

An Ecological and Physical Investigation of Pittsburgh's Hillside



EXECUTIVE SUMMARY - ECOLOGICAL REPORT by Timothy M. Collins

I think I can safely say that our team would be first to argue that land within the city is best used for development. Dense urban environments can create efficient transportation, education and cultural infrastructure and enormous savings in terms of energy consumption. Dense urban environments also leave ex-urban lands open to agriculture, forestry or recreational uses. However, in instances when the development of urban land may create a threat to public safety, or when citizens decide to save land for its intrinsic values we must reconsider the suitability of development. What follows in this report are tools to help clarify the zoning and regulation of undeveloped City hillside lands. Ultimately, these tools will enable the development of a long-term set of policies that provide for systematic hillside land preservation, species conservation and, when warranted and affordable, ecological restoration.

One hundred years ago, preservation and conservation movements were born as a reaction to the perceived encroachment of the industrial economy upon land. For the first time there was a sense of the physical limits of resource extraction within the United States. Preservationists believed that wilderness was in a state of grace, beyond the limits of human habitation. Nature was something to be preserved and contained for future generations. Conservationists believed that wilderness was a resource bounty to be managed and controlled for long-term economic benefits. Both of these philosophical and political positions placed nature (in the form of wilderness and land-resource) well beyond the limits of cities or towns. The post-industrial reaction to impacts upon soil, water, land, air, climate, and our bodies is ecological Restoration. "Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed." (www.ser.org) Restoration ecology is a new way of thinking. It links citizens and experts, as well as cities and outlying lands, in a broad program of ecological awareness and action. It is a community of disciplines synthesizing a continuum of diverse knowledge and practices. In many ways the challenge of restoration ecology is to promote a community of environmental health, aesthetics (after Nassauer and Muelder Eaton) can be an indicator of that healthy vitality.

Through out time there has been a struggle between practical minded people that see utilitarian value in nature and those that see intrinsic value in nature. Utilitarian value is primarily external from the object of contemplation, while intrinsic value is internal. In other words, the utilitarian value of

a tree in a forest can also be found in the value of the wood, when extracted, milled into lumber and brought to the mill workers shop where it can be cut and joined to create fine furniture. Trees in the forest provide jobs for the lumberjack that cuts the tree, the sawmill owner that processes it from tree trunk to usable lumber, the truck driver that hauls it, and the craftsman who makes wonderful objects from lumber. The tree as a raw material is a resource that supports life, enables the economy and is ultimately a renewable resource although one that regenerates slowly over time.

The intrinsic value of the tree is a more complicated question. Does a tree have a sense unto itself? Does it feel pleasure and pain? Does it act in its own self interest? Can humans act as advocates for the legal rights of tree's in much the same way that act as advocates for corporations, small babies, or other non-verbal entities? Recent philosophical literatures raises the question of agency and self interest, moral authority and advocacy are subjects of intense study and conflicting argument. Recent forays in the literature of political ecology examine the idea that nature and tree's could have rights, or that the divided houses of culture and nature could reunite in a new concept of scientifically and metaphysically informed government. Are these thoughts appropriate for a city like Pittsburgh, where the culture and economy has been constructed and sustained upon the ideology of resource use and the economies of extraction?

For our purposes we can leave behind the heady discussions of philosophy and instead discuss intrinsic value in terms of a tree's essential relationship to the land. We can also discuss the utilitarian services this tree provides to the human community during its tenure, which by the nature of the tree's self-replicating life-force can be quite substantial, The tree is part of a network of roots processing nutrients. The roots provide the structure that holds the soil from erosion. The tree has a role in the hydrologic cycle, processing water in the root zone, it draws water through the trunk and releases it from its leaves into the air in the form of gas. It has a role to play in air quality, it is a sink for carbon dioxide and a source of clean fresh air through the stomatal openings in the leaves. The structure of the tree provides shelter for wildlife, its fruits provide food, the shade cools the air. The tree when alive and part of a forest is a primary structural element of a larger ecological infrastructure that is all alive. A tree competes with other trees and plants in the forest for sunlight, Its bark reacts to nails and materials that pierce it, healing itself, not unlike our own flesh. It reacts to changes in the weather, it blooms in the spring, cloaks itself in colorful foliage each fall, and reveals its fundamental bare wood structure each winter. The tree is alive, it procreates, its value is unto itself and in relationship to the forest. Humans can share those values as members of the forest community, or impose a more utilitarian value upon the tree, and deny its life. Mans dominion over nature goes back to the Bible. Despite this history of dominion, the tree is a living entity that is part of the network of life. A living tree has a defensible role in the human economy based on the studies of the environmental economist Steve Farber, whether it has intrinsic value that can be imposed on others, is the meta-topic (but not the focus) of this study. The primary topic is utilitarian, steep wooded hillsides are green-infrastructure that bring significant services to human communities. Green infrastructure mitigates landslides, storm water impacts and air quality issues. Following the bias of Pennsylvania's courts, we will confine what by now should be a clearly perceived empathetic interest (on the part of this author) in the life of nature, to its subservient role in the support of public safety and as a "reasonable" alternative to land use development, on the basis of green-infrastructure values.

