Climate change and human settlements: methodology, case studies and issues arising
Climate change and urban settlements: methodology, case studies and issues arising

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Word count: 5500 total; 4800 excluding references

Running head: Climate change and settlements

Keywords: climate change, integrated assessment, adaptation, vulnerability, urban, Australia.
Abstract

At SoAC 2007, we described the intent and proposed methodology of the research project “Integrated Assessment of Climate Change on Urban Settlements” (IACCIUS) (Li 2007). The research was part of a larger program of Commonwealth-funded research, and unlike much other work focused on small-medium settlements. This paper presents selected findings of the completed project (see Li et al 2009). The project utilised five settlements as case studies to (i) inform development of generically applicable approaches to assessing urban climate change impacts, and (ii) generate practical, specific insights into aspects of each case settlement. This paper presents:

- An overview of the developed and tested methodology, specifically the Integrated Systems Risk and Vulnerability Assessment (ISRaVA) process, which combines multiple disciplinary traditions and methods;
- Selected findings regarding impacts and adaptation options in the five case study settlements (Bendigo, Canberra, Cooma, Darwin, Queanbeyan);
- Emerging issues for research and policy that will arise as further assessment of the implications of climate change for urban settlements are undertaken.
- Comments on the challenge of “mainstreaming” climate change considerations in public policy and administration.
Introduction

This paper reports on methodological development and empirical investigation concerning climate change impacts on five Australian small-medium sized urban settlements. We update the in-progress work of Li (2007), based on the findings reported in Li et al (2009), extending the discussion of Li and Dovers (in press), and drawing on broader perspectives offered in Dovers (2009) and Dovers and Hezri (2009). The methods and findings are summarised, and the discussion identifies issues and challenges that will be encountered in further research and policy activity exploring climate change and urban settlements, with particular relevance to local government or other organisations focusing on small-medium sized settlements.

Such local scale work, however, needs to be considered in the context of a rapidly changing discussion of climate change. In the last few years, there have been four significant and interrelated shifts in research and policy discussions around climate change. First, attention has for two decades focused on whether and to what extent human-induced climate change was occurring, and the timing of the onset of change. That has been, necessarily, a debate dominated by the relevant natural sciences. Especially since the Intergovernmental Panel on Climate Change 4th Assessment Report (IPCC, 2007), there is now a consensus in mainstream scientific and policy circles that climate change is real, is a significant threat to human societies, and that some change is already locked into the climate system and thus inevitable. While continuing scientific effort is crucial, the larger focus now is on policy responses.

A focus on policy responses invites the second shift, from a natural science debate to one that demands the engagement of social science, the humanities, and a range of professional and other knowledge systems. That shift has discomforted some natural scientists as their dominance of the debate has been diluted, led to a degree of less than well-informed prognostication on matters societal by climate scientists, and caught unprepared a number of key social sciences which have yet to give climate change much attention (eg. law, public administration, institutional theory, urban studies, public policy). The third shift is from a focus largely on mitigation (reduction in greenhouse gas emissions) to a more equal focus on adaptation to change already locked into the climate system. Mitigation is a supremely difficult policy problem politically, yet in the event of agreement over emission reduction targets a small range of policy options with systemic impact are available (carbon taxes, energy efficiency standards, emission trading schemes). Adaptation is a far messier policy...
problem, as impacts, vulnerabilities and response options vary across countless political, biophysical, sectoral, legal, administrative and socio-economic contexts. The contextual variation of adaptation defines the further shift, where the spatial (and thus political, economic, administrative, etc) scales of attention move away from the global and regional scales of climate modelling, to scales where human decision making operates: national and sub-national government, firms, sectors and local settlements.

For this paper, the relevant scales are those most important to decision making that impacts on urban settlements, and the portfolios of responsibility central to those settlements: urban planning, water provision, stormwater management, emergency management, maintenance of open spaces, local economic development, service provision. Such a focus requires localised climate information and fine scale data and analysis of economic and social systems. It also requires assessment procedures suited to local economic and urban systems, and that can integrate the multiple impacts and interdependencies in complex modern settlements.

