# Design and Planning for Sustainability

ROBERT GILKEY DYCK

Virginia Polytechnic Institute and State University

## INTRODUCTION

The design and planning professions have yet to develop a comprehensive and generally accepted theory to guide the work of its practitioners in helping to accomplish sustainability. This is partly because the concept of sustainability is elusive and subject to many different interpretations, depending largely on disci-plinary or professional perspective. Significant consensus is growing, however, that sustainability must be approached in a way that fully encompasses its interactive economic. social equity, and environmental components (Campbell, 1996; Yaro and Hiss, 1996), reflecting a realization that the knowledge and methodolo-gies for accomplishing it are not neatly compartmentalized. This realization, linked with the further recognition that many sustainability relationships are both complex and nonlinear in character (Hwang, 1996), argues for a new approach to interprofessional and interdisciplinary collaboration. Such a new approach is consonant with the key recommendation of the UIA's *Beijing Charter* (as adopted by the 20th Congress of the Union of International Architects, held in Beijing in June 1999), calling for a *fusion* of architecture. landscape architecture, and city planning to solve critical global urban and environmental problems.

Most widely accepted modernist theories of urban and regional planning fall into the trap of failing to include environmental considerations as coequal in im-portance with socioeconomic parameters, and fail also to recognize the impor-tance of design concepts in scientific inquiry (Dyck, 1998). As a consequence. en-vironmental planning has become simply a functional subset of general planning, whose premises and operating principles derive almost entirely from socioeco-nomic and sociopolitical constructions. Accordingly, sustainability defined as an outcome of coevo-lutionary processes that embody *the interaction of social and ecological spheres* (Norgaard, 1994) can only occur fortu-itously, if at all.

In fact, prevailing socioeconomic planning and its physical planning and design counterparts are leading away from economic and political sustainability (witness the evergrowing global income gap) and from environmental sustain-ability (as measured by a host of over-population, resource deple-tion, global warming, and pollution indicators). Modernist planning theory, deriving from a compartmentalized view of the social sciences, largely ignores contemporary interdisci-plinary conceptions about the environment that derive from the *intersection* of the natural and social sciences as well as the humanities. Provocative exam-ples of the latter are pro-vided in the work of Sally J. Goerner (1994, 1999), Sang Hwang (1996. 1998), and Edward O. Wilson (1998). Simi-larly, prevailing architec-tural design theory pays little atten-tion to a conception of sustainability that draws as heavily from economic and equity considerations as it does from environmental issues.

## MEDIATION OF SOCIOENVIRONMENTAL CHANGE

Three broad normative premises for a new model of profes-sional practice can be drawn from this brief review of sustain-ability in design and planning. First, design and planning practice should become a more significant mediator of the coevolution of society and its environmental context. Oth-erwise, professional practice in these areas faces the danger of irrelevance to crucial sustainability problems. Designers and planners tend to be caught up in the prevailing mentality of unlimited population and economic growth, with an orienta-tion to public and pri-vate sector clients whose interests are defined by the modernist economic paradigm. Most architec-tural design services are commissioned by wealthy individu-als or by institutions that care little about the energy or resource use or environmental implications of their archi-tects' designs. not to mention their broad sociopolitical impacts: and architects usually have little opportunity to contribute to the solution of community or region-wide prob-lems except through their incre-mental contributions to indi-vidual projects.

The development paradigm needs to shift in the direction of more empha-sis on the *quality* of the growth, rather than its *extent*, but private sector designers are relatively powerless to

effect such a change because their horizons are too limited and because of the prevailing system of fees for services commissioned by individual clients. Society desperately needs new approaches to the design of the built urban environment that are socially, economically, and physically sustain-able at the scale of an entire urban community or region. A more comprehensive and fully integrated model of design and planning theory, integrated with practice, is a necessary condition of success.