Tools to inform the discussion of City hillside zoning.

Our sense of the “nature, or ecology of this place” is colonized by the language of cultural spaces, and architectural design. This is a highly abstract ideology of enclosure, of private parcel ownership and municipal authority. Municipal zoning seeks to minimize the negative impact of private development. It is at its strongest when focused upon the protection of public health, safety, morals or the general welfare of the greater community. Despite a history of urban landscape theory that has roots in ancient city design, modern authority in the writings of Ian McHarg and contemporary validity in the discourse of landscape ecology, political ecology and restoration ecology - the issues of ecosystem services are primarily undermined or enabled by parcel by parcel regulation and decision making. We assembled a team of artists, natural scientists, an environmental planner, an urban designer and various computer mapping experts to develop tools that might enable natural systems in the city. The first question we struggled with was what component of the natural world could we target, that might -- provide the relevant argument that would allow the Hillside Committee of the City of Pittsburgh to feel confident that a new hillside zoning regulation was equitable to landowners as well as legal and enforceable? The second question we struggled with was what issues could we identify that would enable the most robust democratic discourse within each neighborhood, about the value of open space, and the struggle over the meaning of the public realm, the public will, and larger social and environmental ideals in relationship to the rights and aspirations of individual property owners?

After much consideration, we decided to provide analysis of both quantitative and empirical data that can inform rational decision making on steep slope properties at the level of zoning policy, regulation and enforcement. The focus in this section is upon 25% slopes or steeper, this is an angle at which many soils become unfit for urban development, creating both on site and downslope threats to public safety. This is also a slope angle where the buildings in the city drop off significantly, and city services in terms of roads and sewers are inconsistent and often nonexistent. In turn, this also means that these are the places in the city where remnant forests have flourished, or where natural recovery has occurred to significant effect, in some cases creating interconnected forest patch-corridor matrices that result in emerald arcs, forests that are visually stunning and increasingly valuable to humans that value proximity to nature and the green-infrastructure services of nature, even at the urban core.

All materials in the Ecological Report have been developed with the express intention of reflecting the analysis and outcomes of Cyril Fox’ study of the authority and jurisprudence of land-use controls. Following the Fox report, we were seeking an analytical methodology that would “identify potential danger from landslide and other development problems” as well as examine the cities current stock of “adequate public services and infrastructure” at each of these parcels. Finally we were seeking to minimize any “perception of arbitrary decision making” – through the rigorous application of accepted material data sets supported by the City of Pittsburgh, Allegheny County and the United States Agricultural Service. In the high ideals and ancient history of rational planning, we have decided that the best way to act in the interest of the public realm, was to let the data speak for itself.

Specific goals:

Tools for Democratic Discourse

- Contextual analysis at the watershed scale.
- Open space needs analysis at the neighborhood scale, and

Decision Tools

- Decisions analysis at the parcel scale.
- Field studies to inform land use guidelines.

Tools for Democratic Discourse.

- Contextual analysis at the watershed scale.

The ecological report focuses first on the watershed scale - maps that help us understand the urban relationship to topography, hydrology, woodlands, parks and interior forest. This is nothing more than a conceptual framework to help us understand the function and failure of natural ecosystems within the city. The final map in this series (map 1.7) gives us a sense of the significant forested areas of the city, and their relative interior forest, defined as the forest area approximately 100 meters from the edge of forest patch (Moyer 2003). Interior forest habitat is critical to maintaining populations of organisms which require stable sources of food and cover.

- Open space needs analysis at the neighborhood scale.

Secondly we looked at the city on the scale of neighborhoods. On a neighborhood by neighborhood basis, we mapped resident income, average value, population density and vacant parcels in relationship to parks and open space. In this section we argue that neighborhoods with low per capita income, low value, and high population density have a greater need for open spaces than those places with high income, high value and low population density. These maps provide the reader with a means to understand what neighborhoods have access to open space, to parks and forests and which do not. Arguably this can be used by citizens and officials alike to think about what these steep hillsides mean in terms of the social and ecological characteristics of each neighborhood, and where there are issues of equity and access or lack there of.

Decision Tools

- Decisions analysis at the parcel scale.

We were seeking to develop a decision matrix, that would allow each parcel in the city to be analyzed and then sorted into areas for preservation, conservation or development. We were seeking an analytical methodology that would allow us to identify potential danger from landslide as well as available public infrastructure that could service each parcel. Our method is based upon the best available knowledge of soils (in terms of erosion, foundation and roadbed safety) in the city. And upon each parcels relationship to adjacent buildings, or proximate (within 100-300 feet) roads and sewers. This is the most objective, rational manner that we could come up with to sort parcels into scientifically informed and legally defensible zoning categories. The data for this analysis is from the United States Agricultural Department Study of the Soils of Allegheny County, and existing City of Pittsburgh infrastructure studies. Based on this data and analysis we were able to arrive at the following standardized definitions.