To date, climate impact and adaptation studies and especially integrated assessments have most often dealt with broader scales and non-urban, northern hemisphere settings (e.g. Edmonds and Rosenberg, 2005; Holman et al., 2005; Kirshen et al., 2008; Lange, 2008). In this paper, we deal with small-medium sized urban settlements, how climate impacts can be assessed in an integrated fashion, and on the kinds of adaptation options that emerge from an integrated assessment. The paper is based on an applied research project which assessed five Australian settlements, and which was underpinned by (i) a commitment to participatory research; (ii) the aim to develop operational and transferable assessment processes; and (iii) an integrated, systems-oriented methodology. It was also informed by the proposition that climate change impacts may not be as exceptional as many seem to think, and in fact not dissimilar to challenges of managing climate and other variability which agencies and communities are already facing. This proposition invites a ‘normalising’ of climate change into the agendas, skills and activities of urban planning and management (and other sectors) (Dovers, 2009).

**The IACCIUS project and methodology**

The research reported here was undertaken under the Australian Government Department of Climate Change’s (DCC’s) Integrated Assessment of Human Settlements Sub-programme, an exploratory program designed to prompt development of approaches to assessing climate impacts in urban areas.¹ The
project reported here, the Integrated Assessment of Climate Impacts on Urban Settlements (IACCIUS) project, through engagement with five case study settlements, aimed to develop and test a methodology for integrated assessment of urban settlements, and investigate selected issues in each settlement.

The IACCIUS project addressed gaps left by earlier IA studies by developing an initial approach (see Li, 2007) and testing and developing this further through application in the case study settlements. IACCIUS treated these settlements as complex adaptive human-environment systems, and emphasised local realities, information needs and decision making. Settlements are neither static nor independent, but complex parts of a greater complex whole dominated by the interactions of human and natural systems, and are constantly adapting to internal and external pressures. This requires an approach that is integrative, flexible, critical and adaptive, and suited to the urban context. The IACCIUS methodology draws on a range of theoretical and methodological areas, including (Li, 2009; Li et al, 2009):

- Climate science and spatio-temporal modelling.
- Critical realism and adaptive theory.
- Participatory research methods.
- Systems thinking and systems characterisation tools.
- Urban studies and related fields.
- Public policy and institutional theory.
- Risk management, and analysis of uncertainty.
- Vulnerability analysis.

A methodological framework termed the Integrative Systems Risk and Vulnerability Assessment (ISRaVA) process was developed and applied, and is summarised in Box 1 (from Li et al., 2009). Integrated assessment is better thought of as a process and intent rather than a specific method, and utilises diverse methods and tools in different contexts, but within a recognisable and coherent process. Box 2 (Li et al 2009) illustrates the diversity of methods available for use depending on local context and issues.

The following identifies some practical insights derived from the development and application of the ISRaVA methodology, indicating the challenges of local scale climate impact and adaptation assessment and the sorts of adaptation possibilities that will arise.

In each settlement, local scale climate analysis was undertaken (Hutchinson et al, 2009), and used alongside broader scale climate scenarios and plain language
descriptions of likely events, to make climate change more specific and meaningful at local level. An overall risk and vulnerability assessment was undertaken using, and further developing, the ISRaVA process in partnership with local and state and territory governments and other stakeholders. This was followed by a detailed investigation of selected priority issues identified by research partners. The case study settlements and specific issues are summarised in the following.

**Bendigo** in Victoria, a rural city of 90,000 people, built on a gold-mining past and now servicing a rich agricultural district as well as educational, tourism and regional service industries. IACCIUS investigated the impacts of drought and water scarcity, as the priority identified by the local council and stakeholders. Within that the focus was on outdoor sport and recreation facilities being important for local lifestyles, public health, the local economy and cultural identity. In broader debates on climate change, issues such as local and regional sporting activities do not feature, but at a local level such priorities are central to regional settlements and are a major responsibility of local governments.

Although the council and stakeholders were already familiar with the implications of drought, new insights emerged from the analysis, such as issues of equity of access to water for water dependent sports, identified from socio-economic and spatial analysis of facilities across the community. Also revealed were equity issues related to possible under-resourcing of non-water dependent activities as investments become skewed toward maintenance of water-dependent ones during periods of critical water shortages. Differential impacts on sports and recreational activities tied to their relative water (or grass cover) dependence emerged, and varied opportunities to decouple use from water availability.

In this case, as with others, climate change emerged as an added factor affecting existing policy and management issues, emphasising the existence of relevant skills and perspectives in local organisations and the potential to incorporate climate change considerations into existing policy processes and management practices.

