

Creating Synergies from Individual Case Studies: Knowledge Networks, Data Repositories

A significant issue facing the urban remote sensing monitoring and land change modeling community is building synergies from individual efforts on case studies. Notwithstanding the significance of findings particular to each urban area, comparisons are more likely to generate essential insights than stand-alone studies of cities. Therefore, a more concerted effort by scholars needs to be made to crystallize the similarities and differences between disparate urbanization dynamics in different regions and countries.

Urban remote sensing monitoring and land change modeling community can address this issue in several ways. One possibility is organizing the existing knowledge and data that are fragmented across numerous case studies from around the world in a shared online repository. Another would be forming a network of academicians, practitioners, and other stakeholders who would both contribute to the repository and create new collaboration and cooperation opportunities and contribute to identification of research needs and opportunities. Around these two main themes, there are a number of factors that need to be taken into consideration.

Addressing this issue is important because different geographies may call for different mixes of available sustainability strategies in the course of urbanization; the availability of these strategies to decision-makers can help them formulate sustainability strategies specific to their urban areas. On the other hand, in the belief that their circumstances have unique characteristics decision-makers and stakeholders are in general reluctant to learn from others' experiences or sharing their own experiences.

Building a repository that holds the data, results, methodological details from case studies around the world can contribute towards formation of a widely-accessible knowledge network. The repository can be accompanied with an initiative to encourage the research efforts to encompass full spectrum of different city sizes across different regions around the world. To this end, first a template to facilitate consistency across comparisons between monitoring and forecasting in different geographies should be formulated. The template can be used to organize the repository along several dimensions such as –for monitoring, type of sensor, temporal/spatial/spectral resolution, start and end of monitoring period, –for forecasting, the location of the case study (region, country, continent, climatic zone, ecoregion), modeling approach(es), spatial and temporal scales considered, and –for both monitoring and forecasting, the urban population and urban land extent of the case study, the purpose of the study, research questions, and end-users. Many more such features can be included in a final list. The repository organized according to this template can be used, in addition to serving as a measure of consistency, to quantify the distribution of case studies along any of these dimensions.

A network similar to that of The Integrated History and Future of People on Earth (IHOPE) can function as a platform where social and natural sciences interact. Another approach may be integrating urban monitoring and land change modeling scholars to one or more of the existing frameworks such as those of DIVERSITAS programme or the FluxNet. Either way, there will certainly be logistical and programmatic challenges to be dealt with.

A related and promising development regarding the coordination and knowledge sharing issue –among land change scientists– is the GLOBE demonstration project by Erle Ellis of University of Maryland. There are existing procedures in several organizations, e.g., National Institutes of Health (NIH) and World Climate Research Programme (WCRP), that can be taken as examples in formulating policies to that end. For instance, in the NIH model of free and open access to scientific data, after the data is stored in a designated repository by the PIs, there is an embargo period to give the researchers who produced the data the chance to work on it first. When the embargo expires the data becomes open-access. The Urban Climate Change Research Network (UCCRN) is an exemplary approach where scholars and policy-makers from small and large cities from developing and developed countries provide data and information on their cities to each other to aid in urban decision-making (Rosenzweig *et al.* 2010). Scholars and practitioners who work on urban remote sensing monitoring and urban land-use models can either take an active part in the UCCRN or take it as an example to form their own network(s) – which would probably be organically linked to UCCRN.

Building a valid model is an important step but we also need to ensure that valid models are also informative and useful models. This means that they must become integral components in policy-making. This can happen only when the reward structure for academicians is revised so that it takes into account their effort for implementation of their models. Currently, most models remain as academic exercises and inaccessible to a wider audience. This calls for full documentation, streamlining across different modeling approaches, and development of pedagogically-informed model building and analysis tools. In addition, among those that reach the implementation stage, it is important to collect stories of failed implementation of monitoring or modeling studies as well as successful ones. Both can provide a wealth of information on the factors that influence the potential of a study to make a meaningful impact.

Relevant to streamlining a standardized and comparable approach that can encompass urban areas in different natural and cultural settings, we could consider using standard metrics. The concept of *emergy* is such a metric that was proposed as a unifying framework to bring an ecosystem-view of economic activity (Odum 1996). It appears that while such concepts are useful in framing processes in urban areas in different cultural and natural settings we still need to go beyond the common framework to be able to draw useful lessons from each case study. In short, it is probably worth to think afresh how best to utilize available tools and concepts in forming a common platform across case studies.