Sustainability issues could become the catalyst for integration of both theo-retical and practice-oriented perspectives of designers and planners. For example, Frank Fischer's work on levels of discourse in the policy formation process (1995) shows how *argumentation* could be utilized as an umbrella concept that is contributory to the methodology of both planning and physical design. Similarly, Dana Cuff's analysis of the culture of design practice (1991) emphasizes the *complexity* of collaborative relationships in practice and develops the case for educational preparation in *a variety of necessary leadership roles*, not just for ex-cellence in design.

## NEW INSTITUTIONAL AUSPICES BEYOND FEE-FOR-SERVICES ARRANGEMENTS

Second, design and planning practice should embrace expanded institutional auspices, beyond simple fee-for service relationships, to enhance practitioners' opportunities to mediate socioenvironmental issues at all levels of scale. The role of the designer or planner is at once to be both educative and open to information and design concerns shared by stakeholders both inside and outside the com-munity. The architect's traditional role as designer for individual clients on a fee-for-services basis provides no crucial incentive to engage in local community and inter-community dialogue, as minimally required for coevolutionary environmental design.

Significant involvement of the architect in such broader concerns requires that we consider alternative institutional auspices that could be equitably supported by client communities. Something analogous to third-party health insurance may be required to finance the long-term sustainability of communities by covering costs such as interjurisdictional environmental design networking: design and construc-tion of experimental energy production and waste management facilities; and de-sign and construction of environmentally sensitive transportation and communica-tion infrastructure, housing, business structures, and other elements of the built environment.

An important imperative of professional practice in the interest of sustainabil-ity is to comprehend and influence both natural and built environment conditions at different levels of scale. This is much easier said than done, but implies networking relationships that transcend ecological, watershed, airshed, jurisdictional, and even national boundaries, to name some of the more traditional modernist regions for prediction and management by division into parts.

In sum, the finding for typical fee-for-service professional practice is that working for a single private or corporate client does not provide sufficient network-ing leverage for design success across overlapping levels of scale. Institutional auspices must be designed that can facilitate the necessary networking across scale boundaries that range from the local to the global. The necessity of the multi-scale approach is widely recognized in the ecological design literature. Sim van der Ryn (1996), for example, provides a provocative account of the role of frac-tals as mediators of scale in nature, and suggests that designers must learn to work knowledge-ably in such contexts. We need institutional auspices in design and planning that provide intricacy equivalent to that of nature's organization.

## DESIGN AND PLANNING EDUCATION

Third, design and planning education should be grounded in the interrelationships of ecological change and social dynamics to a greater extent than is generally the case at present. Many colleges of design and planning already give attention to a range of land use, landscape ecology, resource planning, energy conservation, pollution abatement, indoor air quality, materials-efficient building construction, indus-trial design, urban design, public administration, and equi-table economic development issues, thus covering the full gamut of sustainability con-siderations. However, these subjects are typically covered in separate depart-ments of urban affairs and planning, architecture, landscape architec-ture, building construction, industrial design, and public administration, and the level of synthesis and integration needed for sustainable development is rarely, if ever, achieved in the curricula of individual students or even groups of students. William E. Mitchell's orientation to urban develop-ment based on *information technology* (1999) suggests the basis for a more interactive and all-encompassing educa-tional process.

Some specialization will still be necessary and desirable, but all students will need broader, more inclusive profes-sional education so that they can at least develop awareness of the range of interrelationships required for sustainability. In-ternet supported college-wide survey courses, together with incentives and re-quirements to encourage students to engage in interdepartmental work, constitute one approach. The work of interdepartmental teams of students in studio courses, fieldwork, and internships should be encouraged. The pedagogy would be based on attention to common linkages of epistemology and methodology, including ap-plicability of design methods such as nonlinear analysis and synthesis across the range of college concerns.