**Cooma** in NSW, a rural town of 8000 people, servicing the Snowy Mountains Hydro-electric Scheme and grazing region, and gateway town for alpine national parks and tourism attractions. Local stakeholders identified threats to tourism income (decline in through-traffic and spending) as a priority, with specific reference to worsening snow seasons and impact of increased bushfire frequency and intensity. This required confirmation of past and likely future event scenarios using climate projections and local climate history. Investigating this showed the difficulty of projecting future
visitation numbers and economic impacts in a believable fashion. Instead, the project examined the impact of past poor snow seasons (especially 2006) and major bushfire events (especially 2003). The research revealed some inadequacies in past visitation data and highly differentiated impacts of poor seasons on different firms and sectors within the local economy. Interviews with local tourist-dependent businesses identified a range of adaptive strategies already implemented in response to existing climate variability and with potential for future adaptation.

Interestingly, many options for ensuring local economic resilience to climate change and variability emerged as similar to typical recommendations for local economic development – enhanced knowledge of local economic patterns, improved visitation data and understanding of visitor markets, integrated land use planning, economic diversification and improved marketing. An enhanced understanding was developed of differentiated roles and responsibilities for local climate assessment and adaptation across firms, business associations, communities and local, state and national government, which may inform coordination and efficiencies in data provision and adaptive strategies. Similar to the Bendigo case, closer potential connections were identified between ‘new’ issues of climate change and existing knowledge and strategies for coping with existing climate variability.

Queanbeyan, a rural centre and dormitory city of 35,000 in New South Wales adjacent to the national capital of Canberra. Drought and rapid urban growth and development have produced a changing urban land surface, intensified by shifts in household landscape preferences and loss of grass cover. A noticeable change is the replacement of lawns with landscaping products in the face of drought and water restrictions, possibly accelerating runoff and complicating stormwater management. Instead of an assumed impervious surface proportion of approximately 40% for suburban landscapes, innovative fine scale analysis of remotely-sensed data revealed a range between 17 and over 80% across the settlement, depending on urban form and housing stock age. A high proportion of impervious surfaces in new low density developments was an unexpected finding. Such insights may inform future subdivision layout, landscaping requirements and stormwater provision.

Canberra, the young, purpose-built and highly planned national capital of Australia with a population of 330,000. The agreed project aim was to investigate water and energy consumption of households using consumption account data, to establish a baseline and explore the impact and potential of demand management interventions as climate change adaptation strategies. Existing data sets have not been organised in a manner suitable for this purpose, being averaged at settlement and suburb level
and designed for billing rather than consumption analysis. Although made available previously in Canberra and other cities in Australia (eg. Randolph and Troy 2007), these data were not made available to the project on privacy grounds, and the analysis could not proceed. This evidences the importance of data suitability and availability issues noted above, and of gaining collaboration of data custodians either by early engagement or through central political support.

Darwin, situated in the wet-dry tropics and cyclone-prone, with a population of 110,000 and a high Indigenous population and demographic turnover. The threats of heat stress and increased cyclone intensity dominated the study, and from this emerged the need to better understand differential vulnerability across the city as defined by spatial locations and socio-economic variables. Differentiated vulnerability was investigated using fine scale spatial, biophysical and socio-economic data, water and energy consumption data and population data, allowing identification of areas within the city where a combination of factors suggested different degrees of vulnerability and adaptive capacity. It also allowed analysis of the adequacy of adaptation measures such as the distribution of cyclone shelters versus population distribution and mobility. Improvements in data availability were identified such as to measure fine scale water and energy demand, population change and socio-economic status, vulnerability to storm surge and building stock attributes. Existing data and information pathways will be tested by questions posed by climate change, and an integrated assessment of climate impacts is likely to generate data useful for other purposes such as public health, emergency management or building stock assessment).

Methodological lessons

These settlements provide diverse urban characteristics, socio-economic attributes, climatic zones and potential climate impacts. The IACCIUS project did not mount a comprehensive, detailed analysis of any one place, but used this diversity as an opportunity to develop a rigorous, practical and transferable approach to assessing climate impacts in urban areas, while taking the opportunity to investigate some priority issues in more depth. While IACCIUS and other projects in the DCC’s Sub-programme were run as separate exercises, the IACCIUS team arranged two cross-project meetings to compare approaches, findings and issues, and the methodological and practical issues reported here were also encountered in other projects.
Research and policy agendas in the domain of environment and sustainability often demand integrated research and policy approaches to address the interdependence of human and natural systems (Dovers, 2005a, Ross and Dovers, 2008). Integration in research incorporates knowledge across disciplines and other knowledge systems (eg. community, professional, Indigenous), and may produce policy-relevant knowledge. Integration in policy connects portfolios, agencies and sectors, and thus informs policy directly or formulates policy. As a research project, IACCIUS could only seek to produce policy-relevant knowledge and make this available by: providing information to local agencies and in particular to officials participating in the project; and developing approaches to undertaking integrated assessments in other places.