The differences or similarities among different urban areas are much more apparent in their patterns rather than in amount of urban area. Moreover, urban patterns may matter more than simple attention to rates and magnitudes of urban land change. Thus, perhaps relatively more emphasis on patterns in comparisons of case studies than on the absolute amount of growth (Schneider and Woodcock 2008) is justified.

Other factors to consider in the context of case studies

Participatory approaches: We also need to explore incorporating participatory approaches to model building and testing phases. This is important not only to increase the validity of the

model but also to increase the likelihood of buy-in by the stakeholders, which in turn ensures the success at the implementation stage. Devising ways to ensure stakeholders have access to the data, methods, and analysis results is critical as is more active and frequent collaboration between academics and practitioners.

Discrepancy among developed and developing countries: In addition to the discrepancy between developed and developing country cities, there is also an uneven distribution of monitoring and modeling studies within developing country regions. For instance, Middle East has drawn very little attention in monitoring and modeling although it presents very interesting questions regarding urbanization in an arid environment and under threat of civil and military conflict. The logistical issues differ even across developing countries. We need to find novel ways to compensate for the lack of data from these locations. Citizen mapping can be used both in monitoring and validation of land-use forecasts.

A strategy to prioritize case studies: How a city evolves spatially over time is shaped by the type of dominant governance regimes in addition to a larger set of socio-economic factors. Although globalization leads to a convergence in urban forms across the world, the physical, historical, and sociocultural forces still play a role in the process. Paying equal attention to both similarities/commonalities and differences have a great potential to reach a deeper understanding on the forces that shape urban form as well as interactions between different regions of the world. The importance of historical precedent and sociocultural and sociopolitical factors require the inclusion of social scientists (historians, cultural geographers, anthropologists etc.) or at least a consideration of these factors to make a better sense of the results of the monitoring; this is also important in deciding what factors to include in building dynamic models of these urban areas to predict their future patterns. Case studies are essential in this respect to be able to capture these trends in different parts of the world. It is infeasible to conduct in-depth case studies of each and every urban area on the face of the Earth. A strategy to select representative urban areas as case studies may include the criteria that are based on population, governance regime (national and city), economic structuring (agriculture-, manufacturing-, or services-oriented), (income and its distribution within the urban area), regional climate or other biophysical factors. This could be one of the tasks of the network mentioned above.

Periodic assessments of the state of the knowledge from case studies are also an important component of a shared knowledge network. Meta-analyses could be conducted with (semi-)regular intervals to keep track of the combined knowledge and data sources from case studies around the world. Such a meta-analysis of urban remote sensing monitoring studies that primarily targets the Landsat-era (i.e., 1972 onwards) was recently conducted (Seto *et al.* 2011). Similar meta-analyses on urban land-use modeling should also be conducted. While not meta-analyses, similar comparative studies on global urban expansion patterns include the case studies of 120 cities from around the world (Angel *et al.* 2005) and Arizona State University's 100 cities project.

Uncertainty: Any template for comparisons across case studies should also include the treatment of uncertainty. The sources of uncertainty may be numerous and it will be helpful to

document and quantify as much as possible all significant sources of uncertainty that may affect the monitoring and forecasts of urban land change.

There are a number of stakeholders at local, regional, and global scales who would find standardized procedures, the existence of a knowledge and data sharing network, and the repository invaluable for their own uses. The first in the list are probably city and metropolitan area governments, national and regional planning offices, and other officials whose responsibilities require a solid understanding of the growth of their urban areas and the drivers behind the growth. The research community would benefit tremendously as there will be many more research and collaboration opportunities around the world not to mention the potential synergies with the policy-makers. Certain NGOs, consulting firms, and even multinational companies may also be interested in the wealth of knowledge the repository will contain. Urban residents are the ultimate stakeholders as they are the ones whose livelihoods both shape and are shaped by urbanization.

In conclusion, what will emerge from such a connected scholar and practitioner network is a more complete understanding of urbanization at the local, regional, and global scales. Moreover, a knowledge network based on case studies can help scholars, decision-makers, and stakeholders to formulate responses to sustainability questions that are appropriate for the particular conditions of their own cities. These questions may include but not limited to examples below:

1. What may be the most suitable set of potential strategies for climate change mitigation and adaptation and urban development?
2. What kind of governance and institutional arrangements work best for urban areas with different characteristics?
3. What are the urban forms for different natural and cultural settings that will lessen the overall environmental impact of an urban area?

References

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