The same interdepartmental approach provides a good starting point for politics. Emphasis should be placed on the concept of co-design, the process by which professionals work in concert with clients and other professionals at differ-ent levels of scale. Alternative networking protocols must be tried and perfected through experience. Studios should be

organized to provide real-life clinical expe-riences in con-texts characterized simultaneously by difficult social, eco-nomic, and environmental problems. Students need exposure to community development theory and the interaction of community culture and politics by involvement in cul-tures and political systems that differ from their own. This will help them with their work both in their own culture and in other cultures.

In addition, students need enough exposure to the micro world of intra-office politics and the macro world of power politics to be able to help with the design of new institutional arrangements that will help design professionals and planners to contribute more directly to solution of sustainability prob-lems. Community founda-tions, third-party insurers, and community-based cooperatives appear to have good potential as institutional brokers of sustainability. Like urban artifacts, such institutions need to be designed, and professionals should be able to help design them to promote their own professional interests as well as those of society at large.

## NEW THEORETICAL MODEL

Based on the foregoing considerations, we now turn to the construction of a theoretical model whose purpose is to contribute explicitly to sustainability through education and practice in the design and planning professions. James M. Mayo's two-dimensional model (1996), which links architec-ture and politics, provides the conceptual starting point. Mayo's theoretical structure is based on contingent (interde-pendent) relationships, identified as ideology, function, pro-cess, and design, which occur at the intersection of politics and architectural prac-tice. Mayo presents these contingent relationships in a theoretical taxonomy (p. 77) showing that architects are both recipients of proscriptive guidance and prescribers of decisions in the political sphere, and also indicating that their practice is informed by both nonmaterial and material considerations, as shown in Figure 1.

| POLITICS | ARCHITECTURAL PRACTICE | |
|---|---|---|
| | Nonmaterial | Material |
| Proscriptive | Ideology | Function |
| Prescriptive | Process | Design |

Figure 1. General Theory--Contingent Relationships between Politics and Architectural Practice (Source: Mayo, p.77)

Mayo defines the meaning of the terms in the lines and columns of the ma-trix as resultants of the cross-cutting intersection of politics and architectural prac-tice. In the case of *ideology*, Mayo concludes that freedom and equality are the key determinative dimensions. For *function*, he desig-nates political power, cultural and economic conditions, and situational current issues (including environmental aware-ness) as critically important. Key *process* variables include individual and collective professional role choices, institu-tional frameworks, work cycles, and communication. Fi-nally, *design* is shown to be influenced by its political context and objectives, its present or future time orientation, and the cumulative causal effects of ideology and process as well as function (78-82).

While Mayo performs the useful service of linking profes-sional practice with its social context through politics, he falls short of providing counterpart contingent relationships based on the equally important environmental context. Mayo does not ignore the environmental issue completely, but environ-mental change is sub-sidiary to his political construction of architectural function and design, and is not specifically included in his consideration of ideology and process. What is needed in the interest of a more complete mapping of the empirical terrain of professional practice in design and plan-ning is a theoretical model which admits natural and built environmental considerations to a co-equal role with politics in determination of ideology, function, process, and design.

My revised model provides a *coevolutionary* view of the interrelationships of politics, the environment, and profes-sional practice, meaning that practice is linked *interactively* with both. Based on this theoretical perspective, professional practice would not be subject either to social or environmental determinism, but would be linked *interactively* with both politics and the environment. In practical terms, this means that the work of designers and planners *mediates* the intersec-tion of social concerns with environmental concerns at sev-eral levels of scale ranging from the micro (single-family housing and other small buildings) to the macro (metropolitan land planning and urban design).

Because of this intersection of environmental, design, and practice spheres, a modified matrix dimension must be iden-tified that is analogous to the "non-material" category that Mayo uses in his matrix shown in Figure 1 (above). Since Mayo's use of "non-material" is related to ideals and process variables in-volved in architectural practice, the new dimen-sion must express both a direction of change (purpose) and a process that is applicable to the spatial design profes-sions, the environment, and politics. A term that meets these criteria is "program-matic." This term embraces a conception of informational guidance that is con-sistent with professional practice and evolutionary environmental change as well as politics. Mayo's "material" counterpart to his "non-material" dimension can be retained in the new matrix, since profes-sional practice and environmental change are both character-ized by material components, and the term has already been shown by Mayo to work with his cross-cutting politics sphere.