Project evaluation feedback from participants showed that the application of the IACCIUS methodology demonstrated the potential of a systems-oriented, participatory approach to identifying risks and vulnerabilities at the local settlement scale. Insights of value to local decision makers were produced at a general, overview level, identifying the broad range of possible impacts and interactions between these, and at a more specific level through detailed assessment of priority issues. The methodology allowed joint learning to occur between researchers/assessors and local agencies. The exercise was not free of problems, however, and the following suggestions of ways to improve future integrated assessment (or similar) exercises emerged from problems faced during the project.

Data, skills and time

Climate change is a relatively new concern for most local agencies and officials, not yet supported by standards and routines within existing administrative, decision-making, human resource and informational capacities. However, coping with climate variability is more familiar, even if not explicitly recognised, via past and existing imperatives to manage drought, natural hazards, and so on. In the past few years, local agencies have begun to explore the implications of climate change for their portfolio of responsibilities, and are seeking frameworks and methods to do so. Shared knowledge of available methods is poorly developed, and wider communication of methods and applications would assist in driving a more rapid, rigorous and efficient assessment of risks and vulnerabilities, and development of response and adaptation options. Local agencies also need information on the likely investment of time, data, skills and resources needed to undertake integrated assessments, and these are difficult to predict until an overview assessment (step 3, Box 1) has identified the full range of impacts and interactions, and priority issues. At that point, it will become evident what further work is required, and this may demand
skills such as spatial analysis, demographic profiling, local climate history and analysis, economic survey and/or modelling, hydrological modelling, business surveys, infrastructure assessment, or biodiversity survey.

IACCIUS recorded the number of work days required to conduct an IA of the case study settlements so as approximate the level of commitment required for future applications. Excluding methodological development (ie. assuming use of an existing methodology such as ISRaVA), this estimated some 200-250 work days per case study settlement, including the overview assessment, localising climate science, and detailed investigation of 4-5 priority issues. For most local councils, this is a significant scale of commitment to what is most often a ‘new’ or emerging issue, whether undertaken internally or via external consultants or a combination of both. However, it might be compared to the commitment required to, for example, prepare a local environmental plan or process a complex development application, and the relative benefits similarly compared.

There are also challenges related to dealing with data and the availability of skills, evident from the wide range of methods potentially required for an integrated assessment. Acquisition and management of diverse, complex data sets is central to investigating impacts and implications, such as energy and water consumption, local climate records, demographic data, remotely sensed topographic and other land surface data, and economic data, usually needing spatial representation and manipulation. Three issues are likely to arise:

- Existing data sets may be unusable because of unsuitable spatial resolution or limited time series, coverage or data quality.
- Large and diverse data sets will require a sophisticated data management system, the provision and servicing of which needs to be included in the project design and funding. Ongoing maintenance of data sets may also be desirable.
- Difficulties will likely arise in accessing data, through cost of purchase, time constraints of data custodians, or confidentiality or privacy provisions. Often, key data custodians will not be part of the project initiation and design phase, but will be identified later and may not collaborate or give the assessment priority.

The range of data is matched by the range of requisite skills – statistics, demography, local economic profiling, policy analysis, meteorology, hydrology, engineering and building asset appraisal and risk assessment, as well as generic
skills in team facilitation, communication and project management. Assessment teams and local agencies will be hard pressed to provide all such skills, particularly when these needs may not be predicted at project commencement.

**Relevance to decision-making**

Local scale assessment of climate change implications need to connect to relevant cycles and procedures of policy and planning. Participatory integrated assessments, such as the IACCIUS project, can to a certain degree create such connection by including local decision makers such as council planners in the assessment process. However, it is also important for assessment design to incorporate understanding of local policy processes. For example, if a local government develops a strategic plan in five-year cycles, an assessment undertaken in a given year may be either very timely or be dated by the time it can be utilised. Given the scale and skills and data requirements of an integrated assessment, and the constraints of local governments, assessments will often be undertaken by external consultants or research teams without close understanding of local decision making cycles or needs. Active participation by local officials is therefore necessary.

