadwood from the tornado was to catch fire and burn the surrounding forest.

In the wake of a wildfire, only the oldest and healthiest oaks would survive. Leaving behind a temporary wasteland. I say “temporary”, because fire is a natural part of a forest’s succession, and nature quickly regenerates a fresh, new environment from a damaged one. So, what if we too created a fresh, new wildland/residential interface in the aftermath.

Wouldn’t it make sense to design along side nature in a regenerating wasteland. Some advantages would be:

1. Reduced negative environmental side effects (i.e., erosion & clear cutting).
2. The opportunity to be located in an ever changing environment at the primary stage of succession.
3. A fresh, new start on a fresh, new idea.

Remember: This does not mean that the practice of “Firescape Architecture” is limited to aftermath site development. The practice can and should be applied to both new and old wildland/residential interface areas -- no matter what the reason.
Figure 8:

Figure 9:

Figure 10:

Figure 11:

Figure 12:

Figure 13:

Figure 14:
Objective Inventory
Symbol Key:

General Tornado Damage Area:
Foot Trails:
Light Duty Dirt Road:
Creeks & Streams:
Surface Ponds:
High Spot Elevation:
Low Spot Elevation:
Pipeline Carrying:
Site Boundry:

Figure 15:

Figure 16:
SUBJECTIVE INVENTORY:

What about those features in the objective inventory that apply to "Firescape Architecture?"

Symbol Explanation: (see figure 18 on page 24)

1. Flat plateau with outlook: Aesthetic vistas and proper slope location, in regard to fire, for home protection from wildfires. This area, also, has a locations on hill tops with proper slope requirements -- 16%. Let's talk a little hit more about slope (see figure 17 on page 23). As far as this project is concerned, there are three types of slope. They are as follows:

A. An area possessing a natural slope less than sixteen percent on the ridge line. This percentage and location are unique because they are the desired maximum percent and location for a safe and logical wildland/residential infrastructure.

B. An area possessing a natural slope greater than sixteen percent anywhere on the site. In regard to structures and infrastructures, an avoidable area for firescape architecture design guidelines and techniques.

C. An area possessing a natural slope less than sixteen percent midway up the ridge or at it’s base. In regard to structures and infrastructures, an avoidable area for firescape architecture design guidelines & techniques.

2. Natural water retention area: adequate, perched water source for wildfire suppression efforts. Also, close proximity to flat plateau areas.

3. Pipeline clearing: An existing 80’ wide grass prairie clearing. By keeping the succession of this area in a low growing grass stage, by controlled burns or mowing, it will serve as part of a valuable fire break system for site protection.

4. Fire season winds: The dry, hot summer (i.e., Indian Summer) winds typically out of the southwest. This wind will feed the fire while pushing it up southwest facing slopes in a northeasterly direction.

5. Northeast facing slope: The moist, cool slope -- opposite the sun beaten, dry southwest facing slope. The northeast facing slope is most likely to maintain moisture in the soil and plant tissue longer during the late summer months. Yet, during a period of drought the vegetation on this slope may sustain the greatest damage due to it’s lack of drought tolerance.

6. Perennial stream bed: A zone of constant flowing water.

7. Annual stream bed: A zone of seasonal, intermittent flowing water.

8. Seasonal wetland area: An area of seasonal or constant soil water saturation. Plant tissue in this area generally has a high water content.

9. Impacted traffic area: By crossing over the pipeline clearing at both the north and south end, this area will, if properly maintained, complete a fire break circle around the entire site. The fact that it is used as a high traffic area and is located on the main ridge line through the site make this area a logical spot for the placement of a road system (see the “Schematic Infrastructure” board for additional details).
Figure 18:

Symbol Key:

Flat plateau with outlooks:

Natural water retention area:

Pipeline clearing:

Fire season winds:

Northeast facing slope:

Perennial stream bed:

Annual stream bed:

Seasonal wetland area:

Impacted traffic area:
SCHEMATIC INFRASTRUCTURE GUIDELINES:

Do you remember Objective C? It was, "to use site design guidelines which recognize factors that increase or decrease wildfire occurrence & safety." In order to focus on safety from a vehicular standpoint, the project set up infrastructure guidelines to be used as design parameters by the landscape architect. They are as follows:

Infrastructure guidelines -- FSCCG, 21-23: (see corresponding figures on site map -- figure 31)

Figure 19 (picture): Road widths: 18' wide two-way traffic (9' lanes). Allows for smooth flow of residents leaving and fire personnel arriving in the case of a fire.

Figure 20: Roadside vegetation management: remove at least 10' on both sides. Allows for a manageable precaution area for fires caused by automobile traffic (i.e., fires caused by car breaks).

Figure 21: Road surfaces: able to support 40,000 lbs (20 tons). Allows for fire engine weights.

Figure 22: Road grades: not to exceed 16%. Allows for max. safe grade for fire engines.

Figure 23 (picture): Roadway radius: no horizontal inside radius < 50' (4' added to curves 50-100' and 2' added to curves 100-200') and no length of vertical curves < 100'. Allows for min. safe radius for fire engines.

Figure 24 (picture): Road turnarounds: 40' radius from center line and within 50' of the structure. Allows for min. safe radius for fire engines and max. distance for hose to tanker engine.

Figure 25 (picture): Road turnouts: 25' taper on each end, 10' min. depth, and 80' min. overall length. Allows for min. safe sizes for fire engines.