Accordingly, the revised model shows an environmental change sphere that includes macro and micro scale dimensions that also cut across the politics sphere and are consistent with professional practice. Scale dimensions must be included simply because the environment cannot be considered except in its spa-tial context, extending from the local to the global. Counterpart sociopolitical insti-tutions must reflect the same scale considerations.

Thus, as we work towards a model expressed in the form of a three-dimensional cube, the face of the model characteriz-ing professional practice em-braces an *ideology* based on complexly *interactive* community-environment rela-tionships rather than community or designer-based determinism with respect to the environment. It includes *functional* impera-tives which necessarily compre-hend both natural and built environment conditions at different levels of scale, *process* concerns that require reformulation of the designer's place in the institu-tional context (because of environmental scale considerations that override indi-vidual project parameters), and *design* considerations that more fully reflect the complex, non-linear interaction of society and nature.

Similarly, now that politics is delineated by a scale continuum ranging from micro to macro levels that cuts across the retained proscriptive and prescriptive dimensions, the face of the cube representing politics yields a focus on four sec-tors representing **culture, community norms, nation, and com-munity.** Finally, the interactive environmental change sphere, incorporating a corresponding macro to micro scale con-tinuum in which programmatic and material dimensions exist, provides a focus on **biosphere, bioregion, metropolis, and individual structure,** and is represented on the third face of the cube.

Assembling all of the above matrices, with design and plan-ning practice represented on the top face of the three-dimen-sional cube and with politics and environmental change represented on two other faces of the cube as shown in Figure 2, we have a diagram that represents the orthogonal interpen-etration and interaction of all three dimensions, in turn pro-viding a complete summary of the interactive characteristics of professional practice, politics, and environmental change as envisioned by the model.

The matrix also provides the framework for an evolution-ary approach to professional education in design and plan-ning, with emphasis on a more inclu-sive range of social, environmental, and institutional factors so that students are comfortable working in varying cultural settings character-ized by difficult social, economic, and environmental prob-lems. It also orients educational programs to institutional arrangements necessary to allow design and planning profes-sionals to contribute more fully to solution of sustainability problems.
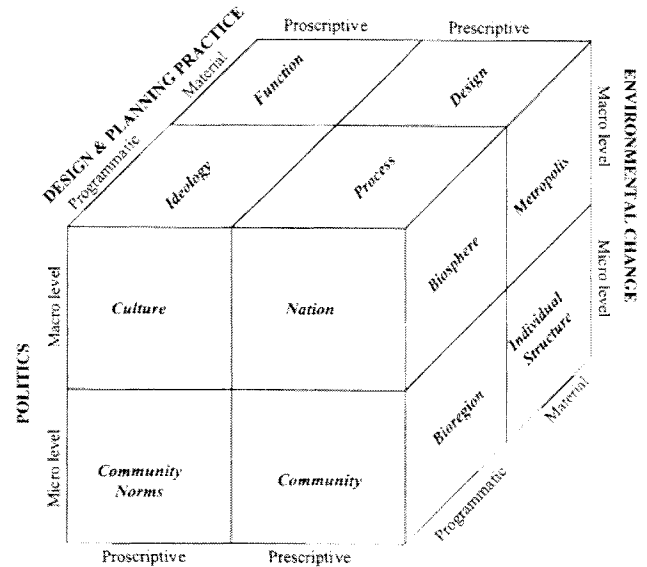


Figure 2. Conceptual Integration of
DESIGN & PLANNING PRACTICE, POLITICS, and ENVIRONMENTAL CHANGE

## OBERLIN COLLEGE EDUCATIONAL PROTOTYPE

From a pedagogical perspective, the work of David W. Orr (1994) is instructive. As chair of the interdisciplinary envi-ronmental studies program at Oberlin College, his current educational project is the development of a sustainable teach-ing, research, and learning facility at Oberlin that itself is a significant instru-ment of pedagogy. This facility provides a useful illustration of principles embod-ied in my theoretical model.