Wide representation from local agencies is also important, especially in project initiation and the overview assessment phase. This will ensure that all impacts, vulnerabilities and interests are identified and interactions between these are mapped, and enhance collaboration in subsequent investigation of specific issues. Especially important is the involvement or at least endorsement by senior management (eg. general manager, mayor, central planning agency, etc) – climate change impacts across sectors and assessment requires cooperation by officials across departments and sectors, and will be less effective if left to only one department or interests (such as engineering, environment or planning).

**Political and commercial sensitivity**

Generic determinants of vulnerability and adaptive capacity such as socio-economic status or resource dependency are common and useful when the aim is to compare across regions or nations; see e.g., Brooks *et al* (2005). In coarse resolution climate impact assessments, such factors will not be mapped at fine enough a scale to delineate beyond broad population subsets (eg. low socio-economic status) or general location types (eg. flood prone or coastal fringe areas). At local scales, investigation into the specific determinants of vulnerability and adaptive capacity will be required, and this will often entail commercial and political sensitivity. Impacts will be described at individual property scales, and indeed must be to inform local
adaptation measures. This can personalise climate change impacts in terms of socio-economic status, risk preparedness, etc, with implications for business viability, individual household vulnerability, insurance, and property prices. Assessment processes must recognise this sensitivity and plan the participatory assessment process and communication strategy accordingly.

**Designing future integrated assessments**

The IACCIUS methodology, and in particular the ISRaVA process, provides an effective framework within which to undertake integrated assessment of climate change impacts and of indicating response strategies, applicable across varying contexts. However, experience across the five case study settlements indicates that future assessments, whether using this approach or another, similar framework, would be best undertaken and developed in the following three stages:

- A broad systems-based overview assessment of climate impacts, risks and vulnerabilities, including stakeholder-led identification and prioritisation of selected issues inviting more detailed investigation.
- Project redesign, including accessing data and provision of specific personnel and skills, to allow detailed analysis of priority issues.
- Re-integration of results from detailed investigations into the overview assessment to capture cross-sectoral interactions (e.g. implications of water management for public health, or emergency evacuation plans for public transport).

While somewhat more complex to design, and presenting difficulties in funding and scheduling, such a staged approach offers gains in efficiency, targeting of efforts, and planning of resources, data needs and skills.

Like most assessments of this kind, IACCIUS and related projects have been one-off exercises dependent on external resources and personnel. The ongoing embedding of climate change issues into information streams and policy processes remains a significant challenge, at the local scales discussed here and at state and national levels of government. Without this, knowledge from assessment will be unlikely to have much effect. Often referred to as ‘mainstreaming’, this is an imperative often promoted but little specified in the climate policy literature (Habib, 2009). In particular, little attention has been paid to the mechanisms by which such integration of climate consideration can be deepened through public policy and administrative structures.
and processes, across the portfolios and agencies of a given jurisdiction. In the climate adaptation literature, integration of climate change into policy processes and institutional systems is often proposed but rarely specified (Dovers and Hezri, 2009). Given the cross-scale as well as cross-sectoral implications of climate change, there is the added complication and challenge of coordination of information and policy vertically through levels of government. It may be that this could be informed by the more mature and highly relevant body of theory and practice of environmental policy integration where such structures and processes have been longer considered and in many places already trialled (Ross and Dovers, 2008).

Conclusion

This paper has summarised a methodology developed and tested across five small-medium sized Australian urban settlements, and identified some practical impacts and response options. The ISRaVA process, or similar integrated assessment approach using multiple methods, has significant potential to inform local understanding and policy formulation concerning climate change. While further methodological development and testing is needed, as well as better communication of available methods, significant advances can be made in the near term, and enhanced by establishing closer connections between broader climate scenarios and debates and local agendas and responsibilities. The ability of local government to provide the funding and skills required for such assessments may be constrained in many cases, necessitating external support.

References


DEH (2003). *Triple bottom line reporting in Australia: A guide to reporting against environmental indicators*. Canberra: Department of the Environment and Heritage (DEH) [online].