Preservation: land deemed environmentally unfit for development due to erosive soils, and a lack of available City infrastructure.

Conservation: land with sensitive but not exclusionary soil characteristics for safe building practices, with some infrastructure necessary to support development.

Development: land with both the soil characteristics for safe building practices and available infrastructure to support development.

With the clear understanding that this exercise is intended to inform Pittsburgh City Zoning, we realized that the geo-referenced data sets would need to be effectively queried at the level of individual City parcels. We were able to develop a Microsoft Access database tool we call the “parcel identifier.” This tool allows the casual user, or City planner to query the infrastructure and soils databases for each City parcel using the lot and block numbers. The results of that query are recommendations for preservation, conservation or development described above. Finally we added two “push” categories that inform the user of potential threats to development due to the proximity of the underlying coal seam, or potential benefits to preservation and conservation ideals in terms of adjacent woodlands.

The relative effects of the “parcel -identifier” database are mapped and charted for the total number of parcels on slopes >25% in the outline below. This data set provides the committee with an understanding of the affects of the analysis on the total number of developable parcels. All four categories include the infrastructure and soil safety information. The ecology team would argue that the soils and infrastructure decision should remain unchanged, however there is room for discussion and decision on the “push” factors.

Parcels Without Woodlands or Coal

This is the cleanest and simplest presentation of the relationship between existing infrastructure and soil conditions as analyzed by the “parcel identifier.” Using just soils and infrastructure we have a very simple, clear and concise tool to inform decisions on zoning.

Preservation	3494 parcels (30%)
Conservation	3951 parcels (34%)
Development	4310 parcels (36%)

Parcels with Coal Only

If we were to only include the coal seam underlay as an additional -public safety- push factor, the categories increase or decrease by the following number of parcels/percentage:

Preservation	3806 parcels (33%)
Conservation	3937 parcels (33%)
Development	4012 parcels (34%)

Parcels with Woodlands Only

If we were to consider the parcel - woodlands condition as an additional -ecological systems- push factor the categories increase or decrease by the following number of parcels/percentage:

Preservation	5782 parcels (49%)
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Conservation 2897 parcels (25%)
 Development 3076 parcels (26%)

Parcels with Woodlands and Coal

With the addition of both the woodland and coal “push” categories the categories either increase or decrease by the following number of parcels/percentage:

Preservation 5992 parcels (51%)
 Conservation 2860 parcels (24%)
 Development 2903 parcels (25%)

- Field studies to inform land use guidelines.

Given our industrial history, it is sometimes hard to fathom the import and value of the remnant and recovering forests of Allegheny County. The botanist found a high diversity of woody species within each of the sites and evidence of four typical forest community types in the three areas sampled. They identified 84 woody species in total: 66 of which were native (=79%), and 13 of which are native hardwood trees (15%) (See Table 1). Many trees were greater than two meters in circumference and one tree at exceeded three meters in circumference. The steep hillsides of Pittsburgh indeed sustain a diverse assemblage of tree species with their attending shrubs and understory trees. Four hardwood forest native plant communities were identified on the hillsides studied. (See Appendix A for complete descriptions of these forest types):

- _____ **Dry oak**– mixed hardwood forest, typically occurs on slopes with dry soil
- _____ **Red oak**– mixed hardwood forest, occurs in mesic soils and found on lower slopes in our survey
- _____ **Sugar maple**– basswood forest, often occurs on rich soils with rocky slopes and supports a rich vernal flora .
- _____ **Mixed mesophytic forest** - typically found on lower slopes, which is unique to the Southwestern portion of Pennsylvania, and supports an extremely rich and diverse flora.

The Geologist comments on the three major site areas, was cautionary. Site studies illustrate the importance of field checking maps of geological hazards and soil types as part of the final decision on the suitability of hillside land for development. Section 4.2 “Understanding the Soil Survey for Planning goes into more detail on this topic.

In Conclusion

Our studies illustrate the fact that there is available data upon which a hillside zoning plan can be written. Given the authority of the United State Department of Agriculture and the City of Pittsburgh, the soil data and infrastructure data are legally defensible sources applicable and indeed intended for land-use decision making. The field studies provide potent tools for informed land use guidelines, and a rational overview of the value of our remnant and recovering forests. The contextual analysis and open space analysis help us see the current patterns and baseline condition today. This report provides the committee with authoritative work on ecology, our colleague have provide equally thoughtful input on design, economy and law. We believe that we have had some success clarifying the issues and setting direction for the process of discourse, compromise and realpolitik to begin.

We look forward to the results. .