Through involvement of faculty, students, and staff (rep-resenting civil society) in the design process, together with noted "green" design consultants and fa-cilitators, the build-ing teaches the necessity of a proactive civil society in the pro-duction of sustainable built environment. It also provides a prototypical college building that discharges no waste water to its surrounding environment, is a net energy exporter, uses no hazardous materials, and promotes biological diversity in its setting.

The building thus teaches politics, design, ecology, rela-tionships of ecology and economics, environmental ethics, and a range of other subjects that in effect constitute a microcosm of the kind of liberal education required to support a sus-tainable society in the twenty-first century, based on Orr's distinction concerning the long term necessity of *slow* (problem avoiding) knowledge as opposed to *fast* (problem-solving) knowledge as the basis for environmental sustain-ability (Orr, 1996).

## ADAM JOSEPH LEWIS CENTER FOR
# ENVIRONMENTAL STUDIES

Oberlin College's Environmental Studies center will use 21 percent of the energy of a typical new classroom building and serve as a teaching tool itself. From the carpeting to the electrical system, the building is designed with environmental concerns in mind. College officials and architects say there is no classroom building like it in the country.

**The Roof**

The roof's first solar cells will be replaced within a few years when new solar cells offering more electrical generating power become available. The plan is for the building to generate more electrical power than it needs and, in fact, to become a supplier.

**Solar Design**

The design includes overhanging eaves and shading trusses that shade the summer sun while allowing winter heat gain.
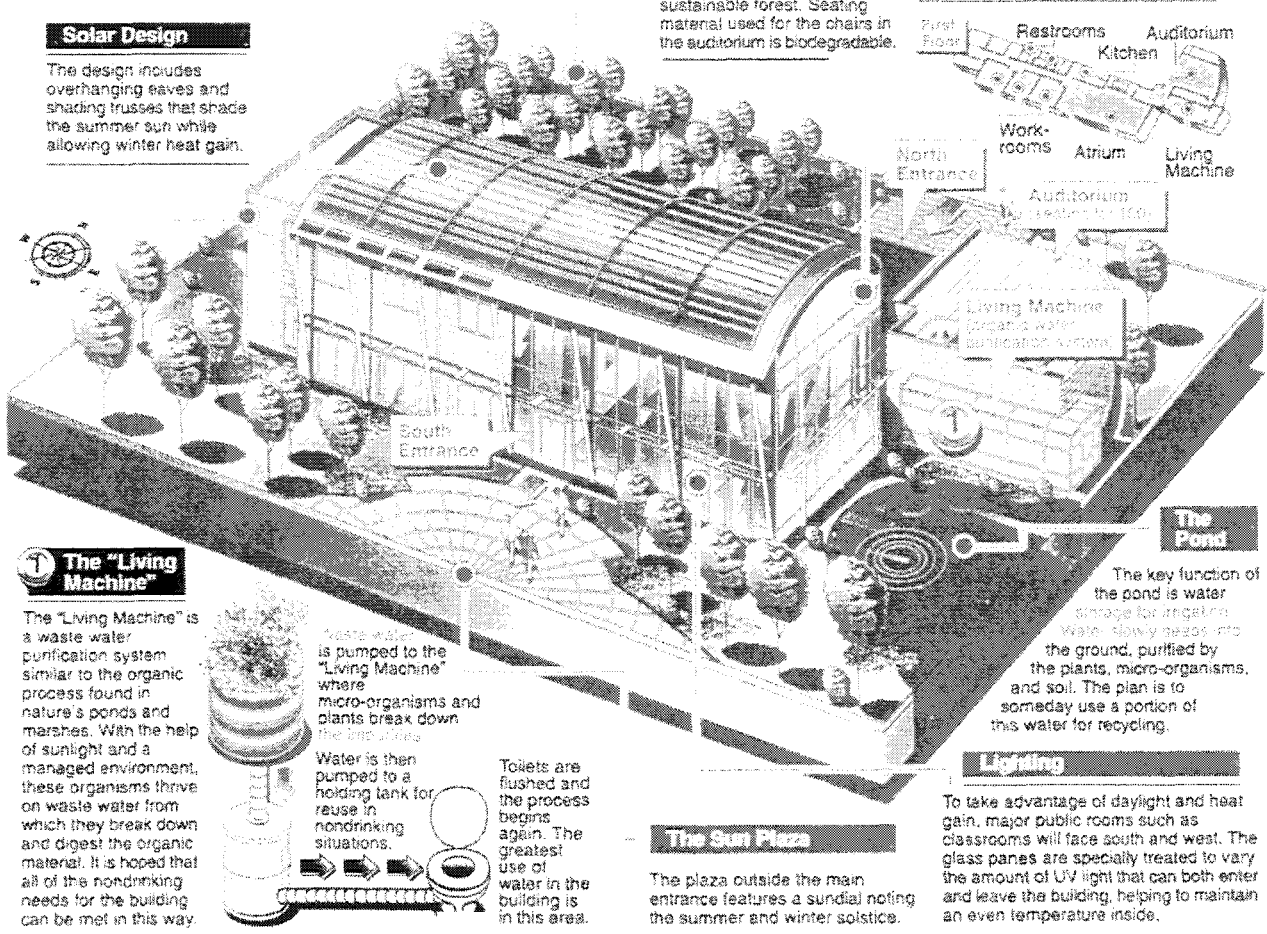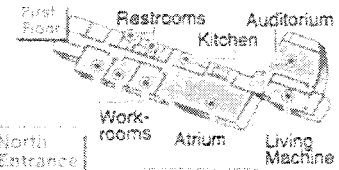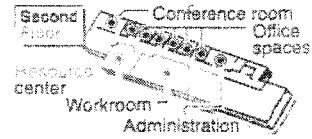
**The Landscape**