Box 1. Integrative systems risk and vulnerability assessment (ISRaVA) process*

Establishing the Context

1. Define the problem of local urban scale climate change impacts as a complex adaptive human-environment system problem, requiring whole-of-system and whole-of-government engagement and response

2. Study, to understand within uncertainty limits, past present and future local climate change and variability

Identifying and analyzing what’s at risk/vulnerabilities

3. Conduct a participatory urban system risk analysis process that:
   - ‘teaches’ participants basic systems concepts and associated tools
   - enables the agreement of where to place system boundaries
   - identifies urban system parts at risk of climate change impacts
   - identifies key constraining relationships between system parts
   - collectively constructs influence diagrams of the urban system
   - identifies systems and subsystems of interest
   - identifies priority subsystems for further in-depth investigation

4. Develop a communication and feedback system between researcher and stakeholder as the research proceeds, especially as may be related to concurrent policy processes

5. Identify relevant policy history and ongoing policy processes that may be relevant to the research process

6. Assess vulnerability for priority subsystems of interest using appropriate methods to collect and analyse primary or secondary data that:
   - enables a better understanding of the parts of the system at risk (exposure units)
   - enables a qualitative or quantitative description of system sensitivities
   - enables an exploration of past and present adaptation actions taken, future possible strategies, and, where possible, adaptive capacities
   - enables a more in-depth systems analysis taking into account vulnerability findings (as reworked influence diagrams, or a more detailed systems model)

7. In the assessment of vulnerability use participatory processes with stakeholders to further identify future possible adaptation strategies, and current and future capacities to adapt, including possible policy recommendations

Evaluating and reviewing the process

8. Identify gaps in the analysis that may require:
   - further research or investigation
   - the collection of further primary or secondary data to fill data gaps

9. Finalise and write up analyses, disseminate and communicate findings to all stakeholders

Treating the risks/vulnerabilities

10. Stakeholders responsible for adaptation strategies and policy-making at the city wide level to:
    - take into account findings of the integrated assessment and commence or continue management and the policy-making and implementation process
    - iterate through any of the above steps as required

*From Li et al. (2009), see also AGO (2006).
### Box 2. Methods to support integrated assessment (from Li et al (2009))

<table>
<thead>
<tr>
<th>Goal</th>
<th>Method</th>
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<tbody>
<tr>
<td>Social and environmental assessment</td>
<td>Risk and vulnerability assessment (e.g., Adger, 2006); social impact assessment (e.g., Henk and Vanclay, 2003); environmental impact assessment (e.g., Morgan, 1998); strategic environmental assessment (e.g., Dovers and Marsden, 2002); sustainability assessment; ecological footprint analysis (e.g., Chambers et al., 2000); material flows analysis; life cycle analysis (e.g., Guinée, 2002); state of environment reporting (e.g., DEWHA, 2009)</td>
</tr>
<tr>
<td>Systems analysis</td>
<td>Systems thinking tools (e.g., Sterman, 2000); influence/causal loop diagrams; reference modes (time series analysis); stock and flow modeling; group model building</td>
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<td>Decision analysis</td>
<td>Game theory (e.g., Hanley and Folmer, 1998), Bayesian decision networks (e.g., Jensen, 1996; Cain, 2001); meta-models, agent-based, expert systems; coupled-component; multi-criteria analysis</td>
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<tr>
<td>Spatial analysis</td>
<td>Demographic mapping; hazard mapping; remote sensing; geostatistics, geographic information systems (e.g., Chang, 2008)</td>
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<tr>
<td>Policy analysis</td>
<td>Policy monitoring and evaluation (e.g., Dovers, 2005b); historical policy analysis; scenario planning; comparative policy analysis; comparative policy instrument choice analysis</td>
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<tr>
<td>Economic analysis</td>
<td>Triple-bottom-line (e.g., DEH, 2003), cost-benefit analysis; non-market valuation; natural resource accounting</td>
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<tr>
<td>Historical analysis</td>
<td>Diachronic and synchronic historical policy analysis; oral history environmental history (e.g., Dovers, 2000; Proust, 2004); ethnographies</td>
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<tr>
<td>Discourse and document analysis</td>
<td>Government, private, archived, internet, newspaper, academic literature, local knowledge (e.g., Kitchin and Tate, 2000).</td>
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<tr>
<td>Participatory and deliberative methods</td>
<td>Workshops; surveys; interviews (e.g., Hay, 2005); participatory modelling; scenario building; local information gathering; deliberative techniques; focus groups, joint problem-framing; citizens juries (e.g., James, 2003); consensus conferences; team-work approaches</td>
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### Notes