Figure 26 (picture): One-way roads: min. 10' wide lane, connect to a two-lane road, not to exceed 2,640' (½ mile), and a turnout at the midpoint. Allows for fire engine width and unobstructed movement (i.e., turnout: so the fire engine can quickly & safely interact with oncoming residential traffic leaving the area).

Figure 27 (picture): Driveways: 10' wide lane, unobstructed vertical clearance of 15', and a turnout at the midpoint. Allows for min. fire engine clearance and oncoming traffic interaction.

Figure 28 (picture): Gate entrances (if desired by residents): 2' wider than traffic lane, located at least 30' from the road, and open inward. Allows for min. space needed for fire engine to fit through gate, pull completely off of road, and not have to back into the traffic lane for swing of gate.

Figure 29: Access: 2 entrance & exit routes. Allows for the fact that fire shifts direction periodically; so, everyone involved needs a second way out.

Figure 30: Bridges: 18' wide, 40,000 lbs (20 tons) support on general bridge, and 80,000 lbs (40 tons) support on main entrance & exit bridges. Allows for min. specifications for fire engines.
TWO-LANE ROAD
Figure 19:

RADIUS 50' - 100' = ADD 4' WIDTH
RADIUS 100' - 200' = ADD 2' WIDTH

CURVE WIDENING
R=50' MIN

TURNAROUND
Figure 24:

R=40' MIN.

10'-18' MIN.

TURNOUT
Figure 25:

25' MIN.
10' MIN.

10'-18' MIN.

CONNECTS TO A TWO-LANE ROAD

250' MIN.
10' MIN.

CONNECTS TO A TWO-LANE ROAD

10'-18' MIN.

15' MIN.

15' MIN.

DRIVEWAY SURFACE 10' MIN.

DRIVEWAY
Figure 27:

30' MIN.
GATE

GATED ENTRANCES
Figure 28:

"FIRESCAPE ARCHITECTURE" Landscape Architecture for a Safe & Logical Wildland/Residential Interface; Case Study: Southern Indiana's Wildland
ZONATION GUIDELINES:

These guidelines demonstrate the use of zones that set up "Defensible Space" -- four boundaries around a structure which define the "do's and don'ts" for the landscape architect based on wildfire protection (see figure 32 on page 29).

Zone 1: 30' (all zones are distanced from the house)
   a. Reduced vegetation (height): single trees (crowns 10' off ground), low perennials & annuals (<18"), water plants or ponds (no restrictions in any zone), fescue (cut to 3")
   b. Low volume: single trees (10' from structure, spacing @ 2x tree height and no limbs overhanging house), no ladder fuels (i.e., shrubs under trees).
   c. Well maintained: mulching, irrigation, and pruning (crowns 10' from power lines).
   d. The use of fire resistant elements and materials (i.e., fish ponds & stone sculptures) are not restricted in any zone.

Zone 2: 30-50'
   a. Increasing vegetation (height): trees (crowns 10' off ground), shrubs (medium size), fescue (cut to 6''), and plants types listed in Zone 1.
   b. Medium-low volume: few well spaced trees (10' apart), shrubs (spacing @ 2x height).
   c. Well maintained: mulching, irrigation, and pruning (crowns 10' from power lines).

Zone 3: 50-100' (depending on site slope)
   a. Island plantings: Zone 1 and 2 plants & shrubs (shrubs can be taller in this zone).
   b. Medium volume: islands spacing (3x the height of the highest plant).
   c. Well maintained: mulching, irrigation, and pruning (crowns 10' from power lines).
   d. Site slope: steeper slopes, >30%, use greater distance (i.e., Zone 3: 70-100'). Also, tree spacing in all zones must respond to the topography: 0 to 30% slope = 10' spacing, 30 to 40% slope = 20' spacing, and 40% and over slope = 30' spacing -- all spacings are from one canopy edge to another.

Zone 4: 100' and beyond
   a. Natural vegetation: deciduous & evergreen trees, saplings, shrubs, groundcovers and/or grasslands.
   b. Natural volumes for native vegetation.
   c. Periodically maintained: removal of excessive deadwood, selective cutting, and controlled burns -- if deemed necessary by an experienced forester.

Remember:
1. Good design is found in the unique application of the zonation guidelines -- there is room for creativity.
2. Zonation guidelines will not make a structure fireproof; but, it will greatly increases the structure's chance of survival.
In the midst of a wildfire's aftermath, this comprehensive project has created a logical opportunity for the landscape architect or responsible home owner to apply simple design guidelines and techniques to a new idea called "Firescape Architecture." The project explained the relevant issue of fire, showed us the problem at present, and created guidelines for the wildland/residential interface as a solution. Most importantly, it allowed for a safe & logical compromise with mother nature.

THE END...
LITERATURE CITED:


BIBLIOGRAPHY:


**ADDITIONAL READINGS & MATERIALS:**

Barrows, J.S. *Fire Behavior in the Northern Rocky Mountain Forests,* Station Paper No. 29. Missoula, Montana: Northern Rocky Mountain Forest and Range Experiment Station, USDA Forest Service, 1951.


"FIRESCAPE ARCHITECTURE" *Landscape Architecture for a Safe & Logical Wildland/Residential Interface; Case Study: Southern Indiana's Wildland*