



Thematic week: Water and Land

Thematic axis: Land Use Planning, Forest Cover and Afforestation

Title of Keynote Lecture: Planning for the Future of Land and Water: Globally? Regionally? Locally?

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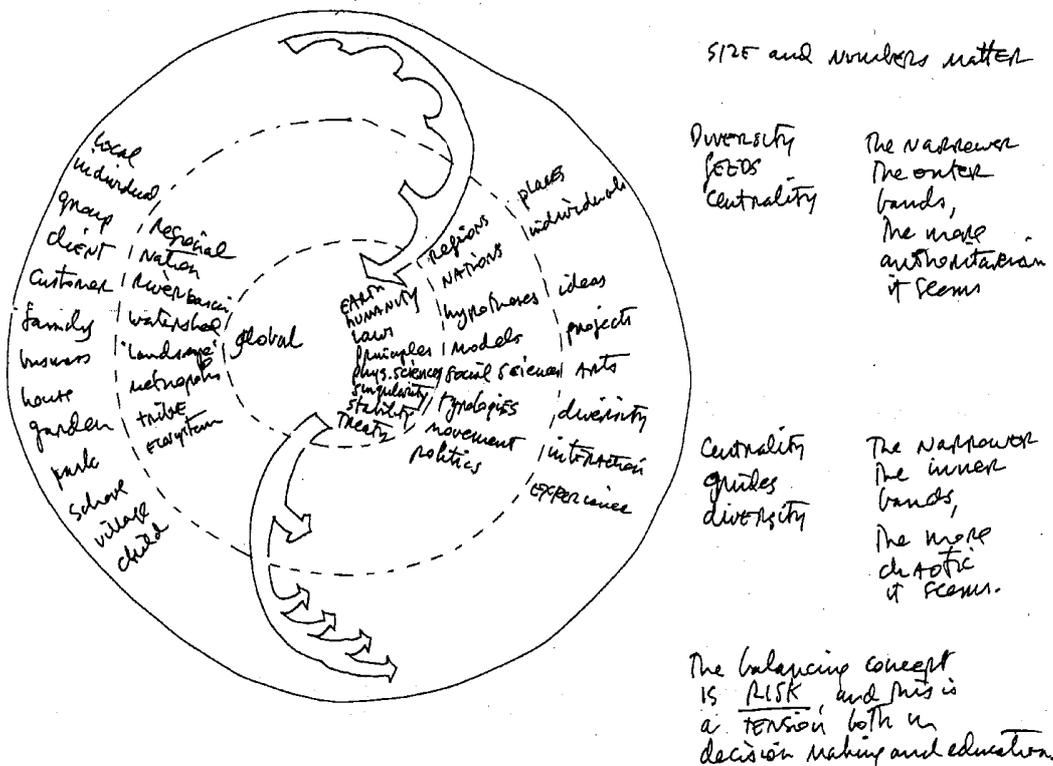
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The central theme of this week of the EXPO Zaragoza is land-water relationships. I have organized many landscape planning studies and worked with some of the world's finest hydrologists and water economists. Water has always been a central issue, often as a binding constraint on potential policies and plans. My experience has raised an important question which will be focus of this talk-- At what scales should we plan for the future of land and its people and resources, and especially for water? At the local level? At the regional level? At the global level? At all levels? Simultaneously? How? And is planning at these scales mutually supportive or in fundamental conflict?

As Galileo said, "Many devices which work on a small scale do not work on a large scale."

The quotation from Galileo and this diagram summarize my lecture.

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Let me start by describing these scale relationships as I see them, albeit in a very simplified manner. In the center are global characteristics. In the middle band are regional and national characteristics. In the outer band are local and individual characteristics. These characteristics are each on a continuum, a range, but the extremes on these ranges are very different.

There is one planet earth. There are many nations, many regions, many watersheds. And there are many, many, many individual places and people. The numbers are very different, and this overriding fact is very important. There is one earth, but there are billions of people who make decisions about land and water.

At the global level, we tend to think and perhaps act for all of humanity. We work with general and singular principles and make generalizable global laws and treaties that (we hope) nations and their people can agree upon. These are mostly based in the earth sciences, chemistry, physics, biology, and ecology, because these are what make the earth one place. They ignore national, regional and local political boundaries (or they should). I think the general aim of global scale studies is to understand change in order to stabilize it. The word “sustainable” has this attribute. Global policies and plans are essentially “defensive”, and I think this characterizes the objectives of the Kyoto Conference, the Rio Conference, Johannesburg, and others. A global perspective is extremely important... a good aspect of globalization.... and especially for its relevant scale of issues such as global warming, rise of sea levels, desertification and loss of biodiversity.

I often work with others in the middle band – in my teaching, my research, and my projects. Instead of globally, we work regionally, often by watershed or city-region. Instead of all humanity, we work with specific cultures. Our clients are public. We recognize that there are differences between rich and poor, Mexican and Californian, older persons and contemporary teenagers. Instead of formulating international treaties we try to find out what the laws are. We work with processes and with hypotheses. We generate and evaluate alternatives. In addition to the physical and ecological sciences, we emphasize the social sciences: politics, economics, sociology, planning. Instead of singular principles we look for patterns and typologies. Instead of seeking stability we try to understand and guide the movement of change, but we don't know exactly where it's going. We deal with politics, with legitimately conflicting views and possible consensus, and this is especially the case when considering water. As my friend Tom Maddock says, “Water isn't for drinking, it's for fighting”. Unfortunately, this is too often the reality.