North side of the building is protected by an earthen berm and tree grove. No pesticides will be used for the gardens, orchards, and restored forest on the east side of the building.

**The Interior**

The interior is designed to change and adapt over time. Carpeting is leased from the manufacturer, which will recycle the carpeting for reuse. The wood used to make the desks and chairs comes from a sustainable forest. Seating material used for the chairs in the auditorium is biodegradable.
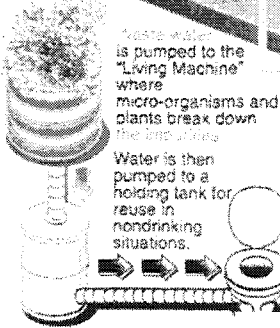
Second Floor — Conference room — Office spaces — Resource center — Workroom — Administration

First Floor — Restrooms — Auditorium — Kitchen — Workrooms — Atrium — Living Machine — Auditorium

North Entrance — South Entrance — Living Machine

**The "Living Machine"**

The "Living Machine" is a waste water purification system similar to the organic process found in nature's ponds and marshes. With the help of sunlight and a managed environment, these organisms thrive on waste water from which they break down and digest the organic material. It is hoped that all of the nondrinking needs for the building can be met in this way.

Waste water is pumped to the "Living Machine" where micro-organisms and plants break down the impurities.

Water is then pumped to a holding tank for reuse in nondrinking situations.

Toilets are flushed and the process begins again. The greatest use of water in the building is in this area.

**The Sun Plaza**

The plaza outside the main entrance features a sundial noting the summer and winter solstice.

**The Pond**

The key function of the pond is water storage for irrigation. Water slowly seeps into the ground, purified by the plants, micro-organisms, and soil. The plan is to someday use a portion of this water for recycling.

**Lighting**

To take advantage of daylight and heat gain, major public rooms such as classrooms will face south and west. The glass panes are specially treated to vary the amount of UV light that can both enter and leave the building, helping to maintain an even temperature inside.

SOURCE: Oberlin College                                      Illustration by James Owens

### Figure 3. Oberlin College Environmental Studies Center

## AFTERWORD

The theoretical model developed here has evolved from the realities of the need for change in the professional practice of architecture and planning, conso-nant with the principles of sustainability. The changes suggested will not be accomplished overnight, but many of the constituent ideas are becoming evident at the scale of regional planning, including Yaro's *Third Regional Plan for the New York-New Jersey-Connecticut Metropolitan Area* (1996), as well as in sustainable development plans for Seattle, Santa Monica, Chattanooga, Cambridge, and Olympia (Krizek and Power, 1966).

The latter group of plans reflects a variety of approaches consistent with unique scale and institutional considerations. They also reflect the fact that urban planners and its professional organization. The American Planning Association,

have been largely silent on the issue of sustainability, in contrast to other profes-sional societies in architecture, land-scape architecture, and civil engineering; *none* of the five sustainability plans discussed in Krizek and Power were initiated in community planning departments (22). This insight gives all the more credence to the need for a theoretical model for the common use of all the relevant professions.

## REFERENCES

Campbell, Scott. "Green Cities, Growing Cities, Just Cities? Urban Planning and the Contradictions of Sustainable Development." *Journal of the American Planning Association* 62, 3 (Summer 1996): 296-312.

Cuff, Dana. *Architecture: The Story of Practice.* Cambridge: MIT Press, 1991.

Dyck, Robert Gilkey. "Integrating Planning and Sustainability Theory for Local Benefit." *Local Environment* 3, 1 (1998): 27-41.

Fischer, Frank. *Evaluating Public Policy.* Chicago: Nelson-Hall, 1995.

Goerner, Sally J. *After the Clockwork Universe: The Emerging Science and Culture of Integral Society.* Edinburgh: Floris, 1999.

Goerner, Sally J. *Chaos and the Evolving Ecological Universe.* Amsterdam: Gordon and Breach Science Publishers, 1994.

Hwang, Sang W. "The Implications of the Nonlinear Paradigm for Integrated Envi-ronmental Design and Planning." *Journal of Planning Literature* 11, 2 (Nov. 1996): 167-180.

Hwang, Sang W. *A General Evolutionary Methodology for Sustainable Develop-ment.* Blacksburg: Virginia Tech, 1998.

Krizek, Kevin J. and Power, Joe. *A Planners Guide to Sustainable Development.* Chicago: American Planning Association, Planning Advisory Report No. 467, 1996.

Mayo, James M. "The Manifestation of Politics in Architectural Practice." *Journal of Architectural Education* 50, 2 (1996): 78-88.

Mitchell, William J. *E-Topia.* Cambridge: MIT Press, 1999, 2000.

Norgaard, Richard B. *Development Betrayed: The End of Progress and a Coevolu-tionary Revisioning of the Future.* London: Routledge, 1994.

Orr, David W. *Earth in Mind: On Education, Environment, and the Human Prospect.* Washington: Island Press, 1994.

Orr, David W. "Slow Knowledge." *Annals of Earth* 14, 2 (1996): 6-7.

UIA. *Architecture of the 21st Century: Beijing Charter* (adopted by the XX Congress of the Union of International Architects, Beijing, 1999), *Sub-Theme Reports.* Beijing: Baihua Colour Printing Co., Ltd., 1999.

Van der Ryn, Sim. *Ecological Design.* Washington: Island Press, 1996.

Wilson, Edward O. *Consilience: The Unity of Knowledge.* New York: Knopf, 1998.

Yaro, Robert D. and Hiss, Tony. *A Region at Risk: The Third Regional Plan for the New York New Jersey-Connecticut Metro-politan Area.* Washington: Island Press, 1996.