The outer band represents the most local level. There are very many of these. Instead of considering all humanity or one culture, you deal with individuals or small groups. The decision makers are frequently dominated by private interests, especially towards scarce resources. If you are a local landscape planner you get to know real, individual people. Instead of global principles and regional information, the data that you study are related to the specific place. Instead of seeking global laws or regional political consensus, those who work with individuals and small groups make locally specific adaptations. Sometimes these produce new, innovative ideas to meet particular local situations. It is very rare to have and use new ideas at the regional and global levels. Instead of seeking global principles or regional typologies, at the local level we should recognize diversity and its advantages. The things that make a place different are how it looks and feels, its people and all their means of individual expression, and these are reflected in the many local landscapes. Instead of studying stability, or broad patterns of change, we should study interactions. We should study exactly where species – including people – go to do things and how they relate to each other, the land and its resources. Exactly how is water used in Zaragosa? or Dacca? or Irkutsk? Or Fresno? And instead of attending global conferences or reporting to regional legislatures, we should act in direct experience. The best way to do this is to live and work there, to be part of it. Planning the landscape at this level is not abstract, it is tangible.

When you look at this diagram and these bands in this way, you should realize that planning the landscape at the global, regional, and local scales are very different. Each band requires different education, different styles of working, different knowledge, and different experience, albeit with fuzzy boundaries and overlapping issues and characteristics.

There are other relationships among these rings. First of all, the diversity of the local feeds the centrality of the global. People do create new ideas. They create new ways of thinking. The central phrase of this EXPO, "...one thousand solutions", is not an accident. And this local inventiveness can influence regions and nations, and this in turn influences global policy. And, like yin-yang, the global in turn influences nations. It *should* influence nations. And nations and regions should also then influence individuals. David Browder said that we should "think globally, act locally." We can also say: "Think locally, act globally."

But there are also potential conflicts and risks in these relationships. The narrower the outer local and regional bands become, the more this diagram moves toward globalization in some of its negative aspects. And the more it moves *only* to globalization, the potentially worse (in my cultural opinion) it may be in the long-term. Not the better but the worse, because it can become authoritarian. The more we believe we really know something, the more we want the world to be as one, and to be how *we* think it should be. And I'm not sure, with my ecological perspective, that this is good, because it is not necessarily diverse, adaptive, self-renewing, and ever-changing. And here I have great concern with the concept of global policy, whether commercial, economic, cultural *or environmental*.

However, and again in the yin-yang relationship, the wider the outer rings, the more emphasis is placed on the national and regional, and the more it becomes locally dominated. This may be better in the long run, but it will be more chaotic. And it may also be more unfair, because we have rich countries and poor countries, big countries and small countries, modern people and traditional people, water-poor areas and water-rich areas with much-too-much water. So if you see the world as the sum of the very many local places, it can be very complicated, very difficult to understand, very difficult to coordinate, very difficult to plan for.

And this is the major dilemma and problem related to scale. If you think only globally, we and our landscape plans can become authoritarian. And if we see it only locally, it can be chaotic and unfair. The balancing concept, the thing that allows people to act locally, *and* nationally *and* globally, is the idea of risk. Risk provides the useful tension in all aspects of decision-making, including what we do in the landscape and with its resources, and also in the education and guidance which we help provide. It can help establish priorities. What is the risk of being more centralized and controlling versus of being more decentralized and diverse?

If it is something that is a risk to everybody, then it belongs globally. Policies on global warming and desertification and the threats to biodiversity absolutely belong in the center. If it is a cultural risk, it belongs regionally. Conservation of cultural heritage, its landscapes and languages, belongs in the middle ring. If it is risk to an individual's right to creative ideas, it absolutely belongs in the outer ring.

So—at what scale, or scales, should we act? What is really hard, is to try to understand the globe, and then to try to act locally. And what is also really hard is to have an idea locally and then to try to change the world. From my experiences, I can recommend that you consider much more action in the middle range, at the regional and watershed levels. It may be the most complicated level, because you will need to be directly influenced both by global issues and also by local issues. It also can be very effective and personally satisfying to act at the regional and watershed levels, and to cut across those circular lines and blur them.

However, there is an especially difficult problem when working from a regional scale. How does one communicate major landscape changes that may occur over a period of 20 to 40 years as the result of many smaller local decisions? How does one tell a property owner that her actions matter to her larger region and that the actions of her many neighbors will influence her future as well....what the ecologist Eugene Odum called “the tyranny of small decisions”?

We now have methods and technologies that increasingly enable assessment, planning and representation across scales. I will show an example from our research on the Upper San Pedro River Basin in Sonora, Mexico and Arizona, USA (Steinitz et al., 2003).

The Upper San Pedro River Basin in Sonora, Mexico, and Arizona, USA, is a globally significant bird habitat. The San Pedro is the last free flowing, undammed perennial desert river in the American Southwest. It is globally significant because it is located on the North American flyway for birds, and it supports the second highest vertebrate biodiversity in the world for an area its size. It is especially important for its diversity of hummingbirds. The river is dying, and its future as a special place is threatened by continued urban and agricultural growth. It is fast becoming a suburban area to the city of Tucson and it is home to Fort Huachuca, a major military base. Our study explores how continued development in the Upper San Pedro River Basin might influence the hydrology and biodiversity of the area over the next 20 years.

The study area is approximately 1000 square kilometers, and includes the Upper San Pedro River Basin from its headwaters near Cananea, Sonora, northwards 188 km to Redington, Arizona. Because the watershed lies partly in Sonora and partly in Arizona, it is subject to widely different national and local laws, regulations, and land use practices.

A suite of interlinked process models was used to describe and evaluate how the current landscape works, and to assess the potential impact of each of several Alternative Futures and their variations relative to the conditions in 2000. First, the development model evaluated the attractiveness of the available land for five kinds of development: commercial, and urban, suburban, rural, and exurban housing. It then simulated the economically driven processes of urbanization of the region in five year increments to the year 2020, under different scenarios for change (see below). The hydrological model evaluated the impacts of the future land use changes in terms of head configuration, loss of groundwater storage, stream capture volume, and flows in the San Pedro River. The vegetation model responded to changes in the hydrologic regime, combined with changes in fire and grazing management practice. The predicted new vegetation patterns formed the basis for a three-part assessment of regional biodiversity: the landscape ecological pattern, a group of single species potential habitat models, and vertebrate species

richness. Finally, a visual model assessed potential impact on the region's landscape in terms of residents' scenic preferences.

Because no single vision of the future can be certain, it is preferable to consider several alternative futures that encompass a spectrum of possibilities. Therefore, this study generated several alternative policy-driven scenarios and examined the resulting range of alternative futures that the region might experience.

Three groups of Scenarios were projected to 2020 via the development model. The first, called PLANS, was based on the research team's interpretation of existing planning documents and land use practices of the region. The second, CONSTRAINED, investigated lower than forecast population growth and more tightly controlled development. The third, OPEN, anticipated greater than forecast population growth and less controlled low-density development across the region. Each of these was expanded by variations that alter key policy positions. The sensitivity analyses based on ten variations provided a basis for better understanding which actions will produce the greatest effects.

We obtained impact assessments by applying the process models to the alternative futures for 2020 and comparing the results with the reference period 2000. Both direct and indirect impacts were assessed, with each revealing one aspect of how an alternative future is predicted to change the landscape.

If we consider the following to be positive impacts: slowing the decline of groundwater storage; slowing the drying of the river; retaining or improving wildlife habitats; maintaining or improving species richness; maintaining the beauty of the landscape; and improving attractiveness for development, we can begin to evaluate the alternative futures.

The first and most important findings involve the fundamental factor for life in an urbanizing desert--water. All of the scenario-generated alternative futures, even those which are most restrictive of population growth and water use, result in overall loss of groundwater storage, and in decreased stream flow in the San Pedro River. All alternatives will result in a lowering of the water table near Sierra Vista, Arizona and Cananea, Mexico with a drop in level around Sierra Vista of 10 to 15 m. However, the alternatives that most restrict irrigated agriculture can result in water table gains in the north of the study region. The San Pedro River will continue to lose flow under the Open and Plans Alternatives, and in the Open Alternatives, the riparian habitat will continue to decline, effectively "killing" the riparian corridor. Those alternatives that restrict irrigated agriculture and especially those that also concentrate development, however, can increase stream flow and improve riparian habitat in downstream parts of the river basin. This can improve species diversity in the region, and benefit those many species that depend on this habitat.

Comparison of the alternative futures reveals that policy decisions affecting irrigated agriculture in Arizona cause the greatest impacts on the region's hydrology and ecology. The second most significant policy is development control. Population growth in Arizona, with its accompanying municipal and industrial water demands, will be the second largest future consumer of water. Policies which encourage population growth and relax development constraints are very powerful influences on potential negative

environmental impacts. Third in significance are growth policies in Sonora related to increased mining and agriculture. However, their influence is small when compared to the effects of agricultural and development policies in Arizona.

These findings are not unexpected. The future of the Upper San Pedro River Basin is one that will bring environmental crisis closer to the direct perception of more people.

One special issue facing the research team was how to show small land owners the consequences of their cumulated actions. Our most effective way was via computer generated animation of the results, with the time condensed, and the imagery capable of being focused on any property. This purposely blurred the scales: for local owners, for a regional watershed, and, for the hummingbirds, global diversity.

Steinitz, Carl, H. Arias, S. Bassett, M. Flaxman, T. Goode, T. Maddock, D. Mouat, R. Peiser, and A. Shearer. 2003., Alternative Futures for Changing Landscapes: The Upper San Pedro River Basin in Arizona and Sonora, Island Press, Washington, D.C. 2003